SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode-638455

Regulation 2023

(Autonomous)

Curriculum and Syllabus

Choice Based Credit System (CBCS)

BE- BIOMEDICAL ENGINEERING

SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455

Regulation 2023 (UG)
Curriculum and Syllabus
BE- Biomedical Engineering

I. Program Educational Objective (PEO)

PEO1: Foundational Concepts: To enable the graduates to demonstrate their skills in design and develop medical devices for health care system through the core foundation and knowledge acquired in engineering and biology.

PEO2: Professionalism: To enable the graduates to exhibit leadership in health care team to solve health care problems and make decisions with societal and ethical responsibilities.

PEO3: Innovation: To Carryout multidisciplinary research, addressing human healthcare problems and sustain technical competence with ethics, safety and standards.

II. Program Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

Chairman
BoS/BME

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Teamwork: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for (i) Independent and life-long learning (ii) adaptability to new and emerging technologies and (iii) Critical thinking in the broadest context of technological change. (WK8)

III. Program Specific Outcomes (PSOs)

1. **Core Skills:** To design and develop diagnostic and therapeutic devices that reduces physician burnout and enhance the quality of life for the end user by applying fundamentals of Biomedical Engineering.
2. **Problem Solving Skills:** To apply software skills in developing algorithms for solving healthcare related problems in various fields of Medical sector.
3. **Social Consciousness:** To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions for current societal and scientific issues thereby developing indigenous medical instruments that are on par with the existing technology

Chairman
BoS/BME

Mapping of Course Outcome and Programme Outcome

Year	Sem	Course name	PO											PSO		
			1	2	3	4	5	6	7	8	9	10	11	1	2	3
I	I	Induction Programme														
		Professional English - I	-	-	-	2	-	1	2	3	-	3	-	-	-	-
		Matrices and Calculus	3	3	1	1	-	-	-	2	-	2	3	-	-	-
		Engineering Physics	3	3	2	1	2	-	-	-	-	-	1	-	-	-
		Engineering Chemistry	3	2	2	1	1	2	-	-	-	-	1	-	-	-
		Problem Solving and Python Programming	2	3	3	3	2	-	-	-	-	2	2	3	3	3
		தமிழர் மரபு /Heritage of Tamils	-	-	-	-	-	1	1	-	1	-	-	-	-	-
		Problem Solving and Python Programming Laboratory	2	3	3	3	2	-	-	-	-	2	2	3	3	3
		Physics and Chemistry Laboratory	3	3	1	1	-	-	-	-	-	-	-			
			3	2	1	-	1	3	1	-	-	-	1	-	-	-
		English Laboratory	-	-	-	-	-	-	1	3	3	-	2	-	-	-
	II	Professional English - II	-	1	1	-	-	-	1	2	3	-	2	-	-	-
		Numerical Methods and Statistics	3	3	1	1	1	-	-	2	-	2	3	-	-	-
		Biosciences for Medical Engineering	3	2	2	1	-	1	-	-	-	-	2	3	1	-
		Basic Electrical and Electronics Engineering	3	3	2	2	-	-	-	-	1	-	-	3	3	2
		Medical Physics	3	3	1	1	1	1	-	-	-	-	-			
		Engineering Graphics	3	1	2	-	2	-	-	-	3	-	2	2	2	-
		தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	2	-	-	-	-	2	2	2	2	-	2			
		Engineering Practices Laboratory	3	-	-	3	-	-	-	-	-	-	-	2	1	1
		Biosciences Laboratory	3	3	2	1	1	2	-	-	-	-	2	1	-	-
		Communication Laboratory / Foreign Language $	-	-	2	-	-	-	1	3	3	-	3	-	-	-
	III	Transforms and Partial Differential Equations	3	3	1	1	-	-	-	2	-	-	3	-	-	-
		Electronic Devices and Circuits	3	3	3	-	-	-	-	-	-	-	-	1	-	-
		Biosensors and Measurements	3	3	2	1	-	-	-	-	-	-	-	1	-	-
		Electric Circuit Analysis	3	3	2	1	-	-	-	-	-	-	1	1	-	-
		Object oriented programming	3	3	1	1	1	-	-	-	-	-	-	-	1	1

Chairman
BoS/BME

II	III	Anatomy and Human Physiology	3	3	2	-	-	-	-	-	-	-	1	1	-	-
		Entrepreneurship and Startup	2	2	2	1.6	1	-	-	-	-	-	-	2	2	2
		Electronic Devices and Circuits Laboratory	3	2	1	1	1	-	-	1	2	-	-	-	1	1
		Biosensors and Measurements Laboratory	3	3	2	1	-	-	-	-	-	-	1	1	-	-
		Object oriented Programming using Java Laboratory	3	3	1	1	1	-	-	-	1	1	-	-	1	1
	IV	Probability and Statistics	3	3	3	-	-	-	-	2	-	-	1	-	-	-
		Biomedical Instrumentation	3	2	1	1	-	-	-	-	-	1	-	2	1	-
		Analog and Digital Integrated Circuits	3	2	1	1	1	-	-	-	-	-	-	2	-	-
		Biocontrol Systems	3	2	2	2	-	-	-	-	-	-	-	2	1	-
		Environmental Sciences and Sustainability	3	2	1	1	-	2	-	-	-	-	2	-	-	-
		Biosignal Processing	3	2	2	2	1	-	-	1	1	1	-	2	1	-
		Biomedical Instrumentation Laboratory	3	3	1	1	1	1	-	1	1	1	-	1	-	1
		Analog and Digital Integrated Circuits Laboratory	3	3	1	1	1	-	-	1	1	1	-	1	-	-
		Soft and Analytical Skills-I	-	-	-	-	-	-	-	-	-	-	-	-	-	-
III	V	Embedded Systems and IoMT	3	2	2	1	2	-	-	-	1	2	1	1	2	1
		Diagnostic and Therapeutic Equipment	3	2	2	1	2	-	-	-	-	-	1	3	2	1
		Embedded systems and IoMT Laboratory	2	2	3	2	1	-	-	1	2	2	2	2	1	2
		Diagnostic and Therapeutic Equipment Laboratory	3	3	3	2	2	-	-	2	2	2	-	3	2	2
	VI	Bio Mechanics	3	1	1	-	-	1	1	-	-	-	-	1	2	-
		Artificial Intelligence and Machine Learning	2	2	1	2	2	1	-	1	1	1	2	2	2	2
		Medical Image Processing	3	3	2	2	2	-	-	-	-	-	1	2	1	1
IV	VII	Human Values and Ethics	2	2	2	2	1	-	-	-	-	-	-	2	2	2
		Hospital Training	3	2	-	1	2	3	3	3	3	3	3	3	-	-
		Mini Project	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	VIII	Project Work	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

SUMMARY OF CREDITS

S.No	Course Category	Credits per Semester								Total Credits	Credits in %	Credits as per AU Curriculum R21
		I	II	III	IV	V	VI	VII	VIII			
1	HSS	4	3					6		13	7.87	12
2	BS	12	4	4	6					26	15.75	26
3	ES	5	9	12						26	15.75	26
4	PC		8	8.5	16	9.5	11			53	32.12	53
5	PE					12	3	3		18	10.9	18
6	OE						6	6		12	7.27	12
7	EEC	1	2	1				3	10	17	10.30	16
8	MC		√		√	√ / √	√					
Total Credits / Semester		22	26	25.5	22	21.5	20	18	10	165		163

CATEGORIZATION OF COURSES

i. Humanities and Social Sciences including Management Courses (HSS)
ii. Basic Science Courses (BS)
iii. Engineering Science Courses (ES)
iv. Professional Core Courses (PC)
v. Professional Elective Courses (PE)
vi. Open Elective Courses (OE)
vii. Mandatory Courses (MC)
viii. Employability Enhancement Courses (EEC)
ix. Other Courses (OC)

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes,

Chairman
BoS/BME

SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455

Regulation 2023 (UG)
Curriculum and Syllabus
BE- Biomedical Engineering

SEMESTER I

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
Induction Program											
1.	23IPA11	Induction Programme	-	-	-	-	-	0	-	-	-
Theory											
2.	23ENT11	Professional English - I	HSS	3	0	0	3	3	40	60	100
3.	23MAT11	Matrices and Calculus	BS	3	1	0	4	4	40	60	100
4.	23PHT11	Engineering Physics	BS	3	0	0	3	3	40	60	100
5.	23CYT11	Engineering Chemistry	BS	3	0	0	3	3	40	60	100
6.	23CST11	Problem Solving and Python Programming	ES	3	0	0	3	3	40	60	100
7.	23TAT11	தமிழர் மரபு /Heritage of Tamils	HSS	1	0	0	1	1	40	60	100
Practicals											
8.	23CSL11	Problem Solving and Python Programming Laboratory	ES	0	0	4	4	2	60	40	100
9.	23PCL11	Physics and Chemistry Laboratory	BS	0	0	4	4	2	60	40	100
10.	23ENL11	English Laboratory	EEC	0	0	2	2	1	60	40	100
			Total	**16**	**1**	**10**	**27**	**22**			

Chairman
BoS/BME

SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455

Regulation 2023 (UG)
Curriculum and Syllabus
BE- Biomedical Engineering

SEMESTER II

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23ENT21	Professional English - II	HSS	2	0	0	2	2	40	60	100
2.	23MAT21	Numerical Methods and Statistics	BS	3	1	0	4	4	40	60	100
3.	23BMT21	Biosciences for Medical Engineering	PC	3	0	0	3	3	40	60	100
4.	23EET22	Basic Electrical and Electronics Engineering	ES	3	0	0	3	3	40	60	100
5.	23PHT24	Medical Physics	PC	3	0	0	3	3	40	60	100
6.	23MET21	Engineering Graphics	ES	2	0	4	6	4	40	60	100
7.	23TAT21	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HSS	1	0	0	1	1	40	60	100
Practicals											
8.	23MEL21	Engineering Practices Laboratory	ES	0	0	4	4	2	60	40	100
9.	23BML21	Biosciences Laboratory	PC	0	0	4	4	2	60	40	100
10.	23ENL21	Communication Laboratory	EEC	0	0	4	4	2	60	40	100
Mandatory Courses											
11.	23MDC21	Mandatory Course - I Yoga for Human Excellence	MC	0	0	1	1	0	100	-	100
			Total	**17**	**1**	**17**	**35**	**26**			

Chairman
BoS/BME

SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455

Regulation 2023 (UG)
Curriculum and Syllabus
BE- Biomedical Engineering
SEMESTER III

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23MAT32	Transforms and Partial Differential Equations	BS	3	1	0	4	4	40	60	100
2.	23ECT31	Electronic Devices and Circuits	ES	3	0	0	3	3	40	60	100
3.	23BMT31	Biosensors and Measurements	PC	3	0	0	3	3	40	60	100
4.	23BMT32	Electric Circuit Analysis	ES	3	0	0	3	3	40	60	100
5.	23CST33	Object oriented programming	ES	3	0	0	3	3	40	60	100
6.	23BMI31	Anatomy and Human Physiology	PC	3	0	2	5	4	50	50	100
7.	23EST31	Entrepreneurship and Startup	EEC	1	0	0	1	1	100	-	100
Practicals											
8.	23ECL31	Electronic Devices and Circuits Laboratory	ES	0	0	3	3	1.5	60	40	100
9.	23BML31	Biosensors and Measurements Laboratory	PC	0	0	3	3	1.5	60	40	100
10.	23CSL35	Object oriented programming using Java Laboratory	ES	0	0	3	3	1.5	60	40	100
		Total		**19**	**1**	**11**	**31**	**25.5**			

Chairman
BoS/BME

SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455

Regulation 2023 (UG)
Curriculum and Syllabus
BE- Biomedical Engineering

SEMESTER IV

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23MAT41	Probability and Statistics	BS	3	1	0	4	4	40	60	100
2.	23BMT41	Biomedical Instrumentation	PC	3	0	0	3	3	40	60	100
3.	23BMT42	Analog and Digital Integrated Circuits	PC	3	0	0	3	3	40	60	100
4.	23BMT43	Biocontrol Systems	PC	3	0	0	3	3	40	60	100
5.	23CYT41	Environmental Sciences and Sustainability	BS	2	0	0	2	2	40	60	100
6.	23BMI41	Biosignal Processing	PC	3	0	2	5	4	50	50	100
Practicals											
7.	23BML41	Biomedical Instrumentation Laboratory	PC	0	0	3	3	1.5	60	40	100
8.	23BML42	Analog and Digital Integrated Circuits Laboratory	PC	0	0	3	3	1.5	60	40	100
Mandatory Courses											
9.	23MDC41	Mandatory Course - II Soft and Analytical Skills-I	MC	1	0	0	1	0	100	-	100
		Total		**18**	**1**	**8**	**27**	**22**			

Chairman
BoS/BME

SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455

Regulation 2023 (UG)
Curriculum and Syllabus
BE- Biomedical Engineering

SEMESTER V

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23BMT51	Embedded Systems and IoMT	PC	3	0	0	3	3	40	60	100
2.	23BMT52	Diagnostic and Therapeutic Equipment	PC	3	0	0	3	3	40	60	100
3.		Professional Elective I*	PE	-	-	-	-	3	40	60	100
4.		Professional Elective II*	PE	-	-	-	-	3	40	60	100
5.		Professional Elective III*	PE	-	-	-	-	3	40	60	100
6.		Professional Elective IV*	PE	-	-	-	-	3	40	60	100
Practicals											
7.	23BML51	Embedded systems and IoMT Laboratory	PC	0	0	3	3	1.5	60	40	100
8.	23BML52	Diagnostic and Therapeutic Equipment Laboratory	PC	0	0	4	4	2	60	40	100
Mandatory Courses											
9.	23MDC51	Mandatory Course - III Soft and Analytical Skills-II	MC	1	0	0	1	0	100	-	100
10		Mandatory Course - IV&	MC	3	0	0	3	0	100	-	100
			Total	-	-	-	-	**21.5**			

*** Professional Elective – I to IV shall be chosen from the list of Professional electives (Verticals) offered by same Programme.**

& Mandatory Course-IV is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-IV)

Chairman
BoS/BME

SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455

Regulation 2023 (UG)
Curriculum and Syllabus
BE- Biomedical Engineering
SEMESTER VI

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23BMT61	Biomechanics	PC	3	0	0	3	3	40	60	100
2.	23CSI42	Artificial Intelligence and Machine Learning	PC	3	0	2	5	4	50	50	100
3.	23BMI61	Medical Image Processing	PC	3	0	2	5	4	50	50	100
4.		Professional Elective V*	PE	-	-	-	-	3	40	60	100
5.		Open Elective – I**	OE	-	-	-	-	3	40	60	100
6.		Open Elective – II**	OE	-	-	-	-	3	40	60	100
Mandatory Courses											
7.		Mandatory Course - V&	MC	3	0	0	3	0	100	-	100
			Total	-	-	-	-	**20**			

*** Professional Elective – V shall be chosen from the list of Professional electives (Verticals) offered by same Programme.**

**** Open Elective – I and II shall be chosen from the list of open electives offered by other Programmes**

& Mandatory Course-V is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-V)

@ The students individually undergo Hospital training in reputed firms/ research institutes / laboratories for the specified duration (04 Weeks) during summer vacation. After the completion of training, a detailed report should be submitted within ten days from the commencement of VII semester.

Chairman
BoS/BME

SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE
(Autonomous)
Gobichettipalayam, Erode -638455

Regulation 2023 (UG)
Curriculum and Syllabus
BE- Biomedical Engineering
SEMESTER VII

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
Theory											
1.	23UHV71	Universal Human Values - 2	HSS	2	1	0	3	3	40	60	100
2.		Elective – Management#	HSS	3	0	0	3	3	40	60	100
3.		Professional Elective VI*	PE	-	-	-	-	3	40	60	100
4.		Open Elective – III**	OE	-	-	-	-	3	40	60	100
5.		Open Elective – IV**	OE	-	-	-	-	3	40	60	100
Practicals											
6.	23BML71	Hospital Training@	EEC	0	0	0	0	2	100	-	100
7.	23BML72	Mini Project	EEC	0	0	2	2	1	100	-	100
			Total	-	-	-	-	18			

#Elective - Management shall be chosen from the Elective Management courses.

*** Professional Elective – VI shall be chosen from the list of Professional electives (Verticals) offered by same Programme**

****Open Elective – III and IV shall be chosen from the list of open electives offered by other Programmes**

@ The students undergone Hospital Training during VI semester summer vacation and same will be evaluated in VII semester.

Chairman
BoS/BME

SEMESTER VIII											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
Practicals											
1.	23BML81	Project Work	EEC	0	0	20	20	10	60	40	100
			Total	**0**	**0**	**20**	**20**	**10**			

TOTAL CREDITS: 165

Chairman
BoS/BME

MANDATORY COURSES IV											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23MDC52	Introduction to Women and Gender Studies	MC	3	0	0	3	0	100	-	100
2.	23MDC53	Elements of Literature	MC	3	0	0	3	0	100	-	100
3.	23MDC54	Film Appreciation	MC	3	0	0	3	0	100	-	100
4.	23MDC55	Disaster Risk Reduction and Management	MC	3	0	0	3	0	100	-	100

MANDATORY COURSES V											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23MDC61	Well Being with Traditional Practices -Yoga, Ayurveda and Siddha	MC	3	0	0	3	0	100	-	100
2.	23MDC62	History of Science and Technology in India	MC	3	0	0	3	0	100	-	100
3.	23MDC63	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0	100	-	100
4.	23MDC64	State, Nation Building and Politics in India	MC	3	0	0	3	0	100	-	100
5.	23MDC65	Industrial Safety	MC	3	0	0	3	0	100	-	100

ELECTIVE – MANAGEMENT COURSES											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23MSE71	Principles of Management	HSS	3	0	0	3	3	40	60	100
2.	23MSE72	Total Quality Management	HSS	3	0	0	3	3	40	60	100
3.	23MSE73	Engineering Economics and Financial Accounting	HSS	3	0	0	3	3	40	60	100
4.	23MSE74	Human Resource Management	HSS	3	0	0	3	3	40	60	100
5.	23MSE75	Knowledge Management	HSS	3	0	0	3	3	40	60	100
6.	23MSE76	Industrial Management	HSS	3	0	0	3	3	40	60	100

Chairman
BoS/BME

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Bio Engineering	Vertical II Innovation and Medical Device Development	Vertical III Management (Healthcare)	Vertical IV Healthcare 4.0	Vertical V Biosignal and Image Processing	Verticals VI Communication System for Health care	Verticals VII Advanced Healthcare Devices
Biomaterials	Foundation Skills in Integrated Product Development	Clinical Engineering	Virtual Reality and Augmented Reality in Healthcare	Pattern recognition	Communication Systems	Bio MEMS
Artificial Organs and Implants	Medical Device Design	Hospital Planning and Management	Biomedical Optics and Photonics	Computer Vision	Wearable Devices	Critical Care and operation theatre Equipment
Rehabilitation Engineering	Patient safety, Standards and Ethics	Medical Waste Management	Physiological Modelling	Speech and Audio Signal Processing	Cloud computing	Human Assistive Devices
Neural Engineering	Medical Device Regulations	Economics and Management for Engineers	Robotics in Medicine	Medical Imaging Systems	Fundamentals of healthcare Analytics	Advancements in Healthcare Technology
Principles of Tissue Engineering	Medical Innovation and Entrepreneurship	Biostatistics	Ergonomics for healthcare	Brain Computer Interface and Applications	Telehealth Technology	Healthcare equipment maintenance and trouble shooting
Genetic Engineering	Rapid Prototyping	Forensic Science in Healthcare	Haptics	Biometric systems	Medical Informatics	Specialized Therapeutic Equipment
Nuclear medicine	Biomedical Device Design and Development	Data Analytics for Healthcare techniques	Artificial Intelligence in Healthcare	Deep learning for Biomedical applications	Ambulatory services	NANO technology in medicine
Genomics	Ophthalmology and Dentistry Equipment	Health policy and equipment	Healthcare Information systems	Bio Inspired Computing	Biotelemetry and telemedicine	Home Medicare technology

Chairman
BoS/BME

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V, VI and VII. These courses are listed in groups called verticals that represent a particular areaof specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2023(Clause 12).

Chairman
BoS/BME

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: BIO ENGINEERING											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23BME11	Biomaterials	PE	3	0	0	3	3	40	60	100
2.	23BME12	Artificial Organs and Implants	PE	3	0	0	3	3	40	60	100
3.	23BME13	Rehabilitation Engineering	PE	3	0	0	3	3	40	60	100
4.	23BME14	Neural Engineering	PE	3	0	0	3	3	40	60	100
5.	23BME15	Principles of Tissue Engineering	PE	3	0	0	3	3	40	60	100
6.	23BME16	Genetic Engineering	PE	3	0	0	3	3	40	60	100
7.	23BME17	Nuclear medicine	PE	3	0	0	3	3	40	60	100
8.	23BME18	Genomics	PE	3	0	0	3	3	40	60	100

VERTICAL 2: INNOVATION AND MEDICAL DEVICE DEVELOPMENT											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23BME21	Foundation Skills in Integrated Product Development	PE	3	0	0	3	3	40	60	100
2.	23BME22	Medical Device Design	PE	3	0	0	3	3	40	60	100
3.	23BME23	Patient Safety, Standards and Ethics	PE	3	0	0	3	3	40	60	100
4.	23BME24	Medical Device Regulations	PE	3	0	0	3	3	40	60	100
5.	23BME25	Medical Innovation and Entrepreneurship	PE	3	0	0	3	3	40	60	100
6.	23BME26	Rapid Prototyping	PE	3	0	0	3	3	40	60	100
7.	23BME27	Biomedical Device Design and Development	PE	3	0	0	3	3	40	60	100
8.	23BME28	Ophthalmology and Dentistry Equipment	PE	3	0	0	3	3	40	60	100

Chairman
BoS/BME

VERTICAL 3: MANAGEMENT (HEALTHCARE)

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23BME31	Clinical Engineering	PE	3	0	0	3	3	40	60	100
2.	23BME32	Hospital Planning and Management	PE	3	0	0	3	3	40	60	100
3.	23BME33	Medical Waste Management	PE	3	0	0	3	3	40	60	100
4.	23BME34	Economics and Management for Engineers	PE	3	0	0	3	3	40	60	100
5.	23BME35	Biostatistics	PE	2	0	2	4	3	50	50	100
6.	23BME36	Forensic Science in Healthcare	PE	3	0	0	3	3	40	60	100
7.	23BME37	Data Analytics for Healthcare techniques	PE	3	0	0	3	3	40	60	100
8.	23BME38	Health policy and equipment	PE	3	0	0	3	3	40	60	100

VERTICAL 4: HEALTHCARE 4.0

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23BME41	Virtual Reality and Augmented Reality in Healthcare	PE	3	0	0	3	3	40	60	100
2.	23BME42	Biomedical Optics and Photonics	PE	3	0	0	3	3	40	60	100
3.	23BME43	Physiological Modelling	PE	3	0	0	3	3	40	60	100
4.	23BME44	Robotics in Medicine	PE	3	0	0	3	3	40	60	100
5.	23BME45	Ergonomics for healthcare	PE	3	0	0	3	3	40	60	100
6.	23BME46	Haptics	PE	3	0	0	3	3	40	60	100
7.	23BME47	Artificial Intelligence in Healthcare	PE	3	0	0	3	3	40	60	100
8.	23BME48	Healthcare Information systems	PE	3	0	0	3	3	40	60	100

Chairman
BoS/BME

VERTICAL 5: BIOSIGNAL AND IMAGE PROCESSING

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23BME51	Pattern recognition	PE	3	0	0	3	3	40	60	100
2.	23BME52	Computer Vision	PE	2	0	2	4	3	50	50	100
3.	23BME53	Speech and Audio Signal Processing	PE	3	0	0	3	3	40	60	100
4.	23BME54	Medical Imaging Systems	PE	3	0	0	3	3	40	60	100
5.	23BME55	Brain Computer Interface and Applications	PE	3	0	0	3	3	40	60	100
6.	23BME56	Biometric systems	PE	3	0	0	3	3	40	60	100
7.	23BME57	Deep learning for Biomedical applications	PE	3	0	0	3	3	40	60	100
8.	23BME58	Bio Inspired Computing	PE	3	0	0	3	3	40	60	100

VERTICAL 6: COMMUNICATION SYSTEM FOR HEALTH CARE

S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23BME61	Communication Systems	PE	3	0	0	3	3	40	60	100
2.	23BME62	Wearable Devices	PE	3	0	0	3	3	40	60	100
3.	23BME63	Cloud computing	PE	3	0	0	3	3	40	60	100
4.	23BME64	Fundamentals of healthcare Analytics	PE	3	0	0	3	3	40	60	100
5.	23BME65	Telehealth Technology	PE	2	0	2	4	3	50	50	100
6.	23BME66	Medical Informatics	PE	3	0	0	3	3	40	60	100
7.	23BME67	Ambulatory services	PE	3	0	0	3	3	40	60	100
8.	23BME68	Biotelemetry and telemedicine	PE	3	0	0	3	3	40	60	100

Chairman
BoS/BME

VERTICAL 7: ADVANCED HEALTHCARE DEVICES											
S.No	Course Code	Course Title	Category	Periods / Week			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
1.	23BME71	Bio MEMS	PE	3	0	0	3	3	40	60	100
2.	23BME72	Critical Care and Operation Theatre Equipment	PE	3	0	0	3	3	40	60	100
3.	23BME73	Human Assistive Devices	PE	3	0	0	3	3	40	60	100
4.	23BME74	Advancements in Healthcare Technology	PE	3	0	0	3	3	40	60	100
5.	23BME75	Healthcare equipment maintenance and trouble shooting	PE	3	0	0	3	3	40	60	100
6.	23BME76	Specialized Therapeutic Equipment	PE	3	0	0	3	3	40	60	100
7.	23BME77	NANO technology in medicine	PE	3	0	0	3	3	40	60	100
8.	23BME78	Home Medicare technology	PE	3	0	0	3	3	40	60	100

Chairman
BoS/BME

OPEN ELECTIVES

S. NO.	COURSE CODE	COURSE TITLE	Category	PERIODS PER WEEK			Total Contact Period	Credits	Max. Marks		
				L	T	P			CA	ES	TM
OFFERED BY DEPARTMENT OF CIVIL ENGINEERING											
1	23CEO11	Civil and Infrastructure Engineering	OE	3	0	0	3	3	40	60	100
2	23CEO12	Environmental Pollution and waste management	OE	3	0	0	3	3	40	60	100
3	23CEO13	Environmental Impact Assessment	OE	3	0	0	3	3	40	60	100
4	23CEO14	Building Services	OE	3	0	0	3	3	40	60	100
5	23CEO15	Water, Sanitation and Health	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING											
1	23CSO11	Foundation of AR/VR	OE	3	0	0	3	3	40	60	100
2	23CSO12	Web Designing	OE	3	0	0	3	3	40	60	100
3	23CSO13	Block Chain fundamentals	OE	3	0	0	3	3	40	60	100
4	23CSO14	Knowledge Management	OE	3	0	0	3	3	40	60	100
5	23CSO15	Cloud Computing Essentials	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING											
1	23ECO11	Basics of Electronics in Automation	OE	3	0	0	3	3	40	60	100
2	23ECO12	Wireless Optical Communication	OE	3	0	0	3	3	40	60	100
3	23ECO13	Soft Computing techniques	OE	3	0	0	3	3	40	60	100
4	23ECO14	Consumer electronics	OE	3	0	0	3	3	40	60	100
5	23ECO15	Principles of communication Engineering	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING											
1.	23EEO11	Renewable Energy Sources	OE	3	0	0	3	3	40	60	100
2.	23EEO12	Electrical Vehicle	OE	3	0	0	3	3	40	60	100
3.	23EEO13	Energy Auditing and Conservation	OE	3	0	0	3	3	40	60	100
4.	23EEO14	Domestic and Industrial Electrical Installations	OE	3	0	0	3	3	40	60	100
5.	23EEO15	Embedded System Design and Control	OE	3	0	0	3	3	40	60	100

Chairman
BoS/BME

OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING											
1	23MEO11	Industrial Instrumentation	OE	3	0	0	3	3	40	60	100
2	23MEO12	Energy Technology	OE	3	0	0	3	3	40	60	100
3	23MEO13	Reverse Engineering	OE	3	0	0	3	3	40	60	100
4	23MEO14	Fire Safety Engineering	OE	3	0	0	3	3	40	60	100
5	23MEO15	Entrepreneurship Development	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT ARTIFICIAL INTELLIGENCE AND DATA SCIENCE											
1	23ADO11	Introduction to Big Data	OE	3	0	0	3	3	40	60	100
2	23ADO12	Principles of Data Science	OE	3	0	0	3	3	40	60	100
3	23ADO13	Data Visualization and its Applications	OE	3	0	0	3	3	40	60	100
4	23ADO14	Data Warehousing and Mining	OE	3	0	0	3	3	40	60	100
5	23ADO15	Principles of Cyber Security	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT INFORMATION TECHNOLOGY											
1	23ITO11	Basics of Java Programming	OE	3	0	0	3	3	40	60	100
2	23ITO12	Ethical Hacking	OE	3	0	0	3	3	40	60	100
3	23ITO13	E-Commerce and Applications	OE	3	0	0	3	3	40	60	100
4	23ITO14	Basics of Android Application Development	OE	3	0	0	3	3	40	60	100
5	23ITO15	Introduction to Web Design	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY											
1	23PTO11	Nutraceuticals	OE	3	0	0	3	3	40	60	100
2	23PTO12	IPR for Pharma Industry	OE	3	0	0	3	3	40	60	100
3	23PTO13	Pharmaceutical Nanotechnology	OE	3	0	0	3	3	40	60	100
4	23PTO14	Basics of Human Anatomy and physiology	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT BIOMEDICAL ENGINEERING											
1	23BMO11	Biosensors and Instrumentation	OE	3	0	0	3	3	40	60	100
2	23BMO12	Medical Robotics	OE	3	0	0	3	3	40	60	100
3	23BMO13	Biometric Technology	OE	3	0	0	3	3	40	60	100
4	23BMO14	Healthcare Management systems	OE	3	0	0	3	3	40	60	100
5	23BMO15	IoT in Healthcare	OE	3	0	0	3	3	40	60	100

Chairman
BoS/BME

OFFERED BY DEPARTMENT OF COMPUTERSCIENCE AND ENGINEERING (CYBER SECURITY)											
1	23CRO11	Mobile Device Security	OE	3	0	0	3	3	40	60	100
2	23CRO12	Malware Analysis	OE	3	0	0	3	3	40	60	100
3	23CRO13	Hardware Security	OE	3	0	0	3	3	40	60	100
4	23CRO14	Web and Mobile Application Security	OE	3	0	0	3	3	40	60	100
5	23CRO15	Information Security	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT OF COMPUTERSCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE ENGINEERING)											
1	23AMO11	AI for Everyone	OE	3	0	0	3	3	40	60	100
2	23AMO12	Machine Learning and its Applications	OE	3	0	0	3	3	40	60	100
3	23AMO13	Quantum AI	OE	3	0	0	3	3	40	60	100
4	23AMO14	Reinforcement Learning	OE	3	0	0	3	3	40	60	100
5	23AMO15	Network Automation using AIML	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT OF BIOTECHNOLOGY											
1	23BTO11	Biotechnology for Engineers	OE	3	0	0	3	3	40	60	100
2	23BTO12	Enzyme Technology	OE	3	0	0	3	3	40	60	100
3	23BTO13	Introduction to Plant Biotechnology	OE	3	0	0	3	3	40	60	100
4	23BTO14	Biofuels	OE	3	0	0	3	3	40	60	100
5	23BTO15	Forensic Technology	OE	3	0	0	3	3	40	60	100

Chairman
BoS/BME

23MAT11	MATRICES AND CALCULUS (Common to B.E./B.Tech. all Branches)	L T P C 3 1 0 4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications
- To familiarize the students with differential calculus
- To familiarize the student with functions of several variables. This is needed in many branches of engineering
- To make the students understand various techniques of integration
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications

UNIT-I **MATRICES** **9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications : Stretching of an elastic membrane.

UNIT-II **DIFFERENTIAL CALCULUS** **9+3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules(sum, product, quotient, chain rules) - Implicit differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT-III **FUNCTIONS OF SEVERAL VARIABLES** **9+3**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT-IV **INTEGRAL CALCULUS** **9+3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Improper integrals - Applications : Hydrostatic force and pressure, moments and centre of mass.

Chairman
BoS / S&H

UNIT-V MULTIPLE INTEGRALS 9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centre of mass, moment of inertia.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to :

CO1: Use the matrix algebra methods for solving practical problems
CO2: Apply differential calculus tools in solving various application problems.
CO3: Use differential calculus ideas on several variable functions
CO4: Apply different methods of integration in solving practical problems
CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS :

1. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2019. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5,7.1 - 7.4 and 7.8]
2. Grewal. B. S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.

REFERENCE BOOKS :

1. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2022
2. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2021
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016

CO's – PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	1	-	-	-	2	-	2	3
CO2	3	3	1	1	-	-	-	3	-	2	3
CO3	3	3	1	1	-	-	-	2	-	2	3
CO4	3	3	1	1	-	-	-	2	-	2	3
CO5	3	2	1	1	-	-	-	2	-	2	3
AVG	3	3	1	1	-	-	-	2	-	2	3

1- Low, 2- Medium , 3-High, "-" No Correlation

Chairman
BoS / S&H

23ENT11	PROFESSIONAL ENGLISH – I (Common to B.E./B.Tech. all Branches)	L T P C 3 0 0 3

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To learn to use basic grammatical structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs,definitions, essays and user manuals.

UNIT-I INTRODUCTION TO EFFECTIVE COMMUNICATION AND FUNDAMENTALS OF COMMUNICATION 10

Introduction to Effective Communication- Barriers of Communication, Seven C's of Effective Communication, Effective Listening, Effective Speaking, Excellence in Reading, Ways to Develop Language and Communication Skills.

Reading- Reading Brochures (Technical Context), Telephone Messages/ Social Media Messages Relevant To Technical Contexts And Emails.

Writing- Writing Emails / Letters Introducing Oneself

Grammar- Present Tense (Simple and Progressive); Question Types: Wh/ Yes Or No/ and Tags

Vocabulary- Synonyms; One Word Substitution; Abbreviations & Acronyms (as Used in TechnicalContexts)

UNIT-II NARRATION AND SUMMATION 9

Reading - Reading Biographies, Travelogues, Newspaper Reports, Excerpts from Literature, and Travel & Technical Blogs.

Writing - Guided writing, Paragraph Writing, Short Report on an Event (Field Trip etc.)

Grammar - Past Tense (Simple); Subject-Verb Agreement; and Prepositions.

Vocabulary - Word Forms (Prefixes& Suffixes); Synonyms and Antonyms. Phrasal Verbs.

UNIT-III DESCRIPTION OF A PROCESS / PRODUCT 9

Reading - Reading Advertisements, Gadget Reviews; User Manuals.

Writing - Writing Definitions; Instructions; and Product /Process Description.

Grammar - Imperatives; Adjectives; Degrees of Comparison; Present & Past Perfect Tenses.

Vocabulary- Compound Nouns, Homonyms; and Homophones, Discourse Markers (Connectives& Sequence Words)

Chairman
BoS / S&H

UNIT-IV CLASSIFICATION AND RECOMMENDATIONS 9

Reading - Newspaper Articles; Journal Reports –and Non Verbal Communication (Tables, Pie Charts etc...)
Writing - Note-making / Note-taking (*Study skills to be taught, not tested); Writing Recommendations; Transferring Information from Non Verbal (Chart , Graph etc, to Verbal Mode)
Grammar - Articles; Pronouns - Possessive & Relative Pronouns.
Vocabulary - Collocations; Fixed / Semi Fixed Expressions

UNIT-V EXPRESSION 8

Reading - Reading Editorials; and Opinion Blogs;
Writing - Essay Writing (Descriptive or Narrative).
Grammar- Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences.
Vocabulary - Cause & Effect Expressions – Content vs. Function Words.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the Course the students will able to

CO1:	Use appropriate words in a professional context
CO2:	Gain understanding of basic grammatical structures and use them in right context
CO3:	Read and infer the denotative and connotative meanings of technical text
CO4:	Read and interpret information presented in tables, charts and other graphic forms
CO5:	Write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS:

1. Department of English, Anna University, "English for Engineers & Technologists" Orient Blackswan Private Ltd, 2020.
2. Dr.Veena Selvam, Dr.Sujatha Priyadarshini, & CO, Department of English, Anna University, "English for Science & Technology" Cambridge University Press, 2021.

REFERENCE BOOKS:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communication–Principles and Practices", Oxford Univ. Press, New Delhi, 2016.

Chairman
BoS / S&H

2. Lakshminarayanan, "A Course Book on Technical English", Scitech Publications (India) Pvt.Ltd. 2012.
3. Aysha Viswamohan, "English For Technical Communication (With CD)", Mcgraw HillEducation, ISBN : 0070264244, 2008.
4. Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House, 2016.

E. RESOURCES:

- https://learnenglish.britishcouncil.org/

CO's-PO's MAPPING :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	2	3	-	3
CO2	-	-	-	-	-	1	-	2	3	-	2
CO3	-	-	-	-	-	1	-	3	3	-	3
CO4	-	-	-	2	-	-	-	3	3	-	3
CO5	-	-	-	-	-	-	-	2	3	-	2
AVR	-	-	-	2	-	1	-	2	3	-	3

1- Low, 2- Medium, 3-High, "-" No Correlation

Chairman
BoS / S&H

23PHT11	ENGINEERING PHYSICS	L	T	P	C
	(B.E./B.Tech-Common to all branches)	3	0	0	3

COURSE OBJECTIVES:

- To make the students effectively achieve an understanding of mechanics
- Provide knowledge of elastic property, thermal property of materials and its applications
- Impart knowledge of laser and their applications
- Introduce the essential principles of fiber optics and its applications
- Equipping the students to successfully understand the importance of quantum physics

UNIT-I **MECHANICS** **10**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia – theorems of M – M.I of a diatomic molecule – torque – rotational dynamics of rigid bodies – rotational energy state of a rigid diatomic molecule – torsional pendulum – double pendulum

UNIT-II **PROPERTIES OF MATTER AND THERMAL PHYSICS** **10**

Elasticity- Hooke's law – stress – strain diagram – Poisson's ratio – Factors affecting elasticity –bending of beams-Bending moment equation – Depression of a cantilever–Young's modulus by uniform bending – I-shaped girders-Modes of heat transfer – thermal conductivity – Newton's law of cooling – Linear heat flow – Lee's disc method – conduction through compound media (series and parallel)

UNIT-III **LASER** **9**

Lasers: Stimulated absorption – Spontaneous emission – Stimulated emission – Population inversion-Einstein's coefficients derivation and their relations – Pumping methods – Types of lasers – Nd:YAG, CO_2 laser, Semiconductor lasers (homojunction & heterojunction) – Industrial and Medical Applications of lasers

UNIT-IV **FIBER OPTICS** **8**

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending – Fiber optics communication system (qualitative) – Temperature and displacement sensors – fiber optic endoscope

UNIT-V **QUANTUM PHYSICS** **8**

Photons and light waves – Electrons and matter waves – Compton effect: theory of scattering –Derivation and experimental verification – The Schrodinger equation (Time dependent and

Chairman
BoS / S&H

time independent forms) – particle in a one-dimensional rigid box for eigen value and eigen function – tunneling (qualitative) – scanning tunneling microscope

TOTAL: 45 PERIODS

COURSE OUTCOME

At the end of the course the students will be able to

- **CO1:** Understand the importance of mechanics.
- **CO2:** Describe the Elastic property of solid materials and thermal conductivity of solids in industrial applications
- **CO3:** Demonstrate a foundational knowledge in lasers
- **CO4:** The students will get knowledge on fiber optics
- **CO5:** Understand the importance of quantum physics

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow, "An Introduction to Mechanics," McGraw Hill Education (IndianEdition), 2017
2. Arthur Beiser, Shobhit Mahajan, S.Rai Choudhury, "Concepts of Modern Physics," McGraw-Hill (Indian Edition), 2017

REFERENCE BOOKS:

1. K.Thyagarajan and A.Ghatak, "Lasers: Fundamentals and Applications," Laxmi Publications, (Indian Edition), 2023
2. D.Halliday, R.Resnick and J.Walker, "Principles of Physics," Wiley (Indian Edition), 2021
3. N.Garcia, A.Damask and S.Schwarz, "Physics for Computer Science Students," Springer-Verlag, 2012

CO's- PO's MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	1	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-
CO3	3	2	2	1	2	-	-	-	-	-	1
CO4	3	2	2	1	2	-	-	-	-	-	1
CO5	3	3	1	1	2	-	-	-	-	-	-
AVG	3	3	2	1	2	-	-	-	-	-	1

1- Low, 2- Medium , 3-High, "-" No Correlation

Chairman BoS / S&H

23CYT11	ENGINEERING CHEMISTRY	L	T	P	C
	(B.E./B.Tech-Common to all branches)	3	0	0	3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques
- To impart knowledge on the basic principles and preparatory methods of nanomaterials
- To introduce the basic concepts and applications of phase rule and composites
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices

UNIT-I **WATER AND ITS TREATMENT** 9

Water: Sources and impurities, **Water quality parameters:** turbidity, pH, hardness, alkalinity, TDS, COD and BOD. **Desalination of brackish water**: Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. **Treatment of boiler feed water**: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination)

UNIT-II **NANOCHEMISTRY** 9

Basics: Distinction between molecules, nanomaterials and bulk materials; **Size-dependent properties** (optical, electrical, mechanical and magnetic); **Types of nanomaterials**: Definition, properties and uses of – nanoparticle, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, electrochemical deposition. **Applications** of nanomaterials with examples in medicine, agriculture, energy, electronics and catalysis.

UNIT-III **PHASE RULE AND COMPOSITES** 9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system – Pattinson's process.

Composites: Introduction: Definition & Need for composites; **Constitution**: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Properties and applications of**: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites.

Chairman
BoS / S&H

UNIT-IV FUELS AND COMBUSTION 9

Fuels: Introduction: Classification of fuels; **Coal and coke:** Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). **Petroleum and Diesel:** Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; **Solid biofuels, Compressed biogas, Power alcohol and biodiesel.**
Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; **Flue gas analysis** - ORSAT Method. **CO_2 emission and carbon foot print.**

UNIT-V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; **Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries:** Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; **Electric vehicles-working principles; Fuel cells:** H_2-O_2 fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able

CO1: To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2: To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3: To apply the knowledge of phase rule and composites for material selection requirements.
CO4: To recommend suitable fuels for engineering processes and applications.
CO5: To recognize different forms of energy resources and apply them for suitable applications in energy sectors

Chairman
BoS / S&H

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018
2. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018

REFERENCE BOOKS:

1. Shashi Chawla, "A Text Book of Engineering Chemistry", Dhanpar Rai & Co (Pvt.) Ltd, New Delhi, 2011
2. O.G. Palanna, "Engineering Chemistry", McGraw Hill Education (India) Private Limited, 2nd Edition, 2017
3. Dr. A.Ravikrishnan, "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Limited, 23rd Edition, 2023

CO's- PO's MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	1	1	3	-	-	-	-	-
CO2	3	2	1	1	2	2	-	-	-	-	1
CO3	3	3	1	1	1	1	-	-	-	-	-
CO4	3	2	1	1	1	1	-	-	-	-	-
CO5	3	2	2	1	2	2	-	-	-	-	-
AVG	3	2	2	1	1	2	-	-	-	-	1

1- Low, 2- Medium , 3-High, "-" No Correlation

Chairman
BoS / S&H

23CST11	PROBLEM SOLVING AND PYTHON PROGRAMMING (Common to: B.E. / B.Tech. all Branches)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To solve problems using computational thinking methods using pseudo code and flowchart
- To understand the fundamentals of algorithmic problem solving basics and strategies
- To define variables data types and error messages
- To learn to solve problems using Python conditionals loops lists tuples and dictionaries to represent complex data
- To understand the functions modules and do input/output with files in Python

UNIT-I **COMPUTATIONAL THINKING** **8**

Introduction - Problem solving and Decomposition - Abstraction - Notations Pseudo code - Flow chart - Programming language

UNIT-II **ALGORITHMIC PROBLEM SOLVING** **8**

Algorithm Implementation - Top down design - Simple strategies for developing algorithms - Iteration - Recursion - Fundamental algorithms - Anticipating and Dealing with Errors

UNIT-III **BASICS BUILDING BLOCKS OF PYTHON** **9**

Variables - Immutable variables - Data types - Operators - Python Reserved Words - Understanding error messages

UNIT-IV **CONTROL STATEMENTS AND STRUCTURED TYPES** **10**

Control Flow - Indenting - if Statement - while Loop - break and continue - for Loop - String - Lists - Tuples - Sets - Dictionaries

UNIT-V **FUNCTIONS, MODULES AND FILES** **10**

Definition - Hiding redundancy - Arguments and return values - Variable Number of Arguments - Scope - Passing Functions to a Function - Mapping Functions in a Dictionary - Lambda function – Recursive Functions - Modules: Standard Modules - OS and SYS modules - User defined Modules - Importing modules – Writing into a File - Reading from a File - File Methods

TOTAL : ~~45 PERIODS~~

Chairman
BoS/CSE& IT

COURSE OUTCOMES:

At the end of the course the students will be able to

- **CO1 :** Develop algorithmic solutions for simple computational problems to develop and execute simple Python programs.
- **CO2 :** Write the Algorithms for problem solving basics and strategies to solve complex problems
- **CO3 :** Compose simple Python programs using to illustrate variables data types and error messages.
- **CO4 :** Represent compound data using Python conditionals loops lists tuples dictionaries for solving problems
- **CO5 :** Create functions modules read and write data from/to files in Python programs.

TEXT BOOKS:

1. R. G. Dromey "How to Solve it by Computer", Pearson Education., 2015
2. Charles Dierbach "Introduction to Computer Science using Python: A Computational Problem- Solving Focus", Wiley India., 2015

REFERENCE BOOKS:

1. John V. Guttag "Introduction to Computation and Programming using Python", The MIT press. 2021 (3rd Edition).
2. Paul Gries, Jennifer Campbell, Jason Montojo "Practical Programming: An Introduction to Computer Science using Python 3", Pragmatic Programmers., 2013 , Second edition
3. Robert Sedgewick, Kevin Wayne, Robert Dondero "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India., 2016
4. Karl Beecher "Computational Thinking - A beginner's guide to problem solving and Programming", BCS Learning &Development., 2017

E-RESOURCES:

1. http://www.flowgorithm.org/
2. https://www.python.org/
3. https://nptel.ac.in/courses/106104074

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	-	-	-	-	2	2	3	3	3
CO2	2	3	3	3	2	-	-	-	-	2	-	3	3	3
CO3	2	2	-	2	2	-	-	-	-	1	-	3	3	3
CO4	1	2	-	-	1	-	-	-	-	1	-	2	3	3
CO5	2	2	-	-	2	-	-	-	-	1	2	2	3	3
AVG	**1.8**	**2.4**	**3**	**2.7**	**1.8**	**-**	**-**	**-**	**-**	**1.4**	**2**	**2.6**	**3**	**3**

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/CSE&IT

23TAT11 | தமிழர் மரபு | L T P C 1 0 0 1

(B.E./B.Tech- அனைத்து பாடப்பிரிவுகளுக்கும் பொதுவானது)

பாடநெறி நோக்கங்கள்:

- தமிழின் இலக்கியங்கள் மற்றும் நவீன இலக்கியங்களைப் புரிந்துகொள்ளுதல்
- தமிழ் கலாச்சார பாரம்பரியத்தைக் கற்றுக்கொள்ளுதல்
- தமிழர்களின் பல்வேறு கலைவடிவங்களைக் கண்டறிதல்
- தமிழர்களின் திணைக்கோட்பாடுகளை விளக்குதல்
- இந்திய சுதந்திர போராட்ட இயக்கங்களுக்கும் இந்திய கலாச்சாரத்திற்குமான தமிழர்களின் பங்களிப்பை உணர்தல்

அலகு - I மொழி மற்றும் இலக்கியம் 3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் ஆறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த மதங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு - II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு - III நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு - IV தமிழர்களின் திணைக் கோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவு, கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி

Chairman
BoS / S&H

அலகு - V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிற்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

பாடநெறி முடிவுகள்:

இப்பாடத்தைப் படிப்பதின் முடிவில் மாணவர்கள்

CO1: தமிழின் பல்வேறு இலக்கியங்களைப் பற்றிய அறிவைப் பெறுவார்கள்
CO2: தமிழ் கலாச்சார பாரம்பரியத்தின் தனித்தன்மையைக் கற்றுக்கொள்வார்கள்
CO3: தமிழகத்தின் பல்வேறு கலைவடிவங்களைக் கண்டறிவார்கள்
CO4: தமிழர்களின் திணைக்கோட்பாடுகளை அறிந்துகொள்வார்கள்
CO5: தமிழ் சுதந்திரப்போராட்ட வீரர்கள் மற்றும் தமிழ் கலாச்சாரத்தை இந்தியாவின் மற்ற பகுதியுடன் ஒப்பிடும் திறனைப் பெறுவார்கள்

மின் -ஆதாரங்கள்:

1. https://www.tamilvu.org/

CO's –PO's விவரணையாக்கம்::

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	1	1	-	1	-	-
CO2	-	-	-	-	-	1	1	-	1	-	-
CO3	-	-	-	-	-	1	1	-	1	-	-
CO4	-	-	-	-	-	1	1	-	1	-	-
CO5	-	-	-	-	-	1	1	-	1	-	-
AVG	-	-	-	-	-	1	1	-	1	-	-

Chairman
BoS / S&H

Shree Venkateshwara Hi-Tech Engineering College

23TAT11	HERITAGE OF TAMILS (B.E./B.Tech-Common to all branches)	L T P C 1 0 0 1

COURSE OBJECTIVES:

- To understand the Sangam and modern literature of Tamil
- To learn the heritage of Tamil culture
- To recognize the various art forms of Tamils
- To explain the Thinai concept of Tamils
- To realize the contribution of Tamils to Indian national movement and Indian culture

UNIT-I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land- Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modernliterature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT-II HERITAGE – ROCK ART PAINTINGS TO MODERN ART - SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT-III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam,Valari, Tiger dance - Sports and Games of Tamils.

UNIT-IV THINAI CONCEPTS OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT-V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the otherparts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Chairman
BoS / S&H

COURSE OUTCOMES:

At the end of the course the student will be able to

- **CO1:** Gain knowledge about various literatures of Tamil
- **CO2:** Learn the uniqueness of Tamil cultural heritage
- **CO3:** Find various art forms of Tamil Nadu
- **CO4:** Understand the Thinai concepts in Tamil
- **CO5:** Distinguish the contribution of Tamils to Indian national movement and Indian culture

E- RESOURCES:

1. https://www.tamilvu.org/

CO's -PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	1	1	-	1	-	-
CO2	-	-	-	-	-	1	1	-	1	-	-
CO3	-	-	-	-	-	1	1	-	1	-	-
CO4	-	-	-	-	-	1	1	-	1	-	-
CO5	-	-	-	-	-	1	1	-	1	-	-
AVG	-	-	-	-	-	1	1	-	1	-	-

Chairman
BoS / S&H

		L	T	P	C
23CSL11	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	0	0	4	2

(Common to: B.E. / B.Tech. all Branches)

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python

LIST OF EXPERIMENTS

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL : 60 PERIODS

Chairman
BoS/CSE&IT

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1 : Develop algorithmic solutions to simple computational problems

CO2 : Develop and execute simple Python programs.

CO3 : Implement programs in Python using conditionals and loops for solving problems.

CO4 : Deploy functions to decompose a Python program.

CO5 : Process compound data using Python data structures and Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021.
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

E-RESOURCES:

1. http://www.flowgorithm.org/
2. https://www.python.org/
3. https://nptel.ac.in/courses/106104074

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	3	3	3
CO2	3	3	3	3	2	-	-	-	-	2	-	3	3	-
CO3	2	2	-	2	2	-	-	-	-	1	-	3	3	3
CO4	1	2	-	-	1	-	-	-	-	1	-	2	3	3
CO5	2	2	-	-	2	-	-	-	-	1	-	2	3	3
AVG	**2.2**	**2.4**	**3**	**3**	**1.8**	**-**	**-**	**-**	**-**	**1.4**	**2**	**2.6**	**3**	**3**

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/CSE&IT

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

		L	T	P	C
23PCL11	PHYSICS AND CHEMISTRY LABORATORY (B.E./B.Tech-Common to all Branches)	0	0	4	2

PHYSICS LABORATORY
(Any Seven Experiments)

COURSE OBJECTIVES:

- Determination of the physical parameters such as young's modulus by Uniform bending method, Non-Uniform bending method, Simple harmonic oscillations of cantilever and rigidity modulus of wire
- To impart knowledge in the determination of the thermal conductivity of a bad conductor by Lee's Disc method and band gap of a semiconductor
- Determination of the wavelength of the laser using grating, numerical aperture and acceptance angle in an optical fiber and width of the groove in an compact disc by using laser
- Determination of the velocity of sound and compressibility of liquids by using ultrasonic interferometer
- Knowledge on the frequency of alternating current using electrically vibrating tuning fork by using Melde's apparatus

LIST OF EXPERIMENTS

1. Determination of Young's modulus by Uniform bending method
2. Determination of Young's modulus by non-uniform bending method
3. Simple harmonic oscillations of cantilever
4. Determination of rigidity modulus of wire and moment of inertia of regular objects – Torsion pendulum
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method
6. Determination of band gap of a semiconductor
7. Determination of the wavelength of the laser using grating
8. a) Determination of numerical aperture and acceptance angle in an optical fiber
   b) Determination of width of the groove in an compact disc by using laser
9. Determination of the velocity of sound and compressibility of liquids by using ultrasonic interferometer
10. Determination of the frequency of alternating current using electrically vibrating tuning fork -Melde's apparatus

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1:	Experiment and determine the physical characteristics of given solid materials using Young's modulus-Uniform bending method, non-uniform bending method, cantilever method and Torsion Pendulum.
CO2:	Experiment and determine the thermal conductivity of a bad conductor using Lee's Disc method and band gap energy of a given semiconducting material using Zener diode.
CO3:	Experiment and determine the optical property of light sources, acceptance angle of optical fiber and width of the groove in an compact disc using Laser.
CO4:	Experiment and determine the velocity of ultrasonic waves using ultrasonic interferometer.
CO5:	Experiment and determine the frequency of alternating current using electrically vibrating tuning fork by using Melde's apparatus

Chairman
BoS / S&H

TEXT BOOKS:

1. Dr. P. Mani, Engineering Physics Practicals, Dhanam Publications (2022)

CO's – PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	1	-	-	-	-	-	-	-
CO2	3	3	1	1	-	-	-	-	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	-
CO4	3	3	1	1	-	-	-	-	-	-	-
CO5	3	3	1	1	-	-	-	-	-	-	-
AVG	3	3	1	1	-	-	-	-	-	-	-

CHEMISTRY LABORATORY

(Any Seven Experiments)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity.
- To acquire the knowledge in total hardness and dissolved oxygen and its impacts in industries through experiments
- To understand the impacts of chlorine in water sample through volumetric analysis.
- To induce the students to familiarize with electroanalytical techniques in the determination of impurities in aqueous solutions.
- To determine the amount of metal ions through spectroscopic techniques.

LIST OF EXPERIMENTS

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard.
2. Determination of types and amount of alkalinity in a water sample
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Conductometric titration of barium chloride against sodium sulphate (precipitation titration).
9. Estimation of iron content of the given solution using potentiometer.
10. Estimation of sodium /potassium present in water using a flame photometer.

TOTAL: 30 PERIODS

Chairman
BoS / S&H

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: Analyse the quality of water samples with respect to their acidity and alkalinity of water samples

CO2: Examine the water quality parameters like total hardness and DO with volumetric analysis.

CO3: Learn the permissible limit of chlorine in the given water sample

CO4: Analyse the impurities in solution by electro analytical techniques quantitatively

CO5: Determine the amount of metal ions through spectroscopic techniques.

CO's – PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	3	1	-	-	-	1
CO2	3	2	2	-	-	3	1	-	-	-	1
CO3	3	2	1	-	-	3	1	-	-	-	1
CO4	3	2	2	-	1	2	-	-	-	-	-
CO5	3	2	1	-	1	2	-	-	-	-	-
Avg.	3	2	1	-	1	3	1	-	-	-	1

TEXT BOOKS:

1. "Vogel's Textbook of Quantitative Chemical Analysis", (8th Edition, 2014)
2. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, "Vogel's Textbookof Quantitative Chemical Analysis", (2009)

Chairman
BoS / S&H

		L	T	P	C
23ENL11	ENGLISH LABORATORY (Common to B.E./B.Tech. all Branches)	0	0	2	1

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audiomaterials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities those are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT-I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6

Listening- Listening for General Information-Specific Details- Conversation: Introduction to Classmates - Audio / Video (Formal & Informal); Telephone Conversation; Listening to Voicemail & Messages; Listening and Filling a Form.
Speaking- Making Telephone Calls-Self Introduction; Introducing a Friend; - Politeness Strategies- Making Polite Requests, Making Polite Offers, Replying to Polite Requests andOffers- Understanding Basic Instructions (Filling out a Bank Application for Example).

UNIT-II NARRATION AND SUMMATION 6

Listening - Listening to Podcasts, Anecdotes / Stories / Event Narration; Documentaries andInterviews with Celebrities.
Speaking - Narrating Personal Experiences / Events-Talking about Current and TemporarySituations & Permanent and Regular Situations - Describing Experiences and Feelings- Engaging in Small Talk- Describing Requirements and Abilities.

UNIT-III DESCRIPTION OF A PROCESS / PRODUCT 6

Listening - Listen to Product and Process Descriptions; A Classroom Lecture; and Advertisements about Products.
Speaking - Picture Description- Describing Locations in Workplaces- Giving Instruction to Use the Product- Explaining Uses and Purposes- Presenting a Product- Describing Shapes and Sizes and Weights- Talking about Quantities (Large & Small)- Talking aboutPrecautions.

UNIT-IV CLASSIFICATION AND RECOMMENDATIONS 6

Listening – Listening to Technology, Entertainment and Design (TED) Talks; Listening to Lectures - and Educational Videos.
Speaking – Small Talk; Discussing and Making Plans-Talking about Tasks-Talking about Progress- Talking about Positions and Directions of Movement-Talking about Travel Preparations- Talking about Transportation.

Chairman
BoS / S&H

UNIT-V EXPRESSION 6

Listening - Listening to Debates/ Discussions; Different Viewpoints on an Issue; and PanelDiscussions.

Speaking - Making Predictions- Talking about a Given Topic-Giving Opinions- Understandinga Website- Describing Processes.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able

CO1: To listen to and understand general and complex academic information
CO2: To listen to and understand different points of view in a discussion
CO3: To speak fluently and accurately in formal and informal communicative contexts
CO4: To describe products and processes and explain their uses clearly as well as accurately
CO5: To express their opinions effectively in both formal and informal discussions

CO's & PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	1	2	3	-	2
CO4	-	-	-	-	-	-	-	2	3	-	2
CO5	-	-	-	-	-	-	1	3	3	-	2
AVR	-	-	-	-	-	-	1	3	3	-	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

E. RESOURCES

- https://www.ted.com/about/programs-initiatives/ted-talks-education
- https://learnenglish.britishcouncil.org/

Chairman
BoS / S&H

		L	T	P	C
23ENT21	PROFESSIONAL ENGLISH – II (Common to B.E./B.Tech. all Branches)	2	0	0	2

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship andplacements

UNIT-I MAKING COMPARISONS 6

Reading - Reading Advertisements, User Manuals, Brochures Emails.

Writing - Professional Emails, Email Etiquette - Compare and Contrast Essay.
Grammar - Mixed Tenses, Prepositional Phrase.

UNIT-II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 6

Reading - Reading Longer Technical Texts– Cause and Effect Essays, and Letters / Emailsof Complaint.
Writing - Writing Responses to Complaints
Grammar - Active Passive Voice Transformations, Infinitive and Gerunds

UNIT-III PROBLEM SOLVING 6

Reading - Case Studies, Excerpts from Literary Texts, News Reports etc.
Writing - Letter to the Editor, Checklists, Problem Solution Essay / Argumentative Essay.
Grammar - Error Correction; If Conditional Sentences

UNIT-IV CLASSIFICATION AND RECOMMENDATIONS 6

Reading - Newspaper Articles
Writing - Recommendations, Transcoding, Accident Report, Survey Report
Grammar - Reported Speech, Modals.
Vocabulary - Conjunctions- Use of Prepositions

Chairman
BoS / S&H

UNIT-V EXPRESSION 6

Reading - Company Profiles, Statement of Purpose, (SOP), An Excerpt of Interview with Professionals.
Writing - Job / Internship Application – Cover Letter & Resume
Grammar - Numerical Adjectives, Relative Clauses

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the Course the students will able to

CO1:	Compare and contrast products and ideas in technical texts.
CO2:	Identify and report cause and effects in events, industrial processes through technical texts
CO3:	Analyse problems in order to arrive at feasible solutions and communicate them in the written format
CO4:	Present their ideas and opinions in a planned and logical manner
CO5:	Draft effective resumes in the context of job search.

TEXT BOOKS:

1. Department of English, Anna University, "English for Engineers & Technologists" Orient Blackswan Private Ltd, 2020.
2. Dr.Veena Selvam, Dr.Sujatha Priyadarshini, & CO, Department of English, Anna University, "English for Science & Technology" Cambridge University Press, 2021.

REFERENCE BOOKS:

1. Raman, Meenakshi, Sharma & Sangeeta, "Professional English", Oxford University Press, New Delhi, 2019.
2. Dr. V. Chellammal, "Learning to Communicate", Allied Publishers, New Delhi, 2003
3. V.N. Arora and Laxmi Chandra, "Improve Your Writing", Oxford University Press, NewDelhi, 2001.

E. RESOURCES:

- https://learnenglish.britishcouncil.org/

Chairman
BoS / S&H

CO'S-PO'S MAPPING :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	1	-	-	-	-	1	2	3	-	2
CO2	-	-	-	-	-	1	-	3	3	-	3
CO3	-	1	1	-	-	-	-	3	3	-	3
CO4	-	-	-	-	-	-	-	2	3	-	2
CO5	-	-	-	-	-	-	-	2	3	-	2
AVG	-	1	1	-	-	1	1	2	3	-	2

1. Low, 2- Medium, 3-High, "-" No Correlation

Chairman
BoS / S&H

23MAT21	NUMERICAL METHODS AND STATISTICS	L	T	P	C
	(Common to B.E./B.Tech. all Branches)	3	1	0	4

COURSE OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations
- To introduce the numerical techniques of interpolation in various intervals and differentiation and integration in engineering and technology
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of engineering and statistical quality control

UNIT-I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting-Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT-II INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules

UNIT-III NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

UNIT-IV TESTING OF HYPOTHESIS 9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Large andsmall samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence ofattributes

UNIT-V DESIGN OF EXPERIMENTS 9+3

One way and two way classifications - Completely randomized design – Randomized block design -- Latin square design - 2^2 factorial design.

TOTAL : 60 PERIODS

Chairman
BoS / S&H

COURSE OUTCOMES:

At the end of the Course the students will be able to

CO1 : Apply the numerical techniques of interpolation in various intervals and differentiation and integration for engineering problems

CO2 : Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations

CO3 : Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications

CO4 : Apply the concept of testing of hypothesis for small and large samples in real life problems

CO5 : Apply the basic concepts of classifications of design of experiments in the field of agriculture

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2023
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2019

REFERENCE BOOKS:

1. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020
2. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016
3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage
4. Learning, New Delhi, 8th Edition, 2014
5 Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, India, 2022

CO's – PO's MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	1	1	-	-	2	-	2	3
CO2	3	3	1	1	1	-	-	2	-	2	2
CO3	3	3	1	1	1	-	-	2	-	2	3
CO4	3	3	1	1	1	-	-	2	-	2	3
CO5	3	2	1	1	1	-	-	2	-	3	3
AVG	3	3	1	1	1	-	-	2	-	2	3

1- Low, 2- Medium , 3-High, "-" No Correlation

Chairman
BoS / S&H

23BMT21	BIOSCIENCES FOR MEDICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 1. To study structural and functional properties of carbohydrates, proteins, lipids and amino acids.
- 2. To emphasize the role of these biomolecules by providing basic information on specific metabolic diseases and disorders of these biomolecules.
- 3. Gain knowledge on the structural and functional aspects of living organisms.

UNIT-I CARBOHYDRATES, LIPIDS, PROTEIN 10

Classification of carbohydrates - mono, di, oligo and polysaccharides. Structure, physical and chemical properties of carbohydrates - Classification of lipids- simple, compound, and derived lipids. Nomenclature of fatty acid - Structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Nucleic acid: Structural aspects – Components of DNA and RNA, Nucleosides & Nucleotides (introduction, structure & bonding).

UNIT-II VITAMINS AND MINERALS 8

Vitamins: classification (A, D, E, K, and B-complex members), basic structure, source, daily requirement, functions and deficiency symptoms- Minerals: classification- macro elements and microelements, specific function and deficiency disorders

UNIT-III CELL DEGENERATION, REPAIR AND NEOPLASIA 10

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

UNIT-IV HEMODYNAMIC DERANGEMENTS AND DISEASES 9

Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Hematological disorders- Bleeding disorders, Leukaemias, Lymphomas Haemorrhage- Lifestyle diseases - diabetes, obesity, blood pressure.

UNIT-V FUNDAMENTALS OF MICROBIOLOGY AND IMMUNOPATHOLOGY 8

Structure of Bacteria and Virus - List of common bacterial, fungal and viral diseases of human beings.- Basics of Microscopes : Light microscope, Electron microscope (TEM & SEM). - Natural and artificial immunity - Immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies.

TOTAL: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Acquire knowledge on structure, properties and biological functions of carbohydrates, lipids and proteins.

CO2: Assess the significance of vitamins and minerals

CO3: Comprehend genetics and the immune system

CO4: Outline cause, symptoms, diagnosis and treatment of common diseases.

CO5: Understand the basics of microbiology and pathology

TEXT BOOKS:

1. RAFI MD "Text book of biochemistry for Medical Student" Fourth Edition, Universities Press, Orient Blackswan Private Limited - New Delhi 2021.
2. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, "Pathologic Basis of Diseases", 10th edition: South Asia Edition Elsevier India, 2020.
3. Lehninger, A. L, Nelson D. L and Cox, M. M, "Principles of Biochemistry", Freeman Publishers, New York, Eighth edition, 2021.

REFERENCE BOOKS:

1. Dubey RC and Maheswari DK. "A Text Book of Microbiology" Chand & Company Ltd, 5th edition, 2022.
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 6th edition, 2016.
3. Ananthanarayanan & Panicker, "Microbiology" Orientblackswan, 10th edition 2017.
4. Prescott, Harley and Klein, "Microbiology", 10th edition, McGraw Hill, 2017.

E-RESOURCES:

1. NPTEL-Online Courses and Video lectures: https://nptel.ac.in/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	1	-	-	-	-	1	2	1	-
CO2	3	3	2	1	-	1	-	-	-	-	2	3	1	-
CO3	3	2	2	1	-	1	-	-	-	-	2	3	1	-
CO4	3	2	2	1	-	1	-	-	-	-	2	3	2	-
CO5	3	1	2	1	-	1	-	-	-	-	1	2	1	-
AVG	3	2	2	1	-	1	-	-	-	-	2	3	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23EET22	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn the basic concepts of electric circuits and analysis.
- To analyze the magnetic circuits and domestic wiring.
- To understand the basics of working principles and application of electrical machines
- To impart knowledge about analog devices and their characteristics.
- To educate on the fundamental concepts of digital electronics.

UNIT-I	ELECTRICAL CIRCUITS	9

Basic Components of Electric Circuits, Charge, Current, Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchhoff's laws, Series and Parallel Connected Independent Sources, Resistors in Series and Parallel, Voltage division and Current division rule, Mesh current and node voltage methods of analysis.

UNIT-II	MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS	9

Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems. Domestic wiring , types of wires and cables, earthing, protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid.

UNIT-III	ELECTRICAL MACHINES	9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT-IV	ANALOG ELECTRONICS	9

Resistor, Inductor and Capacitor in Electronic Circuits- PN Junction Diodes, Rectifier , Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT

UNIT-V	DIGITAL ELECTRONICS	9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

Total Hours	45

COURSE OUTCOMES

Chairman
BoS/EEE

CO's	OUTCOME
CO1	The students will be able to explain circuit's behavior using circuit laws and analyze the mesh analysis and nodal analysis.
CO2	The students will be able to analyze the Magnetic circuits, earthing and wiring.
CO3	The students will be able to understand the working principle and applications of electrical machines.
CO4	The students will be able to analyze the characteristics of analog electronic devices.
CO5	The students will be able to explain the basic concepts of digital electronics.

CO, PO& PSO MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	1	-	3	2	1
CO2	3	3	2	2	-	-	-	-	-	1	-	3	3	2
CO3	3	3	3	3	-	-	-	-	-	1	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	1	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	1	-	3	3	3

Text Books:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4. James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley,2018

Reference Books:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017
2. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017
4. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition., Cengage India,2019.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

Online Sources

1. NPTEL Videos

Chairman
BoS / EEE

23PHT24	MEDICAL PHYSICS	L	T	P	C
	(B.E. Bio Medical Engineering)	3	0	0	3

COURSE OBJECTIVES:

- To provide understanding of the application of the radiation concepts and methods of Physics in Medical science
- To accentuate the principle, effects and clinical applications of ionizing, non-ionizing electromagnetic radiation
- To enunciate the fundamentals of acoustic waves and their interaction with human tissues
- To explore the effects of radiation in matter and how isotopes are produced
- To study effects of sound and light in human body

UNIT-I LOW ENERGY ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL APPLICATION 9

Physics of radiation, Intensity of radiation-Ionizing and Non-ionizing Electromagnetic spectrum: Overview of non-ionizing radiation effects - Low Frequency Effects - Higher frequency effects., Radiation exposure control– Application

UNIT-II PRINCIPLES OF RADIOACTIVE NUCLIDES 9

Radioactive Decay – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radionuclide-fission and neutron capture reaction

UNIT-III INTERACTION OF RADIATION WITH MATTER LIPIDS 9

Interaction of charged particles with matter – Linear energy transfer range, Bremsstrahlung, Interaction of X and 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 RADIATION DOSE AND ITS EFFECTS 9

Dose and Exposure measurements – Units (SI), Inverse square law, Maximum permissible exposure, relationship between the dosimetric quantities, Radiation biology – effects of radiation, concept of LD 50, Stochastic and Non-stochastic effects, Radiation Syndrome.

Chairman
BoS / S&H

UNIT-V PRINCIPLES AND APPLICATIONS OF SOUND IN MEDICINE 9

Physics of sound, Normal sound levels, ultrasound fundamentals, Generation of ultrasound (Ultrasound Transducer), Interaction of Ultrasound with matter- Reflection, Transmission, Scanning methods, Artifacts, Ultrasound- Doppler effect, Clinical Applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: Interpret the properties of electromagnetic radiations and its effect on human

CO2: Apply the principles and understand the production of radioactive nuclides

CO3: Explain the interaction of radiation with matter

CO4: Identify and Analyse the radiation quantities and its effects

CO5: Demonstrate the knowledge on the properties of sound and its application in medicine

TEXT BOOKS:

1. B.H. Brown, R.H. Smallwood, D.C. Barber, P.V. Lawford, D.R. Hose, "Medical Physics and Biomedical Engineering", Institute of physics publishing, Bristol and Philadelphia, 2017

2. Gopal B. Saha, "Physics and Radiobiology of Nuclear Medicine", Fourth edition Springer, 2013

REFERENCE BOOKS:

1. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology", Varghese Publishing house, Third Edition, 2013

2. Steve Webb, "The Physics of Medical Imaging", Taylor & Francis, Newyork, Second Edition, 2012

3. R.S. Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2010

Chairman
BoS / S&H

CO's – PO's MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	1	1	-	-	-	-	-	-
CO2	3	3	1	1	1	1	-	-	-	-	-
CO3	3	3	1	1	1	-	-	-	-	-	-
CO4	3	3	-	1	1	-	-	-	-	-	-
CO5	3	3	-	1	1	1	-	-	-	-	-
AVG	3	3	1	1	1	1	-	-	-	-	-

1- Low, 2- Medium , 3-High, "-" No Correlation

Chairman
BoS / S&H

23MET21	ENGINEERING GRAPHICS (BE/B.Tech-Common to all Branches)	L	T	P	C
		2	0	4	4

Course Objectives:

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing projection of points, lines and plane surface.
- Drawingprojection of solids and freehand sketching.
- Drawing of sectioned solids and development of surfaces
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT-I PLANE CURVES 5+12

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT-II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT-III PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Orthographic projection- Freehand sketching of multiple views from pictorial views of objects.

UNIT-IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 7+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

UNIT-V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection — isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL : 90 PERIODS

Chairman
BoS / Mech

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: Construct the conic curves, involutes and cycloid

CO2: Solve practical problems involving projection of lines, Planes.

CO3: Draw Projection of solids and can draw freehand sketch.

CO4: Draw projection of sectioned solids and development of surfaces

CO5: Draw the isometric and perspective projections.

TEXT BOOKS:

1. K Venugopal, Engineering Drawing and Graphics, Sixth edition, New Age International, 2013.
2. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.

REFERENCE BOOKS:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edit ion, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/112/102/112102304/
2. https://onlinecourses.nptel.ac.in/noc20_me79/preview
3. https://www.youtube.com/watch?v=ANEvQyt3PnU

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO2	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO3	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO4	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO5	3	1	2	-	2	-	-	-	3	-	2	2	2	-
Avg	3	1	2	-	2	-	-	-	3	-	2	2	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS / Mech

		L	T	P	C
23TAT21	தமிழரும் தொழில்நுட்பமும்	1	0	0	1

(B.E./B.Tech- அனைத்து பாடப்பிரிவுகளுக்கும் பொதுவானது)

பாடநெறி நோக்கங்கள்:

- நெசவு மற்றும் பானைத்தொழில்நுட்பத்தைப் புரிந்து கொள்ளுதல்
- சேர, சோழ, பல்லவ மற்றும் நாயக்கர்களின் வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பத்தை ஒப்பிடுதல்
- தமிழர்களின் பல்வேறு உற்பத்தி தொழில்நுட்பத்தைப் பற்றிய அறிவைப் பெறுதல்
- தமிழர்களின் வேளாண்மை மற்றும் கடல்சார் அறிவைப் பெற்றுக்கொள்ளுதல்
- அறிவியல் தமிழையும் அதன் இணையப்பயன்பாட்டையும் கற்றல்

அலகு - I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு - II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமானப்பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும் கோவில்களும் - சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை

அலகு - III உற்பத்தித் தொழில்நுட்பம் 3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்

அலகு - IV வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் 3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும்

Chairman
BoS / S&H

வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்

அலகு - V அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்

மொத்தம்: 15 பாடவேளைகள்

பாடநெறி முடிவுகள்:

இப்பாடத்தைப் படிப்பதின் முடிவில் மாணவர்கள்

CO1: நெசவு மற்றும் பானைத்தொழில்நுட்பத்தை பற்றிப் புரிந்துகொள்வார்கள்
CO2: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பத்தில் தமிழர்களின் அறிவைப் பெறுவார்கள்
CO3: தமிழர்களின் உற்பத்தி தொழில்நுட்பத்தை கண்டறிவார்கள்
CO4: தமிழர்களின் வேளாண்மை மற்றும் கடல்சார் அறிவைக் குறித்து விவாதிப்பார்கள்.
CO5: பல்வேறு இணையப் பயன்பாடுகளில் அறிவியல் தமிழைப் பயன்படுத்திப்பார்ப்பார்கள்

மின் -ஆதாரங்கள்:

1. https://www.tamilvu.org/
2. https://sorkuvai.com/

CO's –PO's விவரணையாக்கம்:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	1	1	1	1	-	1
CO2	2	-	-	-	-	2	2	2	2	-	2
CO3	2	-	-	-	-	2	2	2	2	-	2
CO4	1	-	-	-	-	1	1	1	1	-	1
CO5	2	-	-	-	-	2	2	2	2	-	2
AVG	2	-	-	-	-	2	2	2	2	-	2

Chairman
BoS / S&H

23TAT21	TAMILS AND TECHNOLOGY (Common to B.E./B. Tech. all branches)	L T P C 1 0 0 1

COURSE OBJECTIVES:

- To understand about weaving and ceramic technology of Tamils
- To compare the design and constructive technology of Cheras, Cholas, Pallavas and Nayakkars
- To gain knowledge in various manufacturing technology of Tamils
- To analyse the agriculture and fishery knowledge of Tamils
- To learn about scientific Tamil and its usage in online platforms

UNIT-I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT-II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT-III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT-IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society

UNIT-V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

Chairman
BoS / S&H

COURSE OUTCOMES:

At the end of the course the student will be able to

CO1: Relate the weaving ceramic technology of Tamils
CO2: Understand the knowledge of Tamils in design and construction technology
CO3: Recognize the manufacturing technology knowledge of Tamils
CO4: Criticize the agriculture and fishery knowledge of Tamils
CO5: Apply scientific Tamil in Various online platforms

E- RESOURCES:

1. https://www.tamilvu.org/
2. https://sorkuvai.com/

CO's –PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	1	1	1	1	-	1
CO2	2	-	-	-	-	2	2	2	2	-	2
CO3	2	-	-	-	-	2	2	2	2	-	2
CO4	1	-	-	-	-	1	1	1	1	-	1
CO5	2	-	-	-	-	2	2	2	2	-	2
AVG	2	-	-	-	-	2	2	2	2	-	2

Chairman
BOS / S&H

23MEL21	ENGINEERING PRACTICES LABORATORY (BE/B.Tech-Common to all Branches)	L	T	P	C
		0	0	4	2

Course Objectives:

- Acquire skills in operating hand tools and instruments. Provide hands on training on common household plumbing work and wood work
- Provide hands on training on welding processes.
- Provide hands on training on various simple machining processes. Making a tray out of metal sheet using sheet metal work.
- Wiring various electrical joints in common household electrical wire network.
- Soldering and testing simple electronic circuits. Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & MECHANICAL)

I) CIVIL ENGINEERING PRACTICES (12)

PLUMBING WORK:

Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components - External thread cutting

WOOD WORK:

Hands-on-exercise: Sawing, Planing and Making joints

II) MECHANICAL ENGINEERING PRACTICES (18)

WELDING WORK:

Fabrication of Models with MS Plate using Arc Welding

BASIC MACHINING WORK:

a) Simple Turning
b) Drilling and Tapping Practice

SHEET METAL WORK:

Model making – Trays and funnels

ASSEMBLING AND DISMANTLING WORK:

Assembling a centrifugal pump

GROUP B (ELECTRICAL & ELECTRONICS)

III) ELECTRICAL ENGINEERING PRACTICES (15)

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

Chairman
BoS / Mech

IV) ELECTRONIC ENGINEERING PRACTICES (15)

SOLDERING WORK:

Soldering simple electronic circuits and checking continuity

ELECTRONIC ASSEMBLY AND TESTING WORK:

Assembling and testing electronic components on a small PCB

ELECTRONIC EQUIPMENT STUDY:

a) Study elements of smart phone
b) Assembly and dismantle of LED TV
c) Assembly and dismantle of computer/ laptop

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: Make a wooden model using carpentry Process.

CO2: Make various shapes using welding processes.

CO3: Make various shapes using manufacturing processes like machining and sheet metal work.

CO4: Wires various electrical joints in common household electrical wire network.

CO5: Solder and test simple electronic circuits. Assemble and test simple electronic components on PCB.

REFERENCE:

1. Manual prepared by the faculty of Civil, Mechanical, Electrical and Electronics and Communication Engineering Department, SVHEC.

E-RESOURCES:

1. https://www.youtube.com/watch?v=GPnQjCrb83Y
2. https://www.youtube.com/watch?v=njwdsMI3PcY

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	3	-	-	-	-	-	-	-	2	1	1
CO2	3	-	-	3	-	-	-	-	-	-	-	2	1	1
CO3	3	-	-	3	-	-	-	-	-	-	-	2	1	1
CO4	3	-	-	3	-	-	-	-	-	-	-	2	1	1
CO5	3	-	-	3	-	-	-	-	-	-	-	2	1	1
Avg	3	-	-	3	-	-	-	-	-	-	-	2	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS / Mech

23BML21	BIOSCIENCES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- 1 .Estimation and quantification of biomolecules.
- 2. Separation of macromolecules.
- 3 .Practice on chemical examinations, Histopathological examinations etc

LIST OF EXPERIMENTS

1. Preparation of solutions: 1) percentage solutions, 2) molar solutions, 3) normal solutions.
2. Standardization of pH meter, preparation of buffers, emulsions.
3. Spectroscopy: Determination of absorption maxima (λmax) of a given solution.
4. General tests for carbohydrates, proteins and lipids.
5. Identification of Blood Collection Tubes and Phlebotomy equipment.
6. Preparation of serum and plasma from blood.
7. Estimation of Haemoglobin and blood glucose.
8. Estimation of creatinine, urea and Uric acid.
9. Separation of proteins by SDS electrophoresis (Demo) and amino acids by thin layer. chromatography (Demo).
10. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood).
11. Basic staining – Hematoxylin and eosin staining.
12. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Understand the Biochemistry laboratory functional components
- **CO2:** Have a sound knowledge of qualitative test of different biomolecules.
- **CO3:** Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample.
- **CO4:** Have a sound knowledge of separation technology of proteins and amino acids.
- **CO5:** Student can perform practical experiments on staining Processes.

Chairman
BoS/BME

TEXT BOOKS:

1. Ramnik Sood, Modern Medical Laboratory Technology: methods and Interpretation, 7thEdition, Jaypee Brothers Medical Publishers, 2023.

REFERENCE BOOKS:

1. Manual prepared by the faculty of BME Department, SVHEC

E-RESOURCES:

1. NPTEL-Online Courses and Video lectures: https://nptel.ac.in/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	-	-	-	-	1	1	-	-
CO2	3	3	1	1	2	2	-	-	-	-	2	1	-	-
CO3	3	3	2	1	2	2	-	-	-	-	2	1	-	-
CO4	3	3	2	1	1	2	-	-	-	-	2	1	-	-
CO5	3	2	2	1	1	1	-	-	-	-	1	1	-	-
AVG	3	3	2	1	1	2	-	-	-	-	2	1	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23ENL21	COMMUNICATION LABORATORY (Common to B.E./B.Tech. all Branches)	L T P C 0 0 4 2

COURSE OBJECTIVES:

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT-I MAKING COMPARISONS 12

Speaking - Role Play Exercises Based on Workplace Contexts- Talking about Competition- Discussing Progress toward Goals- Talking about Experiences- Talking about Events in Life-Discussing Past Events
Writing - Writing Emails (Formal & Semi-Formal)

UNIT-II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 12

Speaking - Discussing News Stories – Talking about Frequency- Talking about Travel Problems-Discussing Travel Procedures- Talking about Travel Problems- Making Arrangements-Describing Arrangements- Arrangements Discussing Plans and Decisions-Discussing Purposes and Reasons- Understanding Common Technology Terms
Writing -Writing Different Types of Emails

UNIT-III PROBLEM SOLVING 12

Speaking - Discussing Predictions- Describing the Climate- Discussing Forecasts and Scenarios- Talking about Purchasing- Discussing Advantages and Disadvantages- Making Comparisons- Discussing Likes and Dislikes- Discussing Feelings about Experiences-Discussing Imaginary Scenarios
Writing - Short Essays and Reports- Formal/Semi-Formal letters.

UNIT-IV CLASSIFICATION AND RECOMMENDATIONS 12

Speaking - Discussing The Natural Environment- Describing Systems- Describing Position and Movement Explaining Rules (Example- Discussing Rental Arrangements)-Understanding Technical Instructions.

Writing - Writing Instructions -Writing a Short Article.

Chairman
BoS / S&H

UNIT-V EXPRESSION 12

Reading - Describing Things Relatively-Describing Clothing-Discussing Safety Issues (Making Recommendations) Talking about Electrical Devices-Describing Controlling Actions.

Writing - Job Application (Cover Letter + Curriculum Vitae) – Writing Recommendations.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the Course the students will able to

CO1: Speak effectively in group discussions held in a formal/semi formal contexts
CO2: Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
CO3: Create emails, letters and effective job applications with resume.
CO4: Write critical reports to convey data and information with clarity and precision
CO5: Deliver suitable instructions and recommendations for safe execution of tasks

CO's-PO's MAPPING :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	2	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	3	3	-	2
CO4	-	-	-	-	-	-	-	3	3	-	3
CO5	-	-	1	-	-	-	1	3	3	-	2
AVG	-	-	2	-	-	-	1	3	3	-	3

1- Low, 2- Medium, 3-High, "-" No Correlation

E-RESOURCES:

- https://www.englishclub.com/speaking/
- https://learnenglish.britishcouncil.org/

Chairman
BoS / S&H

23MDC21	YOGA FOR HUMAN EXCELLENCE (Common to B.E./B.Tech. all Branches)	L T P C 0 0 1 0

UNIT-I **SIMPLIFIED PHYSICAL EXERCISES** 3

Physical exercises: Hand exercises – Leg exercises. Breathing exercises: Eye exercises – Kapalabathi. Makarasana. Body massages: Acupressure – Relaxation.

UNIT-II **KAYA KALPA** 3

Kaya Kalpa Exercise – Aswini Mudra – Moola Bandha – Ojas Breath (Kayakalpa Exercise should be learnt directly from the World Community Service Centre.)

UNIT-III **MEDITATION** 3

Agna. Santhi : Clearence. Thuriya. Thuriyatheetham meditation

UNIT-IV **HUMAN RESOURCES DEVELOPMENT** 3

Eradication of worries – Benefits of Blessings – Greatness of Friendship – Neutralization of anger - Individual peace and world peace

UNIT-V **YOGASANAS** 3

Suriya Namaskar, Padmasana, Vajrasana, Sukasana, Chakrasana (side posture), Viruchasana, Bhujangasana, Yoga mudra, Ustrasana, Maha Mudra, Vakkarasana.

TOTAL : 15 PERIODS

TEXT BOOKS:

1. Yoga Practices – I: VISION, Vethathiri Publications.

2. Yogasana – Vethathiri Publications

REFERENCE BOOKS:

1. Simplified Physical Exercises – Vethathiri Publications.

2. Sound health through yoga – Dr. K. Chandrasekaran.

Chairman
BoS / S&H

23MAT41	PROBABILITY AND STATISTICS (for B.E BME)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To introduce the basic concepts of probability and random variables
- To introduce the basic concepts of two dimensional random variables
- To provide the most appropriate estimator of the parameter in statistical inference
- To acquaint the knowledge of non-parametric tests in real life phenomenon
- To introduce the basic concepts of statistical quality control in the field of agriculture

UNIT-I PROBABILITY AND RANDOM VARIABLES 9+3

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Exponential and Normal distributions .

UNIT-II TWO- DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression

UNIT-III ESTIMATION THEORY 9+3

Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means, variations and ratio of two variances.

UNIT-IV NON- PARAMETRIC TESTS 9+3

Introduction - The Sign test - The Signed - Rank test - Rank - sum tests - The U test – The H test - Tests based on Runs - Test of randomness - The Kolmogorov Tests

UNIT-V STATISTICAL QUALITY CONTROL 9+3

Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Johnson. R.A., Miller. I and Freund. J., "Miller and Freund's Probability and Statistics forEngineers", Pearson Education, Asia, 9th Edition, 2016.

Chairman
BoS / S&H

2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
3. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition,2018.

REFERENCE BOOKS:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences",Cengage Learning,New Delhi, 8th Edition, 2014.
2. Papoulis. A. and Unnikrishnapillai . S., "Probability, Random Variables and StochasticProcesses", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross . S.M., "Introduction to Probability and Statistics for Engineers and Scientists",5th Edition, Elsevier, 2014.
4. Spiegel. M.R., Schiller. J. and Srinivasan . R.A., "Schaum's Outline of Theory and Problems ofProbability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
5. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons,10th Edition, New Delhi, 2016.

COURSE OUTCOME:

At the end of the Course the students will be able to

CO1: Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon

CO2: Understand the basic concepts of two dimensional random variables and apply in engineering problems

CO3: Understand the knowledge of estimator of the parameter in statistical inference

CO4: Understand the knowledge of non-parametric tests and apply suitable test in statistics

CO5: To know the concepts of Statistical tables for quality control

CO'S – PO'S MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	-	-	-	-	2	-	-	1
CO2	3	3	3	-	-	-	-	2	-	-	1
CO3	3	3	2	-	-	-	-	2	-	-	1
CO4	3	3	2	-	-	-	-	2	-	-	1
CO5	3	3	3	-	-	-	-	2	-	-	1

1- **Low, 2- Medium , 3-High, "-" No Correlation**

Chairman
BoS / S&H

23BMT41	BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the origin of various biological signals and electrode configurations specific to bio-potential measurements
- To understand the characteristics of Bio signals.
- To understand the design of bio amplifiers
- To explain the different techniques used for measurement of non-electrical bio-parameters
- To explain the bio chemical measurement techniques as applicable for diagnosis and treatment.

UNIT-I BIO POTENTIAL MEASUREMENT 9

Bio signals characteristics – Origin of bio potential and its propagation. Frequency and amplitude ranges. Electrode configurations: Electrode-electrolyte interface, electrode–skin interface impedance, polarization effects of electrode – non-polarizable electrodes. Unipolar and bipolar configuration, classification of electrodes.

UNIT-II ELECTRODE CONFIGURATIONS 9

ECG Electrode system - Einthoven's triangle, standard 12 lead system. EEG –10-20 electrode system, unipolar, bipolar and average mode. EMG–unipolar and bipolar mode. EMG - Electrode configuration-unipolar and bipolar mode.

UNIT-III BIO AMPLIFIERS 9

Need for bio-amplifier- Differential bio-amplifier– Single ended amplifier- Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference.

UNIT-IV MEASUREMENT OF CARDIOVASCULAR PARAMETERS 9

Temperature, respiration rate and pulse rate measurements. Blood Pressure - indirect methods: auscultatory method, oscillometric method, directs 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 ultra sound blood flow measurements .

Chairman
BoS/BME

UNIT-V **BIO CHEMICAL MEASUREMENTS** **9**

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors. Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Illustrate the origin of various biological signals and their characteristics.

CO2: Gain knowledge on characteristics of bio signals.

CO3: Gain knowledge on various amplifiers involved in monitoring and transmission of bio signals.

CO4: Explain the different measurement techniques for non-electrical bio-parameters

CO5: Explain the biochemical measurement techniques as applicable for diagnosis and further treatment.

TEXT BOOKS:

1. Leslie C rom well, "Bio medical Instrumentation and measurement", 2nd edition, Prentice hall of India, NewDelhi, 2015.
2. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd, NewDelhi, 2015.
3. Khandpur R.S, "Handbook of Biomedical Instrumentation",TataMcGrawHill, NewDelhi, 2003.

REFERENCE BOOKS:

1. John Enderle, Susan Blanchard, Joseph Bronzino, "Introduction to Biomedical Engineering", second edition, Academic Press, 2005.
2. Joseph J. Carrand John M.Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.

E-RESOURCES:

1.NPTEL-Online Courses and Video lectures: https://nptel.ac.in/

Chairman
BoS/BME

CO's–PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	2	1	-
CO2	3	2	1	1	-	-	-	-	-	-	-	2	1	-
CO3	3	2	1	1	-	-	-	-	-	-	-	2	1	-
CO4	3	2	1	2	-	-	-	-	-	1	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	1	-	2	1	-
AVG	3	2	1	1	-	-	-	-	-	1	-	2	1	-

1-low, 2-medium, 3-high ,'-' – no correlation

Chairman
BoS/BME

23BMT42	ANALOG AND DIGITAL INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

Course Objectives:

- To study the circuit configuration and introduce practical applications of linear integrated circuits.
- To introduce the concept of application of ADC and DAC in real time systems.
- To introduce the concept of Phase Locked Loop with applications.
- To introduce the design of various combinational digital circuits using logic gates.
- To bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.

UNIT-I INTRODUCTION TO OPERATIONAL AMPLIFIER AND ITS APPLICATIONS **9**

Operational amplifier – ideal characteristics, Performance Parameters, Linear and Nonlinear Circuits and their analysis - voltage follower, Inverting amplifier, Non - inverting Amplifiers, Differentiator, Integrator, Voltage to Current converter, Instrumentation amplifier, Low pass, High pass filter and band pass filters, Comparator, Multivibrator and Schmitt trigger, Triangular wave generator.

UNIT-II DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS AND PLL **9**

Analog switches, High speed sample and hold circuit and IC's, Types of D/A converter – Weighted resistor, R-2R ladder DAC, D/A Accuracy and Resolution. A/D converter - Flash, Dual slope, Successive approximation, A/D Accuracy and Resolution. Voltage controlled oscillator, Voltage to Frequency converters. PLL-Closed loop analysis of PLL, Frequency multiplication/ division, FSK demodulator.

UNIT-III THE BASIC GATES AND COMBINATIONAL LOGIC CIRCUITS **9**

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary,BCD,Excess3,Gray,Alpha numeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Min terms and Max terms, Karnaugh map and Tabulation methods. Logic families-TTL,MOS,CMOS, BiCMOS – Comparison of Logic families.

Chairman
BoS/BME

UNIT-IV **COMBINATIONAL LOGIC CIRCUITS** **9**

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux / Demux.

UNIT-V **SEQUENTIAL LOGIC CIRCUITS** **9**

Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits–state minimization, state assignment, and circuit implementation. Counters, Ripple Counters, Ring Counters. Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In -Serial Out, Parallel In - Parallel Out, Universal Shift Register.

TOTAL: 45PERIODS

COURSEOUTCOME

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

CO1 Design new analog linear circuits and develop linear IC based Systems.

CO2 Apply the concept of ADC and DAC in real time systems and Phase Locked Loop with applications.

CO3 Apply the concept of ADC and DAC in real time systems and Phase Locked Loop with applications.

CO4 Apply the concept of ADC and DAC in real time systems and Phase Locked Loop with applications.

CO5 Bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.

Text Books:

1. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", McGraw Hill Education, 3rd Edition, 2023.
2. John.F.Wakerly, "Digital design principles and practices", Pearson Education, 5th Edition, 2018.

Reference Books:

1. Taub and Schilling, "Digital Integrated Electronics", McGrawHill, 2017.

Chairman
BoS/BME

2. Charles H.Roth, Jr, "Fundamentals of Logic Design", Jaico Books,7th Edition, 2013.
3. M.Morris Mano and Michael D.Ciletti, "Digital Design", Pearson, 5th Edition, 2013.
4. S Salivahanan and V S Kanchana Bhaaskaran, Linear Integrated Circuits, McGrawHill Education, 3rd Edition, 2018.

Online Sources

NPTEL-Online Courses and Video lectures:

https://archive.nptel.ac.in/content/storage2/courses/106108099//Digital%20Systems.pdf

https://archive.nptel.ac.in/courses/108/105/108105132/https://nptel.ac.in/courses/117106086

CO&PO MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	2	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	2	-	-
CO4	3	2	1	1	1	-	-	-	-	-	-	2	-	-
CO5	3	2	1	1	1	-	-	-	-	-	-	2	-	-
AVG	3	2	1	1	1	-	-	-	-	-	-	2	-	-

1-low, 2-medium, 3-high, '-' -no correlation

Chairman
BoS/BME

23BMT43	BIO CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the concept behind feedback and continuum in various systems and subsystems
- Understand the need for mathematical modeling of various systems.
- Analyze the systems in time and frequency domains
- Understand the concept of stability of various systems.
- Apply mathematical modeling principles in understanding the various fundamental biological systems.

UNIT-I INTRODUCTION 9

Open and Closed loop Systems, Mathematical Modeling of systems, Block diagram and signal flow graph representation of systems - reduction of block diagram and signal flow graph -Introduction to Physiological control systems Illustration- Linear model physiological systems- Difference between engineering and physiological control systems.

UNIT-II TIME RESPONSE ANALYSIS 9

Step and impulse responses of first order and second order systems - time domain specifications of first and second order systems-steady state error constants.

UNIT-III STABILITY ANALYSIS 9

Definition of stability, Routh- Hurwitz criteria of stability, Root locus technique-construction of root locus and study of stability.

UNIT-IV FREQUENCY RESPONSE ANALYSIS 9

Frequency domain specifications - Polar plots - Bode plots - Nyquist plot - Nyquist stability criterion, closed loop stability-Constant M and N circles - Nichol's chart.

UNIT-V BIO LOGICAL CONTROL SYSTEM ANALYSIS 9

Simple models of muscle stretch reflex action - steady state analysis of muscle stretch reflex action-transient response analysis of neuro muscular reflex model action- frequency response of circulatory control model- Stability analysis of Pupillary light reflex-Mathematical model for ventilation.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

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

CO1 Interpret the need for a the mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems

CO2 Determine the time response of various systems

CO3 Discuss the concept of system stability

CO4 Examine the frequency response characteristics of various systems using different charts

CO5 Appraise the concept of modeling basic physiological systems

Text Books:

1. I.J. Nagarath and M. Gopal, Control Systems Engineering, New Age International Publishers, 1st September, 2021.
2. Michael CK Khoo, Physio logical Control Systems, IEEE Press, Prentice Hall India,2018.
3. George E. Heimpel and Nicholas J. Mills, Biological Control Ecology and Applications, Cambridge University Press,2017.

Reference Books:

1. Salivahanan S. Rengaraj R. and Venkatakrishnan G. R., Control Systems Engineering, Pearson Education India, 2020.
2. Benjamin C. Kuo, Automatic Control Systems, Prentice Hall of India, 2018.
3. Ogata, Katsuhiko and Yanjuan Yang, Modern control engineering, Vol 4, Prentice-Hall,2009.

OnlineSources:

https://nptel.ac.in/courses/108/101/108101037/

https://nptel.ac.in/content/storage2/courses/112104158/lecture14.pdf

https://nptel.ac.in/content/storage2/courses/112104158/lecture16.pdf

https://nptel.ac.in/content/storage2/courses/112104158/lecture17.pdf

Chairman
BoS/BME

CO & PO MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	2	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	2	1	-
CO3	3	2	2	2	-	-	-	-	-	-	-	2	1	-
CO4	3	2	2	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	2	2	-	-	-	-	-	-	-	2	1	-
AVG	3	2	2	2	-	-	-	-	-	-	-	2	1	-

1-low, 2-medium, 3-high, '-' -no correlation

Chairman
BoS/BME

23CYT41	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY (Common to B.E./B.Tech. all Branches)	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and sustainable practices
- To imbibe awareness on population issues and manmade activities

UNIT-I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity – values of biodiversity, India as a mega-diversity nation – threats to biodiversity – conservation of biodiversity.

Activity: Documentation of ecosystems/Biodiversity within Campus.

UNIT-II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

Activity: Documentation of pollution issues in Erode district.

UNIT-III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation - New Energy Sources: Need and different types of new energy sources. Concept, origin and applications of - Hydrogen energy, Ocean energy, Tidal energy and geothermal energy conversion.

Activity: Documentation of available renewable resources in Erode district.

UNIT-IV SUSTAINABILITY AND MANAGEMENT 6

Development, GDP, Sustainability- concept, needs and challenges - Sustainable Development Goals - Concept of Carbon Credit, Carbon Footprint. Circular economy, ISO 14000 Series, Material Life Cycle Assessment, Environmental Impact Assessment. Green Engineering.

Activity: Documentation of sustainable goals of Tamilnadu. **Case Study:** E-Waste Management

UNIT-V HUMAN POPULATION AND DISASTER MANAGEMENT 6

Population growth, Population explosion— Family Welfare Program – Environment and human health. Human rights – HIV/AIDS – Women and Child Welfare – Role of Information Technology in environment and human health – Disaster management: Floods, earthquake, cyclone and landslides.

Activity: Documentation of women development schemes in Tamilnadu.

TOTAL HOURS 30

Chairman
BoS / S&H

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1 : To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

CO2 : To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.

CO3 : To identify and apply the understanding of renewable and non-renewable resources

CO4 : To recognize the different goals of sustainable development and sustainability practices and apply them for future development.

CO5 : To aware the population issues and to handle the disaster issues

TEXT BOOKS:

1. Dr. A.Ravikrishnan "Environmental Sciences and Sustainability", 2nd Edition, Sri Krishna Hitech Publishing Company Pvt. Ltd, 2022.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2010.
3. Gilbert M.Masters & Wendell P Ela, 'Introduction to Environmental Engineering and Science', 3rd edition, Prentice – Hall of India Pvt. Ltd, New Delhi, 2008.

REFERENCE BOOKS:

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2009.
2. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2022.
3. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2023.

ONLINE SOURCES:

Unit 1: https://www.youtube.com/watch?v=Ar04qG1P8Es (IIT ROORKEE NPTEL) & https://www.youtube.com/watch?v=SHxAOoxhKTA (IIT KANPUR NPTEL)
Unit 2: https://www.youtube.com/watch?v=I7Z34WU257U (IIT ROORKEE NPTEL)
Unit 3: https://www.youtube.com/watch?v=1kUE0BZtTRc (NATIONAL GEOGRAPHIC)
Unit 4: https://www.youtube.com/watch?v=Crd3CFq5B4s (IITM NPTEL)
Unit 5: https://www.youtube.com/watch?v=sMqtwbKc8EA (FINANCIAL TIMES)

Chairman
BoS / S&H

CO's & PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	3	-	-	-	-	2
CO2	3	2	-	-	-	3	-	-	-	-	2
CO3	3	-	1	-	-	2	-	-	-	-	2
CO4	3	2	1	1	-	2	-	-	-	-	2
CO5	3	2	1	-	-	2	-	-	-	-	1

Chairman
BoS / S&H

23BMI41	BIOSIGNAL PROCESSING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To understand about the continuous time and discrete time signals and systems.
- To learn the analysis of LTI systems using Laplace and Z transform
- To represent the signal in frequency domain using FFT.
- To gain knowledge about the design of IIR filters.
- To gain knowledge about the design of FIR filters

UNIT-I FUNDAMENTALS OF SIGNALS AND SYSTEMS 9

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect

UNIT-II ANALYSIS OF LTI SYSTEMS 9

Fourier Series- Fourier Transform and Properties, Analysis of Continuous Time LTI Systems - Z Transform - Properties of ROC– Inverse Z Transform – DTFT - Analysis of Discrete Time LTI Systems.

UNIT-III DISCRETE FOURIER TRANSFORM 9

DFT and its properties, magnitude and phase representation- Linear Convolution- Correlation - Circular Convolution, Overlap - add and overlap - save methods. FFT – Decimation in Time Algorithm, Decimation in Frequency Algorithm. Use of FFT in Linear Filtering.

UNIT-IV INFINITE IMPULSE RESPONSE FILTERS 9

Analog filters – Butterworth filters, Chebyshev Type I filters (up to 3rd order), Analog Transformation of prototype LPF to BPF /BSF/ HPF. Transformation of analog filters into equivalent digital filters using Impulse invariant method and Bilinear Z transform method –Realization structures for IIR filters –direct, cascade and parallel forms.

UNIT-V FINITE IMPULSE RESPONSE FILTERS AND MULTI RATE SIGNAL PROCESSING 9

Design of linear phase FIR filters – windowing and Frequency sampling methods. Realization structures for FIR filters – Transversal and Linear phase structures. Comparison

Chairman
BoS/BME

of FIR and IIR. Introduction to Multirate signal Processing –Decimation and Interpolation. Case study – Wave shape analysis-Heart rate variability measurement-Bio signal preprocess.

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

MATLAB/ EQUIVALENT SOFTWARE PACKAGE / DSP PROCESSOR BASED IMPLEMENTATION

1. Construction of signals with different Frequencies.
2. Analyse the stability of a CT System with various inputs
3. Analyse the stability of a DT System with various inputs
4. Reconstruct a signal from samples and study the effect of Aliasing
5. Spectrum Analysis using FFT
6. Filter Design & Analysis.
7. Multirate Signal Processing
8. Heart rate variability analysis using ECG signal
9. Preprocessing of Bio signals

THEORY : 45 PERIODS

PRACTICAL: 30 PERIODS

TOTAL (45+30) : 75 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: To classify the continuous time and discrete time signals and systems.

CO2: To analyze the signals in both continuous time and discrete time.

CO3: To apply DFT for the analysis of digital signals &systems

CO4: To design IIR filter to process real world signals

CO5: To design FIR filter to process real world signals.

TEXT BOOKS:

1. Allan V. Oppenheim, S. Wilsky and S.H.Nawab, "Signals and Systems", Pearson, Indian Reprint, 2nd Edition, 2015.
2. John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, 4th Edition, 2014

REFERENCE BOOKS:

1. S.Haykin and B.VanVeen, "Signals and Systems", Wiley, 2nd Edition, 2017

Chairman
BoS/BME

2. B.P.Lathi, "Principles of Linear Systems and Signals", Oxford, 2nd Edition, 2021.
3. M.H.Hayes, "Digital Signal Processing, Schaum's outlines", Tata Mc Graw Hill, 2nd Edition, 2020.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	1	-	-	2	1	-
CO2	3	2	2	2	-	-	-	-	1	-	-	2	1	-
CO3	3	2	2	2	-	-	-	1	1	-	-	2	1	-
CO4	3	2	2	2	1	-	-	1	1	1	-	2	1	-
CO5	3	2	2	2	1	-	-	1	1	1	-	2	1	-
AVG	3	2	2	2	1	-	-	1	1	1	-	2	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BML41	BIO MEDICAL INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To study and design Bio amplifiers.
- To provide hands on training on Measurement of physiological parameters.

LIST OF EXPERIMENTS

1. Design of pre amplifiers to acquire bio signals along with impedance matching circuit using suitable IC's
2. Design of ECG Amplifiers with appropriate filter to remove power line and other artifacts.
3. Design of EMG amplifier.
4. Design a suitable circuit to detect QRS complex and measure heart rate.
5. Design of frontal EEG amplifier.
6. Design of EOG amplifier to detect eye blink.
7. Design a right leg driven ECG amplifier.
8. Design and study the characteristics of optical Isolation amplifier.
9. Design a Multiplexer and Demultiplexer for any two bio signals.
10. Measurement of pulse-rate using Photo transducer.
11. Measurement of pH and conductivity.
12. Measurement of blood pressure using sphygmomanometer.
13. Measurement and recording of peripheral blood flow.
14. Design a PCB layout for any bio amplifier using suitable software tool.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Design the amplifier for Bio signal measurements

CO2: Measure heart rate and heart sounds

CO3: Record and analyze pulse rate and respiration rate.

CO4: Measure blood pressure and blood flow.

CO5: Design isolation amplifier.

Chairman
BoS/BME

REFERENCE BOOKS:

1. Manual prepared by the faculty of BME Department, SVHEC.

CO's– PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	-	1	1	1	-	1	-	1
CO2	3	3	1	1	1	1	-	1	1	1	-	1	-	1
CO3	3	3	1	1	1	1	-	1	1	1	-	1	-	1
CO4	3	3	1	1	1	1	-	1	1	1	-	1	-	1
CO5	3	3	1	1	1	1	-	1	1	1	-	1	-	1
AVG	3	3	1	1	1	1	-	1	1	1	-	1	-	1

1-low, 2-medium, 3-high, '-' -no correlation

Chairman
BoS/BME

		L	T	P	C
23BML42	ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY	0	0	3	1.5

Course Objectives:

- To design digital logic and circuits.
- To learn the function of different ICs.
- To learn the function of different ICs.
- To learn the working of multivibrators.
- To design circuits for generating wave forms using ICs.

List of Experiments

1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Design and analysis of active filters using opamp
4. Schmitt trigger using operational amplifier
5. Instrumentation amplifier using operational amplifier
6. RC and LC oscillators
7. Multivibrators using IC 555 Timer
8. Study of logic gates, Half adder and Full adder
9. Encoder and BCD to 7 segment decoder
10. Multiplexer and demultiplexer using digital ICs
11. Universal shift register using flip flops
12. Design of mod-N counter
13. Simulation and analysis of circuits using software

TOTAL: 45 PERIODS

COURSE OUTCOME

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

CO1 Design Combinational Circuits using logic gates.
CO2 Design and implement arithmetic circuits for different applications using op amp.
CO3 Design Sequential Circuits using logic gates.
CO4 Design Sequential Circuits using logic gates.
CO5 Simulate and analyse circuits using ICs.

Chairman
BoS/BME

Reference Books:

1. Manual prepared by the faculty of Biomedical Engineering Department, SVHEC.
2. Sergio Franco, "Design with operational amplifiers and analog integrated circuits",Mc Graw Hill Education, 3rd Edition, 2017, Reference Book 2.
3. John.F.Wakerly, "Digital design principles and practices", Pearson Education, 5th Edition, 2018

CO & PO MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	1	1	-	-	1	-	-
CO2	3	3	1	1	1	-	-	1	1	-	-	1	-	-
CO3	3	3	1	1	1	-	-	1	1	1	-	1	-	-
CO4	3	3	1	1	1	-	-	1	1	1	-	1	-	-
CO5	3	3	1	1	1	-	-	1	1	1	-	1	-	-
AVG	3	3	1	1	1	-	-	1	1	1	-	1	-	-

1-low, 2-medium, 3-high, '-' – no correlation

Chairman
BoS/BME

23MDC41	SOFT SKILLS AND ANALYTICAL SKILLS - I	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:

- ☐ To make the students aware of critical thinking.
- ☐ To understand the significance of emotional intelligence in self-growth.
- ☐ Basic Knowledge about the Arithmetic Ability.
- ☐ To solve the problems in Business Computations.
- ☐ Understand the basics of Data Interpretation

UNIT-I **CRITICAL THINKING** 3

Active Listening –Observation –Curiosity –Introspection –Analytical Thinking –Open-mindedness – Creative Thinking.

UNIT-II **EMOTIONAL INTELLIGENCE** 3

Transactional analysis – Empathy – Sympathy - Conflict management.

UNIT-III **ARITHMETIC ABILITY** 3

Vedic Maths - Algebraic operations BODMAS, Fractions, Divisibility rules, LCM & GCD (HCF).

UNIT-IV **BUSINESS COMPUTATIONS** 3

Time & Distance, Partnership, simple & compound interest.

UNIT-V **DATA INTERPRETATION** 3

Line Graphs - Venn diagrams - Mixed Graphs.

TOTAL : 15PERIODS

Chairman
BoS / S&H

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1 : Analyse and evaluate arguments and identify most common fallacies.

CO2 : Discover personal competence and techniques of building emotional intelligence.

CO3 : Enhance the Aptitude Round Clearing ability in interview process.

CO4 : Infer the concepts of Business Computations.

CO5 : Interrupt the data.

TEXT BOOKS:

1. Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.
2. Soft Skills: an Integrated Approach to Maximise Personality, Gajendra S. Chauhan, Sangeeta Sharma, Wiley India.

REFERENCE BOOKS:

1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by AbhijitGuha, Tata Mc Graw Hill Publications.
4. Personality Development and Soft Skills, Barun K. Mitra, Oxford Press
5. Communication Skills for Engineers and Scientists , Sharma, Sangeeta & Binod Mishra., PHI India. (2 nd edition).

Chairman
BoS / S&H

23MAT32 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(for B.E. CIVIL, MECH, BME & BIO-TECHNOLOGY)

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations
- To acquaint the student with Fourier, transform techniques used in wide variety of situations
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT-I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations –Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation

UNIT-II FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.

UNIT-III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Classification of PDE – Method of separation of variables - Fourier series solutions of one- dimensional wave equation – One dimensional equation of heat conduction

UNIT-IV FOURIER TRANSFORMS 9+3

Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT-V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9+3

Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z – transforms

TOTAL : 60 PERIODS

Chairman
BoS / S&H

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1: Understand how to solve the given standard partial differential equations.

CO2: Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

CO3: Appreciate the physical significance of Fourier series techniques in solving one dimensional heat flow problems and one-dimensional wave equations

CO4: Understand Fourier transform and its properties and to handle various types of problems using different kind of integral Transforms.

CO5: Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems

TEXT BOOKS:

1. Grewal B.S.,"Higher Engineering Mathematics",44thEdition, Khanna Publishers, New Delhi, 2023.
2. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2023.

REFERENCE BOOKS:

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2021.
2. James. Glyn., "Advanced Modern Engineering Mathematics", 5thEdition, Pearson Education, New Delhi, 2018.
3. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
4. Wylie. R.C. and Barrett. L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_ma37/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma20/preview

CO's - PO's MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	1	-	-	-	2	-	-	3
CO2	3	3	1	1	-	-	-	2	-	-	3
CO3	3	3	1	1	-	-	-	2	-	-	3
CO4	3	3	1	1	-	-	-	2	-	-	3
CO5	3	3	1	1	-	-	-	2	-	-	3
Avg	3	3	1	1	-	-	-	2	-	-	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS / S&H

23ECT31	ELECTRONIC DEVICES AND CIRCUITS (For-B.E / B.Tech- ECE and BME)	L T P C 3 0 0 3

COURSE OBJECTIVES:

- To give a comprehensive exposure to all types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze single stage and multistage amplifier circuits
- To study about feedback amplifiers and oscillators principles
- To understand the analysis and design of multi vibrators

UNIT-I SEMICONDUCTOR DEVICES **9**

PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator.

UNIT-II AMPLIFIERS **9**

Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS, CG and Source follower – Gain and frequency response- High frequency analysis.

UNIT-III MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER **9**

Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – MOSFET input stages – tuned amplifiers – Gain and frequency response – Neutralization methods.

UNIT-IV FEEDBACK AMPLIFIERS AND OSCILLATORS **9**

Advantages of negative feedback – Voltage / Current, Series , Shunt feedback Amplifiers – positive feedback–Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators .

UNIT-V POWER AMPLIFIERS **9**

Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect-Class AB Power amplifier using MOSFET

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1: Explain the structure and working operation of basic electronic devices
CO2: Design and analyze amplifiers.
CO3: Analyze frequency response of BJT and MOSFET amplifiers
CO4: Design and analyze feedback amplifiers and oscillator principles.
CO5: Design and analyze power amplifiers and supply circuits

Chairman
BoS / ECE

TEXT BOOKS:

1.David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5 th Edition, 2010.

2.Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition,Pearson Education / PHI, 2008.

3.Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7th Edition,2014.

REFERENCE BOOKS:

1.Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd Edition, 2010.

2.D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, 3 rd Edition, 1989

3.Muhammad H.Rashid, "Power Electronics", Pearson Education / PHI , 2004

E-RESOURCES:

1.NPTEL-Online Courses and Video lectures: https://nptel.ac.in/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	-	-	-	-	1	2	1	1
CO2	3	2	2	3	2	2	-	-	-	-	1	2	1	1
CO3	3	3	3	2	1	2	-	-	-	-	1	2	1	1
CO4	3	3	2	3	2	2	-	-	-	-	1	2	1	1
CO5	3	2	3	2	2	1	-	-	-	-	1	2	1	1
AVG	**3**	**3**	**3**	**3**	**2**	**2**	-	-	-	-	**1**	**2**	**1**	**1**

1 -low,2-medium,3-high,'-'-no correlation

Chairman
BoS

23BMI31	ANATOMY AND HUMAN PHYSIOLOGY	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To integrate the individual functions of all the cells and tissues and organs into functional whole, the human body.
- Function is dependent on a structure, the curriculum lays stress on functional anatomy of the organs.
- Emphasizes on the cardiovascular, respiratory, urinary and nervous system and their Interrelatedness.
- Stimulate the students to understand the basic functioning of every system and the resultant unified organization.

UNIT-I BASIC ELEMENTS OF HUMAN BODY 9

Cell – Cell Structure and organelles - Functions of each component in the cell. Cell membrane – transport across membrane - Action potential (Nernst, Goldman equation), Homeostasis. Tissue: Types, functions – Endocrine and exocrine glands

UNIT-II SKELETAL AND MUSCULAR SYSTEM 9

Skeletal: Types of Bone and function – Physiology of Bone formation – Division of Skeleton – Types of joints and function – Types of cartilage and function. –Types of muscles – Structure and Properties of Skeletal Muscle- Changes during muscle contraction- Neuromuscular junction.

UNIT-III CARDIOVASCULAR AND RESPIRATORY SYSTEM 9

Cardiovascular System: Structure – Conduction System of heart – Cardiac Cycle-Cardiac output. Blood: Composition – Functions - Haemostasis – Blood groups and typing. Blood Vessels – Structure and types - Blood pressure – Respiratory system: Parts of respiratory system – Respiratory physiology – Lung volumes and capacities – Gaseous exchange.

UNIT-IV DIGESTIVE AND EXCRETORY SYSTEMS 9

Structure and functions of gastrointestinal system - secretory functions of the alimentary tract - digestion and absorption in the gastrointestinal tract - structure of nephron - mechanism of urine formation - skin and sweat gland - temperature regulation.

Chairman
BoS/BME

UNIT-V **NERVOUS AND SENSORY SYSTEM** **9**

Structure and function of nervous tissue – Brain and spinal cord – Functions of CNS – Nerve conduction and synapse – Reflex action – Somatic and Autonomic Nervous system. Physiology of Vision, Hearing, Integumentary, Olfactory systems. Taste buds.

THEORY :45 PERIODS

LIST OF EXPERIMENTS

1. Collection of Blood Samples
2. Identification of Blood groups (Forward and Reverse)
3. Bleeding and clotting time
4. Estimation of Hemoglobin
5. Total RBC and WBC Count
6. Differential count of Blood cells
7. Estimation of ESR, PCV, MCH, MCV, MCHC
8. Hearing test – Tuning fork
9. Visual Activity – Snellen's Chart and Jaeger's Chart

PRACTICAL: 30 PERIODS

TOTAL (45+30): 75PERIODS

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1: Identify and explain basic elements of human body.

CO2: Explain the functions of skeletal and muscular system.

CO3: Describe the structure, function of cardiovascular system and respiratory system.

CO4: Discuss the structure of digestive and excretory system.

CO5: Describe the physiological process of Nervous and sensory system.

TEXT BOOKS:

1. Elaine.N. Marieb, "Essential of Human Anatomy and Physiology", Ninth Edition, Pearson Education, New Delhi, 2018.
2. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine", Third edition Springer, 2006. (Unit 2, 3, 4)

Chairman
BoS/BME

3. Ross and Wilson "Anatomy and Physiology in Health and Illness", 14th International Edition Edition, 1 July 2022.

REFERENCE BOOKS:

1. Guyton & Hall, "Text book of Medical Physiology", 13th Edition, Saunders, 2015.
2. Ranganathan T S, "Text book of Human Anatomy", S.Chand& Co. Ltd., New Delhi, 2012.
3. SaradaSubramanyam, K MadhavanKutty, Singh H D, "Textbook of Human Physiology", S. Chand and Company Ltd, New Delhi, 2012.

E-RESOURCES:

1. http://nptel.ac.in/courses/107103004/7, "Human physical dimension concern", Prof.MainakDas, IIT Kanpur.
2. http://nptel.ac.in/courses/122103039/14, "Nervous System", Prof.MainakDas, IIT Kanpur.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	1	1	-	-
CO2	3	3	2	-	-	-	-	-	-	-	1	1	-	-
CO3	3	3	2	-	-	-	-	-	-	-	1	1	-	-
CO4	3	3	3	-	-	-	-	-	-	-	1	1	-	-
CO5	3	3	3	-	-	-	-	-	-	-	1	1	-	-
AVG	3	3	2	-	-	-	-	-	-	-	1	1	-	-

1 -low, 2-medium, 3-high, '-' –no correlation

Chairman
BoS/BME

23BMT31	BIO SENSORS AND MEASUREMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- To know the principle of transduction, classifications and the characteristics of different Transducers.
- To learn the different bridges for measurement.
- To know the different display and recording devices.
- To understand various type of biosensors.

UNIT-I FUNDAMENTALS OF MEASUREMENTS 9

Measurement System – Instrumentation - Classification and Characteristics of Transducers – Static and Dynamic - Errors in Measurements and their statistical analysis- methods of error analysis,-uncertainty analysis-expression of uncertainty: accuracy and precision index, propagation of errors– Calibration - Primary and secondary standards.

UNIT-II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS 9

Strain Gauge: Gauge factor, sensing elements, configuration, and unbounded strain gage. Capacitive transducer - various arrangements, Inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, Active type: Thermocouple - characteristics.

UNIT-III PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS 9

Phototube, scintillation counter, photo multiplier tube (PMT), photovoltaic, photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers. Optical displacement sensors and optical encoders. Piezoelectric active transducer - Equivalent circuit and its characteristics.

UNIT-IV RECORDING DEVICES AND BRIDGE CIRCUITS 9

Impedance matching circuits, AC and DC Bridges - Wheat stone bridge-Kelvin-Maxwell-Hay-Schering-Q meter-PMMC-MI- CRO – block diagram, CRT – vertical & horizontal deflection system – DSO - LCD monitor-PMMC writing systems-servo recorders-photographic recorder-Magnetic tape recorder-Inkjet recorder-thermal recorder.

Chairman
BoS/BME

UNIT-V **BIO SENSORS** **9**

Biosensors: transduction mechanism in a biosensor and Classification -Electronic nose. Biological Sensors- baro receptors-Hemo receptors-Sensory receptors for smell-vision-Taste, and Olfactory-Bio chemical Sensors for medicine-Fiber optic sensors-Light sensors in medicine-Bio mechanical sensor.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Measure various electrical parameters with accuracy, precision, resolution.

CO2: Select appropriate passive or active transducers for measurement of physical phenomenon.

CO3: Select appropriate light sensors for measurement of physical phenomenon.

CO4: Use Recording devices and bridge circuits for relevant parameter measurement.

CO5: Select appropriate Biosensors for measurement of physical phenomenon.

TEXT BOOKS:

1. A.K.Sawhney, "Electrical & Electronics Measurement and Instrumentation",10th edition, DhanpatRai& Co, New Delhi, 19th Revised edition 2011, Reprint 2014.
2. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
3. Ernest O Doebelin and Dhanesh N Manik, "Measurement systems, Application and design", 6th edition, McGraw-Hill, 2012.

REFERENCE BOOKS:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", 3rd edition,Tata McGraw-Hill, New Delhi, 2014.
2. Leslie Cromwell, "Biomedical Instrumentation and measurement", 2nd edition, Prentice hall of India, New Delhi, 2015.
3. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 1st edition, 2016.
4. Tatsuo Togawa, ToshiyoTamma and P. Ake Ã–berg, "Biomedical Transducers and Instruments", CRC Press, 2018.

Chairman
BoS/BME

E-RESOURCES:

1. http://nptel.ac.in/courses/112103174/3, Sensors and Transducers by Prof. AlokBarua, IIT, Kharagpur.
2. http://nptel.ac.in/courses/108105064/1, Classification of Instruments by Prof. AlokBarua, IIT, Kharagpur.
3. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html,Piezoelectric sensors by Prof. AlokBarua, IIT Kharagpur.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	1	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	1	-	-
AVG	3	3	2	1	-	-	-	-	-	-	-	1	-	-

1 -low, 2-medium, 3-high, '-' – no correlation

Chairman
BoS/BME

23BMT32	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of DC and AC circuits behavior.
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems.
- To introduce different methods of circuit analysis using duality.
- To introduce different methods of circuit analysis using topology.

UNIT-I BASIC CIRCUITS ANALYSIS 9

Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Law, Kirchoff's Laws, Mesh current and node voltage method of analysis for D.C and A.C. circuits. The single Node – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Nodal analysis, Mesh analysis.

UNIT-II NETWORK THEOREM AND DUALITY 9

Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, application of Network theorems. Network reduction: voltage and current division, source transformation, Delta-Wye Conversion. Duals, Dual circuits.

UNIT-III SINUSOIDAL STEADY STATE ANALYSIS 9

Sinusoidal Steady – State analysis , Characteristics of Sinusoids, The Complex Forcing Function, The Phasor, Phasor relationship for R, L, and C, impedance and Admittance, Nodal and Mesh Analysis, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power.

UNIT-IV TRANSIENTS AND RESONANCE IN RLC CIRCUITS 9

Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits, RLC Circuits, Frequency Response, Parallel Resonance, Series Resonance, Quality Factor.

Chairman
BoS/BME

UNIT-V **COUPLED CIRCUITS AND TOPOLOGY** **9**

Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

TOTAL :45 PERIODS

COURSE OUTCOME

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

CO1	Comprehend and design ac/dc circuits.
CO2	Apply circuit theorems in real time.
CO3	Evaluate ac/dc circuits.
CO4	Evaluate ac/dc circuits.
CO5	Evaluate ac/dc circuits.

Text Books:

1. Hayt Jack Kemmerly, Steven Durbin, "Engineering Circuit Analysis", McGraw Hill education, 9th Edition, 2020.
2. Joseph Edminister and MahmoodNahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2020.

Reference Books:

1. Robert.L. Boylestead, "Introductory Circuit Analysis", Pearson Education India, 12th Edition, 2022.
2. John O Mallay, Schaum's Outlines "Basic Circuit Analysis", The McGraw Hill companies, 2nd Edition, 2018.
3. Charles.K.Alexander, Mathew N.O.Sadiku,"Fundamentals of Electric Circuits", McGraw Hill, 5th Edition, 2017.
4. Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning, Fifth Edition, 1st Indian Reprint 2017.

Chairman
BoS/BME

Online Sources

https://archive.nptel.ac.in/courses/117/106/117106108/

https://archive.nptel.ac.in/courses/108/105/108105159/

CO & PO MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	3	-	-	-	-	-	-	-	1	-	-
CO3	3	3	2	3	-	-	-	-	-	-	1	1	-	-
CO4	3	3	2	3	-	-	-	-	-	-	1	1	-	-
CO5	3	3	3	2	-	-	-	-	-	-	1	1	-	-
AVG	3	3	2	1	-	-	-	-	-	-	1	1	-	-

Chairman
BoS/BME

		L	T	P	C
23CST33	**OBJECT ORIENTED PROGRAMMING** (for B.E./B.Tech. –CSE, IT,CS,AIML and BME)	3	0	0	3

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basics of Java programming language
- To know the principles of packages, inheritance and interfaces
- To develop a java application with threads and generics classes
- To define exceptions and use I/O streams
- To design and build Graphical User Interface Application using JAVAFX

UNIT-I **INTRODUCTION TO OOP AND JAVA** **9**

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming –Java Buzzwords –Overview of Java –Data Types, Variables and Arrays –Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors- Methods -Access specifiers - Static members- Java Doc comments

UNIT-II **INHERITANCE, PACKAGES AND INTERFACES** **9**

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT-III **EXCEPTION HANDLING AND MULTITHREADING** **9**

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions–User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT-IV **I/O, GENERICS, STRING HANDLING** **9**

I/O Basics–Reading and Writing Console I/O– Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

Chairman
BoS/CSE& IT

UNIT-V **JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS** **9**

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – Scroll Pane. Layouts – Flow Pane – H Box and V Box – Border Pane – Stack Pane – Grid Pane. Menus – Basics – Menu – Menu bars – Menu Item.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: Apply the concepts of classes and objects to solve simple problems

CO2: Develop programs using inheritance, packages and interfaces

CO3: Make use of exception handling mechanisms and multithreaded model to solve real world problems

CO4: Build Java applications with I/O packages, string classes ,Collections and generics concepts

CO5: Integrate the concepts of event handling and JavaFX components and controls for Developing GUI based applications

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New Delhi, 2019
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, New Delhi, 2015

REFERENCE BOOK:

1. Cay S.Horstmann, "Core Java Fundamentals", Volume1,11thEdition,Prentice Hall,2018.

E-RESOURCES:

1.http://www.delnet.in/

2. https://onlinecourses.nptel.ac.in/noc22_cs43/preview

Chairman
BoS/CSE&IT

CO's–PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	3	1	3	-	-	3	2	2	2	3	1	2
CO2	2	1	3	2	1	-	-	2	1	1	3	3	3	2
CO3	3	3	1	2	2	-	-	3	2	1	2	3	1	3
CO4	3	1	2	2	2	-	-	1	2	1	3	3	1	1
CO5	1	1	2	3	2	-	-	3	2	1	2	3	3	3
AVG	**2**	**1.4**	**2.2**	**2**	**2**	**-**	**-**	**2.4**	**1.8**	**1.2**	**2.4**	**3**	**1.8**	**2.2**

1- low,2 -medium,3- high,'-'- no correlation

Chairman
BoS/CSE& IT

23EST31	ENTREPRENEURSHIP AND STARTUP (Common to: B.E / B.Tech. all Branches)	L	T	P	C
		1	0	0	1

Course Objectives:

The main learning objective of this course is to prepare the students :

- To develop a knowledge on basic concepts of entrepreneurship.
- To know about business opportunities and project evaluation criteria.
- To explore the concept of startups, government schemes and other financial institutions support

UNIT-I ENTREPRENEURSHIP CONCEPTS 5

Entrepreneurship-Meaning-Origin-Functions-Factors Affecting Entrepreneurial Growth- - Role of Entrepreneurship in Economic Development- Skills required for an Entrepreneur - Barriers to Entrepreneurship - Stages in Entrepreneurial Process.

UNIT-II PROJECT FORMULATION AND IDENTIFICATION 5

Identification of business opportunities -Project formulation- Project Classification and Identification - Project Objectives - Technical Analysis, Financial Analysis – Environmental Appraisal of Project - EDP Phases - Project Report Preparation.

UNIT-III START UP OPPORTUNITIES AND FINANCE 5

The New Industrial Revolution- Business Start-up - Rise of the startup Economy- Government Initiatives - Government schemes and incentives - Institutional service to entrepreneur - Sources of Finance.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: Enhanced the knowledge of entrepreneurship qualities and skills to startup a business.

CO2: Understand the project classification and prepare a feasibility report.

CO3: Provide vision for the own Start-up and its importance for economic development.

TEXT BOOKS:

1. Gupta C.B and Srinivasan N.P- Entrepreneurial development-Sultan Chand and Sons-Latest edtion.
2. Khanka S.S.-Entrepreneurial Development-S.Chand& Co, RamNagar, New Delhi, Latest edtion.

Chairman
BoS / MBA

REFERENCE BOOKS:

1. Vasant Desai-Project Management and Entrepreneurship-Himalaya Publishing House,2023
2. P.Narayana Reddy – Entrepreneurship Text and Cases- cengage learning.2022
3. Prasanna Chandra- Projects planning, analysis, selection, implementation and review Tata McGraw-Hill Publishing Co, Latest edtion.
4. Donald F.Kuratko- Entrepreneurship theory, process & practice-9th Edition-Cengage Learning,2022.

E-RESOURCES:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	1	-	-	-	-	-	-	3	2	2
CO2	2	3	1	3	-	-	-	-	-	-	-	2	1	2
CO3	1	-	3	2	2	-	-	-	-	-	-	1	3	2
Avg	**2**	**2**	**2**	**1.6**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

1. http://nptel.ac.in/courses/122106032/Pdf/7_2.pdf,"Business Plan",Dr.T. J.Kamalanabhan, Indian Institute of Technology Madras.
2. http://www.nptel.ac.in/syllabus/110104049/,"Entrepreneurial Finance", Dr. B.V. Phani, IIT Kanpur.
3. http:// nptel.ac.in/noc20_mg35/ Entrepreneurship and Start up

CO, PO & PSO's MAPPING

1-low, 2-medium, 3- high, '-'-no correction

Chairman
BoS / MBA

23ECL31 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

(For-B.E / B.Tech- ECE and BME)

COURSE OBJECTIVES:

1. To learn the characteristics of PN Junction diode and Zener diode.
2. To understand the operation of rectifiers and filters.
3. Familiarize the operation and characteristics of transistor like BJT and FET.
4. To assist the students in obtaining a better understanding of the operation of electronic circuits and devices
5. To study the characteristics of amplifier.

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode and Zener diode.
2. Full Wave Rectifier with Filters.
3. Design of Zener diode Regulator.
4. Common Emitter input-output Characteristics.
5. MOSFET Drain Characteristicand Transfer Characteristics.
6. Frequency response of CE and CS amplifiers.
7. Frequency response of CB and CC amplifiers.
8. Frequency response of Cascode Amplifier
9. CMRR measurement of Differential Amplifier
10. . Class A Transformer Coupled Power Amplifier.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Characteristics of PN Junction Diode and Zener diode.

CO2: Experiment and test half wave and full wave rectifier circuit using PN Junction diode and obtain the ripple factor, rectifier efficiency and experiment and test voltage regulation characteristics.

CO3: Design and Testing of BJT and MOSFET amplifiers

CO4: Analyze the characteristics of FET based differential amplifier experimentally.

CO5: Operation of power amplifiers.

Chairman
BoS / ECE

REFERENCE BOOKS:

1. Manual prepared by the faculty of ECE Department, SVHEC

E-RESOURCES:

1. NPTEL-Online Courses and Video lectures: https://nptel.ac.in/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	3	2	1	-	-	-	-	1	2	1	1
CO2	3	2	1	3	2	1	-	-	-	-	1	2	1	1
CO3	3	2	1	1	1	1	-	-	-	-	1	2	1	1
CO4	3	2	1	-	3	1	-	-	-	-	1	2	1	1
CO5	3	2	1	-	2	1	-	-	-	-	1	2	1	1
AVG	3	2	1	3	2	1	-	-	-	-	1	2	1	1

1 -low,2-medium,3-high,'-'-nocorrelation

Chairman
BoS/EC

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

		L	T	P	C
23BML31	BIOSENSORS AND MEASUREMENTS LABORATORY	0	0	3	1.5

COURSE OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, simulations with a futuristic vision along with socio-economic impact and issues.
- To study the characteristics of sensors, signal conditioning circuits and display devices.

LIST OF EXPERIMENTS

DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS

1. Characteristics of thermistor
2. Characteristics of thermocouple
3. Characteristics of LDR
4. Characteristics of Photo Diode
5. Characteristics of Photo transistor
6. Characteristics of RTD
7. Characteristics of LVDT
8. Measurement of unknown Resistance using Kelvin Double Bridge and Wheatstone bridge
9. Measurement of unknown Capacitance using Schering Bridge
10. Voltage and current time base circuits
11. Characteristics of strain gauge
12. Study of Electronic nose
13. Characteristics of Piezoelectric Transducer
14. Heart rate measurement
15. Heart sound measurement
16. Blood flow Measurement using Ultrasonic Sensor
17. Blood pressure Measurement using pressure sensor

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Maria Teresa, Restivo Fernando, Gomes de Almedia, Maria de Fatima, Chouzal Joaquim, Gabriel Mendes Lopese- Book on "Laboratories of Instrumentation for Measurement".

Chairman
BoS/BME

REFERENCE BOOKS:

1. Webster, The Measurements, Instrumentation and Sensors Handbook, 2nd Edition, CRC Press, 2014.
2. Khandpur R.S, Hand book of Bio Medical Instrumentation, 3rd Edition,Tata McGraw-Hill, New Delhi,2014.
3. Leslie Cromwell, Bio Medical Instrumentation and Measurement, 2nd Edition, Prentice Hall of India, New Delhi, 2015.

COURSE OUTCOMES:

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

CO1: Design and understand characteristics and calibration of various transducers.

CO2: Design and develop bridge circuits to find unknown variables.

CO3: Select proper transducer for various applications.

CO4: Understand various read out and display devices.

CO5: Design a measurement system for various applications.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	-	-	1	2	-	-	2	-	-
CO2	3	2	1	1	-	-	-	1	2	-	-	2	-	-
CO3	3	2	1	1	-	-	-	1	2	-	-	2	-	-
CO4	3	2	1	2	-	-	-	1	2	1	-	2	-	-
CO5	3	2	1	1	-	-	-	1	2	1	-	2	-	-
Avg	3	2	1	1	-	-	-	1	2	1	-	2	-	-

1 -low, 2-medium, 3-high, '-' –no correlation

Chairman
BoS/BME

		L	T	P	C
23CSL35	**OBJECT ORIENTED PROGRAMMING USING JAVA LABORATORY** (BE- BME)	0	0	3	1.5

COURSE OBJECTIVES:

- To develop problem-solving skills using Java programming
- To design and implement object-oriented applications using classes, objects, inheritance, interfaces, and polymorphism.
- To develop Java applications for employee management systems
- To apply advanced Java programming concepts such as exception handling,
- To design graphical user interface (GUI) applications using JavaFX controls

LIST OF EXPERIMENTS

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4. Solve the above problem using an interface.
5. Implement exception handling and creation of user defined exceptions.
6. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
7. Develop applications to demonstrate the features of generics classes.
8. Develop applications using JavaFX controls, layouts and menus.

Chairman
BoS/CSE&IT

Lab Requirements: for a batch of 30 students

Operating Systems: Linux / Windows

Front End Tools: Eclipse IDE / Netbeans IDE

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1 : Apply searching and sorting algorithms such as sequential search, binary search, selection sort, and insertion sort to solve computational problems.

CO2 : Design and implement object-oriented programs using classes, objects, inheritance, interfaces, and polymorphism.

CO3 : Develop Java applications for employee management and payroll processing using inheritance and interface concepts.

CO4 : Implement robust Java programs using exception handling, user-defined exceptions, multithreading, and generic classes.

CO5 : Design and develop graphical user interface applications using JavaFX controls, layouts, and menus.

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	1	1	-	-	1	1
CO2	3	3	1	1	1	-	-	-	1	1	-	-	1	1
CO3	3	3	1	1	1	-	-	-	1	1	-	-	1	1
CO4	3	3	1	1	1	-	-	-	1	1	-	-	1	1
CO5	3	3	1	1	1	-	-	-	1	1	-	-	1	1
AVG	3	3	1	1	1	-	-	-	1	1	-	-	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/CSE&IT

23BMT51	EMBEDDED SYSTEMS AND IoMT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the 8051 Microcontroller.
- To familiarize with Embedded System Concepts.
- To explore Hardware/Software Co-Design.
- To develop Skills for IoT System Design.
- To understand Applications of IoMT (Internet of Medical Things).

UNIT-I 8051 MICROCONTROLLER **9**

Introduction 8051 Microcontroller, Architecture, Instruction Set and Programming, Programming Parallel Ports, Timers and Serial Port, Interrupt Handling.

UNIT-II INTRODUCTION TO EMBEDDED CONCEPTS **9**

Introduction to embedded systems, Application, Architecture of embedded systems-Hardware and Software, Application Software, Communication Software.

UNIT-III HARDWARE/SOFTWARE CO-DESIGN FOR EMBEDDED SYSTEMS **9**

Microcontrollers for embedded systems, 32-bit RISC Architectures for embedded Design-ARM architectural details, ARM microcontroller programming in C, Peripheral Interafcing with ARM, Communication Protocols, UART, I2C, SPI, PLCC, Bluetooth, WiFi, Zigbee.

UNIT-IV DESIGN AND DEVELOPMENT OF IOT **9**

Definition and characteristics of IoT, Technical Building blocks of IoT, Communication Technologies, Physical design of IoT - system building blocks - sensors and sensor Node - Interfacing using any Embedded target boards, Benefits and impact of IoMT-Medical Big Data Analytics

UNIT-V INTERNET OF MEDICAL THINGS **9**

Novel Symmetrical Uncertainty Measure (NSUM) Technique for Diabetes, Healthcare Monitoring system through Cyber-physical system, loT Model for Neuro sensors, Healthcare Application Development in Mobile and Cloud Environments - Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Understand 8051 architecture, instruction set, and programming.
- **CO2:** Examine the fundamental concepts and importance of embedded systems, including their applications in real-world scenarios.
- **CO3:** Develop ARM programs and interface with UART, I2C, SPI, and Zigbee.
- **CO4:** Illustrate IoT design using sensors and medical data platforms.
- **CO5:** Analyze IoMT solutions using real-time and cloud-based systems.

TEXT BOOKS:

1. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 4th Edition, McGraw Hill Education, 2024.
2. Daniele Lacamera, Embedded Systems Architecture: Design and write software for embedded devices to build safe and connected systems, 2nd Edition, Packt Publishing, 2023.
3. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, 2nd Edition, VPT, 2023.

Chairman
BoS/BME

REFERENCE BOOKS:

1. Satish Shah,Internet of Things (IoT): Concepts and Applications, 1st Edition, McGraw Hill, 2022.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_cs147/
2. https://www.aranca.com/

CO's – PO's & PSO's MAPPING:

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	2	2	1	1	2	1
CO2	3	2	2	1	2	-	-	-	1	2	1	1	2	1
CO3	3	3	3	2	3	-	-	-	2	3	1	3	3	1
CO4	3	2	3	2	3	-	-	-	2	2	1	1	1	1
CO5	3	3	2	2	3	-	-	-	1	1	1	2	2	2
AVG	3	2	2	1	2	-	-	-	1	2	1	1	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BMT52	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the devices for measurement of parameters related to cardiology.
- To illustrate the recording and measurement of EEG.
- To demonstrate EMG recording unit and its uses.
- To explain diagnostic and therapeutic devices related to respiratory parameters.
- To understand the various therapeutic devices that hold clinical importance.

UNIT-I PHYSIOLOGICAL PARAMETER MEASUREMENT 9

ECG, EEG, EMG, PCG, EOG - electrodes for physiological measurement-Recording system. Heart rate, blood pressure, temperature, respiration rate & cardiac output measurement, Blood flow measurement.

UNIT-II NEUROLOGICAL EQUIPMENT 9

Clinical significance of EEG, Multi-channel EEG recording system, Epilepsy, Evoked Potential– Visual, Auditory and Somatosensory, MEG (Magneto encephalography). EEG Bio Feedback Instrumentation. EEG system maintenance and troubleshooting.

UNIT-III MUSCULAR EQUIPMENT 6

Recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation.

UNIT-IV RESPIRATORY MEASUREMENT EQUIPMENT 10

Instrumentation for measuring the mechanics of breathing – Spiro meter - Whole body plethysmograph, Apnoea Monitor, CPAP, BiPAP, oxygen concentrators -Ventilators (Electronic, pneumatic and servo Ventilators)- Humidifiers

UNIT-V THERAPEUTIC EQUIPMENT 11

Cardiac Defibrillators, Pacemakers, blood warmers, Infusion and syringe pumps, Haemodialysis, electro surgical diathermy, anesthesia equipment, lithotripter, hearing aids.

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1	Understand the working and recording setup of all basic cardiac equipment.
CO2	Outline the working and recording of all basic neurological equipment's.
CO3	Examine the recording of diagnostic and therapeutic equipment's related to EMG.
CO4	Analyze the measurements of parameters related to respiratory system.
CO5	Apply the therapeutic procedures in assisting common therapeutic equipments.

TEXT BOOKS:

SVHEC-R2023

Chairman
BoS/BME

1. Khandpur, R. S. Handbook of Biomedical Instrumentation (3rd ed.). McGraw Hill Education (India), 2024.
2. Bronzino, J.D., The Biomedical Engineering Handbook: Medical Devices and Human Engineering, 4th Edition, CRC Press, 2014.

REFERENCE BOOKS:

1. John G. Webster, Medical Instrumentation: Application and Design, 5th Edition, Wiley, 2023.
2. Leslie Cromwell, Fred J. Weibell & Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, 2nd Edition, Pearson, Reprint 2022.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_bt49/preview
2. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	1	3	2	1
CO2	3	2	1	1	2	-	-	-	-	-	1	3	2	1
CO3	3	2	1	1	2	-	-	-	-	-	1	3	2	1
CO4	3	2	1	1	2	-	-	-	-	-	1	3	2	1
CO5	3	2	1	1	2	-	-	-	-	-	1	3	2	1
AVG	3	2	1	1	2	-	-	-	-	-	1	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

		L	T	P	C
23BML51	EMBEDDED SYSTEMS AND IoMT LABORATORY	0	0	3	1.5

COURSE OBJECTIVES:

- To develop 8051 programming for arithmetic, logic, and serial communication.
- To design real-time applications like digital clocks using 8051 timers.
- To apply ARM programming for ADC, DAC, PWM, and UART interfacing.
- To demonstrate IoT interfacing with LED arrays, Zigbee, and Bluetooth.
- To enable wireless communication between embedded boards for IoT/biomedical use.

LIST OF EXPERIMENTS

1. Programming Arithmetic and Logical Operations in 8051.
2. Programming using Serial Ports in 8051.
3. Design of a Digital Clock using Timers/Counters in 8051.
4. Interfacing Biosensors with Raspberry PI (Pulse oximeter and ECG).
5. Interfacing ADC and DAC using ARM.
6. Interfacing Stepper Motor with PWM using ARM.
7. UART using ARM.
8. Interface LED Array using IOT.
9. Interface With Zigbee, Bluetooth using IOT.
10. Communicate between Arduino and Raspberry PI using any wireless medium.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Daniele Lacamera, Embedded Systems Architecture: Design and write software for embedded devices to build safe and connected systems, 2nd Edition, Packt Publishing, 2023.
2. Muhammad Ali Mazidi, Rolin D. McKinlay, Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2nd Edition, Pearson, 2023.
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2nd Edition, Pearson, 2023.

E-RESOURCES:

1. https://www.sanfoundry.com/microcontroller-mcqs-introduction/
2. https://archive.nptel.ac.in/courses/106/105/106105193/

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Design a real-time digital clock using timers and counters in 8051 microcontroller.

CO2: Develop UART-based communication in ARM and test data transmission functionality.

CO3: Construct LED array control using IoT-based embedded platform and interpret output behavior.

CO4: Analyze the wireless interfacing of Zigbee and Bluetooth modules in IoT-based systems.

CO5: Establish wireless communication between Arduino and Raspberry Pi and evaluate the performance for real-time data exchange.

Chairman
BoS/BME

CO's – PO's & PSO's MAPPING

CO/PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	1	2	3	3	2	1	3
CO2	2	1	3	2	2	-	-	1	2	2	3	3	1	3
CO3	3	1	3	3	1	-	-	1	2	1	1	1	3	3
CO4	3	2	3	2	1	-	-	1	2	2	3	2	2	1
CO5	2	3	3	2	2	-	-	1	3	3	2	3	1	3
Avg	2	2	3	2	1	-	-	1	2	2	2	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BML52	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- Demonstrate recording and analysis of different Bio potentials
- Examine different therapeutic modalities.
- Measure the different bioelectrical signals.
- Analyze the various physiological signal using telemetry.
- Understand the concept of different bio signals using suitable tools.

LIST OF EXPERIMENTS

1. Measurement of visually and auditory evoked potential.
2. Heart rate estimation using ECG signal acquisition.
3. Galvanic Skin Resistance (GSR) measurement.
4. Shortwave and ultrasonic diathermy Radiation Treatment.
5. Measurement of various physiological signals using biotelemetry.
6. Electrical safety Analyzer.
7. Simulation of therapeutic current waveforms using medical simulation.
8. Analyze the working of ESU–cutting and coagulation modes.
9. Recording of Audiogram.
10. Study the working of Defibrillator and pacemakers using virtual lab.
11. Study of ventilators and Ultrasound Scanners.
12. Study of Haemodialysis model using virtual lab.
13. Study of heart lung machine model.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Measure the different bioelectrical signals.

CO2: Record the various physiological signals using telemetry.

CO3: Demonstrate various diagnostic and therapeutic techniques.

CO4: Examine the electrical safety measurements.

CO5: Analyse the different bio signals using suitable tools.

REFERENCE BOOKS:

1. Manual prepared by the faculty of BME Department, SVHEC

Chairman
BoS/BME

E-RESOURCES:

1. http://bmsp-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Biotechnology

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	1	1	-	-	3	2	2
CO2	3	3	3	2	2	-	-	1	1	-	-	3	2	2
CO3	3	3	3	2	2	-	-	2	2	1	-	3	2	3
CO4	3	3	2	2	2	-	-	2	2	2	-	3	2	2
CO5	3	3	3	2	2	-	-	2	2	2	-	3	3	1
AVG	3	3	3	2	2	-	-	2	2	2	-	3	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23MDC51	SOFT SKILLS AND ANALYTICAL SKILLS - II	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:

- ☐ To enhance the collaboration and cooperation between individuals towards a common goal.
- ☐ To provide a critical perspective on the socialization of men and women.
- ☐ Basic Knowledge about the Verbal Reasoning.
- ☐ To solve the problems in Quantitative Aptitude.
- ☐ Understand the basics of Data Interpretation

UNIT-I **TEAM SKILLS** 3

Trust and collaboration - Team building – Shouldering responsibilities

UNIT-II **GENDER SENSITIZATION** 3

Media and the Social Context - Social Networks - Gender Sensitization

UNIT-III **VERBAL REASONING** 3

Verbal Reasoning: Syllogism, Blood relationship

UNIT-IV **QUANTITATIVE APTITUDE** 3

Ratio and proportion, Problems on ages, Partnership.

UNIT-V **DATA INTERPRETATION** 3

Tabulation – Profit & loss, Percentage.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1 : Share and exchange knowledge and ideas, clarify doubts, and arrive at a collective decision or understanding.

CO2 : Meet the needs of an increasingly ethnically and gender-diverse workplace.

CO3 : Enhance the Aptitude Round Clearing ability in interview process

CO4 : Solve problems pertaining to quantitative ability.

CO5 : Interrupt the data.

Chairman
BoS / S&H

TEXT BOOKS:

1. Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.
2. Soft Skills: an Integrated Approach to Maximise Personality, Gajendra S. Chauhan, Sangeeta Sharma, Wiley India

REFERENCE BOOKS:

1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by AbhijitGuha, Tata Mc Graw Hill Publications.
4. Personality Development and Soft Skills, Barun K. Mitra, Oxford Press
5. Cornerstone: Developing Soft Skills, Sherfield, Pearson India

Chairman
BoS / S&H

23MDC55 DISASTER RISK REDUCTION AND MANAGEMENT

L	T	P	C
3	0	0	0

COURSE OBJECTIVES:

- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
- To acquaint with the skills for planning and organizing disaster response
- To develop disaster response skills by adopting relevant tools and technology
- To Enhance awareness of institutional processes for Disaster response in the country
- To Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

UNIT-I HAZRADS, VULNERABILITY AND DISASTER RISKS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - Inter relations between Disasters and Sustainable development Goals

UNIT-II DISASTER RISK REDUCTION (DRR) 9

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT-III DISASTER MANAGEMENT 9

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

Chairman
BoS / Civil

UNIT-IV **TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT** **9**

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT-V **DISASTER MANAGEMENT: CASE STUDIES** **9**

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill -

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1 : To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)

CO2 : To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction

CO3 : To develop disaster response skills by adopting relevant tools and technology

CO4 : Enhance awareness of institutional processes for Disaster response in the country and

CO5 : Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

TEXT BOOKS:

1. Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2. Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
4. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

Chairman
BoS / Civil

REFERENCE BOOKS:

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009.
3. Shaw R (2016), Community based Disaster risk reduction, Oxford University Press

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/124/107/124107010/
2. https://nptel.ac.in/courses/124107010

CO's – PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	3	-	-	2	2	-	-	2	2	-	1
CO2	3	3	3	3	-	-	2	1	-	-	2	2		1
CO3	3	3	3	3	-	-	2	2	-	-	-	2		1
CO4	3	3	2	3	-	-	2	1	-	-	2	2		1
CO5	3	3	2	3	-	-	2	2	-	-	2	3		1
Avg.	**3**	**3**	**2.4**	**3**	**-**	**-**	**2**	**1.6**	**-**	**-**	**2**	**2.2**	**-**	**1**

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS - Civil

23BMT61	BIOMECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamental principles of mechanics applied to human movement.
- To provide basic understanding of biofluid mechanics and blood flow characteristics.
- To explore the mechanical properties of musculoskeletal tissues such as bone, muscle and skin.
- To examine the biomechanics and functional mechanism of human joints.
- To apply biomechanics to modeling techniques and ergonomic design for improving human performance and safety.

UNIT-I INTRODUCTION TO BIOMECHANICS 9

Definition and perspective of biomechanics – kinematics concepts for analyzing human motion – kinetic concepts for analyzing human motion-linear kinetics of human movements –Angular Kinetics of linear movements –Equilibrium and human Movements.

UNIT-II MECHANICS OF BIOSOLIDS AND BIOFLUID 9

Constitutive equation-Stress- Strain- Viscoelasticity-Flow properties of blood-Rheology of blood in micro vessels-Bio viscoelastic solids.

UNIT-III BIOMECHANICS OF HARD AND SOFT TISSUES 9

Bone: structure, composition, mechanical properties, anisotropy, fracture mechanisms – pseudo elasticity, Structure, function, mechanical properties of: skin, ligaments, skeletal muscles and tendons, Constitutive equations for soft tissues.

UNIT-IV BIOMECHANICS OF JOINTS 9

Skeletal joints - Joints of upper extremity: Shoulder, Elbow – Joints of lower extremity: Hip, knee and ankle - Spinal cord.

UNIT-V MODELLING AND ERGONOMICS 9

Introduction to Finite Element Analysis, finite element analysis of lumbar spine; models for voice biomechanics, Ergonomics –Musculoskeletal disorders, Ergonomic principles-workplace design, Computer work station design , Sports mechanics, Hand transmitted and whole-body vibrations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1	To understand the kinematic and kinetic principles involved in human motion and equilibrium
CO2	To analyze the mechanical behavior of biosolids and biofluids, including stress-strain relationships and blood rheology.
CO3	To evaluate the structure and mechanical characteristics of hard and soft tissues such as bone, ligaments and muscles.
CO4	To understand the biomechanics and functional mechanisms of major joints in the human body.

Chairman
BoS/BME

CO5 To apply finite element modeling and ergonomic principles in biomechanical system design and workplace optimization.

TEXT BOOKS:

1. Andrew Kerr, John Middleton, Jim Richards," Biomechanics in Musculoskeletal Health", 1st Edition, Academic Press, 2023.
2. David E. Rival," Biological and Bio-Inspired Fluid Dynamics: Theory and Application, 1st edition, Springer, 2022.
3. Duane Knudson, "Fundamentals of Biomechanics", 3rd Edition, Springer, 2021.

REFERENCE BOOKS:

1. Benjamin L. Klarlund, Peter C. W. Lee, Introduction to Biomechanics: Mechanical Principles of Biological Systems, 1st Edition, Elsevier, 2022.
2. Kaushik Kumar (Editor), J Paulo Davim, "Design, Development, and Optimization of Bio-Mechatronic Engineering Products, 1st Edition , Engineering Science Reference,2019.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/102/106/102106098/
2. https://www. Jove.com/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1	1	-	-	-	-	1	2	-
CO2	3	1	1	-	-	1	1	-	-	-	-	1	2	-
CO3	3	1	1	-	-	1	1	-	-	-	-	1	2	-
CO4	3	1	1	-	-	1	1	-	-	-	-	1	2	-
CO5	3	1	1	-	-	1	1	-	-	-	-	1	2	-
AVG	3	1	1	-	-	1	1	-	-	-	-	1	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Cha[illegible]
BoS/BME

23CSI42	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (for B.E./B.Tech. -CSE, IT,CS and BME)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms
- Learn the basics of deep learning using neural networks

UNIT-I **PROBLEM SOLVING** 9

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP).

UNIT-II **PROBABILISTIC REASONING** 9

Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning– Bayesian networks – exact inference in BN–approximate inference in BN – causal networks.

UNIT-III **SUPERVISED LEARNING** 9

Introduction to machine learning–Linear Regression Models : Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests.

UNIT-IV **ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING** 9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT-V **NEURAL NETWORKS** 9

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error back propagation, from shallow networks to deep networks –Unit saturation (akathe vanishing gradient problem) – ReLU, hyper parameter tuning, batch normalization, regularization, dropout.

TOTAL:45 PERIODS

Chairman
BoS/CSE&IT

PRACTICAL EXERCISES:

1. Implementation of Uninformed search algorithms (BFS,DFS)
2. Implementation of Informed search algorithms (A*,memory-boundedA*)
3. Implement naïve Bayes models
4. Implement Bayesian Networks
5. Build Regression models
6. Build decision trees and random forests
7. Build SVM models
8. Implement ensembling techniques
9. Implement clustering algorithms
10. Implement EM for Bayesian networks
11. Build simple NN models
12. Build deep learning NN models

TOTAL:30 PERIODS
TOTAL:75(45+30)PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1 : Use appropriate search algorithms for problem solving

CO2 : Apply reasoning under uncertainty

CO3 : Build supervised learning models

CO4 : Build ensembling and unsupervised models

CO5 : Build ensembling and unsupervised models

TEXT BOOKS:

1. Stuart Russell and Peter Norvig," Artificial Intelligence–A Modern Approach", Fourth Edition, Pearson Education,2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition,2020.

REFERENCE BOOKS:

1. DanW.Patterson,"Introduction to Artificial Intelligence and Expert Systems", Pearson Education, 2007
2. Kevin Night, Elaine Rich, and NairB.,"Artificial Intelligence",McGrawHill,2008.
3. Patrick H. Winston," Artificial Intelligence", Third Edition, Pearson Education,2006.
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013

Chairman
BoS/CSE&IT

E-RESOURCES:

1. https://nptel.ac.in/courses/106106226
2. https://nptel.ac.in/courses/106106139

CO's – PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	1	3	3	3	1	2	2
CO2	1	1	1	3	1	-	-	1	2	1	3	2	3	2
CO3	2	1	2	1	1	-	-	2	1	1	3	1	1	1
CO4	3	1	3	1	-	-	-	2	1	2	1	2	2	2
CO5	3	1	1	2	2	-	-	3	1	2	3	2	1	2
AVG	2.4	1.2	2	2	1.3	-	-	1.8	1.6	1.8	2.6	1.6	1.8	1.8

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/CSE&IT

23BMI61	MEDICAL IMAGE PROCESSING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To Understand the fundamental principles and techniques used in medical image processing.
- To Learn image intensity transformations and filtering techniques in both spatial and frequency domains.
- To Acquire knowledge of image segmentation and restoration methods relevant to medical imaging.
- To Gain insight into image registration and visualization techniques used in medical diagnosis.
- To Explore real-world applications of medical image, computer-aided diagnostic systems.

UNIT-I DIGITAL IMAGE PROCESSING CONCEPTS 9

Introduction, Digital Image Processing -Components –Elements of Visual Perception-Image Sensing and Acquisition - Image Sampling and Quantization -color models-DICOM Image format.

UNIT-II IMAGE ENHANCEMENT 9

Spatial domain processing– Point processing operation, Histogram processing – Basics of Spatial Filtering – Smoothing and Sharpening, Frequency domain processing- Smoothing and Sharpening –Butterworth and Gaussian filters. Notch filter, Wavelets

UNIT-III MEDICAL IMAGE RESTORATION AND SEGMENTATION 9

Image Restoration - Inverse Filtering – Wiener filtering. Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Region Growing, Region Splitting, K Means and Fuzzy Clustering.

UNIT-IV REGISTRATION AND VISUALISATION 9

Registration–Rigid body transformation, principal axes registration, and feature based. Visualisation-Orthogonal and perspective projection in medicine, Surface based rendering, Volume visualization in medical image.

UNIT-V COMPRESSION AND MEDICAL IMAGE ANALYSIS 9

Image compression - DCT and Wavelet transform based image compression- Application of Medical image analysis-Preprocessing-Retinal images, Ultrasound-Mammogram., Computer aided diagnosis system – Analysis of performance metrics.

THEORY : 45 PERIODS

Chairman
BoS/BME

PRACTICAL EXERCISES:

1. Basic operation on Images.
2. Image Enhancement in Spatial domain.
3. Image Enhancement in frequency domain.
4. Pseudo coloring of medical images
5. Color image enhancement
6. Implementation of image segmentation
7. Implementation of Canny edge detection.
8. Image compression using DCT.

PRACTICAL: 30 PERIODS
TOTAL (45+30) =75 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the basic concepts of digital image processing relevant to medical imaging.

CO2: Apply the various image enhancement techniques for improving medical image quality.

CO3: Analyze the image restoration and segmentation techniques for extracting meaningful medical information.

CO4: Demonstrate the knowledge of image registration and visualization techniques in clinical imaging applications.

CO5: Design healthcare-related applications using image processing tools and evaluate their societal impact.

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods' Digital Image Processing, Fourth Edition, Global Edition. published by Pearson Education, 2018
2. Suri, Jasjit S., Rangaraj M. Rangayyan, Recent Advances in Computer-Aided Diagnosis Using Medical Imaging, 1st Edition, Elsevier, 2022.
3. John L. Semmlow (Author), Benjamin Griffel, Biosignal and Medical Image Processing 3rd Edition, CRC Press, 2021.

REFERENCE BOOKS:

1. Rijwan Khan , Indrajeet Kumar, Advancements in Bio-Medical Image Processing and Authentication in Telemedicine, 1st Edition, Igi Global Medical Information Science Reference,2023.
2. Jayaram K. Udupa, Milan Sonka, Digital Image Processing and Analysis: Human and Computer Vision Applications with CVIP tools, 4th Edition, CRC Press, 2020.

Chairman
BoS/BME

E-RESOURCES:

1. NPTEL-Online Courses and Video lectures: nptel.ac.in/courses/108/105/108105091/
2. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	1	2	1	1
CO2	3	3	2	2	2	-	-	-	-	-	1	2	1	1
CO3	3	3	1	2	2	-	-	-	-	-	1	2	1	1
CO4	3	3	1	2	2	-	-	-	-	-	1	2	-	-
CO5	3	3	1	2	2	-	-	-	-	-	1	1	-	-
AVG	3	3	2	2	2	-	-	-	-	-	1	2	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23MDC65 **INDUSTRIAL SAFETY**

L	T	P	C
3	0	0	0

Course Objectives:

The main learning objective of this course is to prepare the students to:

- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate the various Safety activities in the Industry.
- To have knowledge about Workplace Exposures and Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT-I SAFETY TERMINOLOGIES 9

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold Limit Value (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT-II STANDARDS AND REGULATIONS 9

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT-III SAFETY ACTIVITIES 9

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT-IV WORKPLACE HEALTH AND SAFETY 9

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT-V HAZARD IDENTIFICATION TECHNIQUES 9

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis-Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis-and Hazard Identification and Risk Assessment

TOTAL : 45 PERIODS

Chairman
BoS / Mech

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: Understand the basic concept of safety.

CO2: Obtain knowledge of Statutory Regulations and standards.

CO3: Know about the safety Activities of the Working Place.

CO4: Analyze on the impact of Occupational Exposures and their Remedies

CO5: Obtain knowledge of Risk Assessment Techniques.

TEXT BOOKS:

1. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control, McGraw-Hill Education, 2005.
2. R.K. Jain and Prof. Sunil S. Rao, Industrial Safety, Health and Environment Management Systems, Khanna Publishers, 4th Edition, 2006.

REFERENCE BOOKS:

1. Frank P. Lees, Lees' Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control, Butterworth-Heinemann (Elsevier), UK, 4th Edition, 2012.
2. John Ridley and John Channing, Safety at Work, Routledge, 9th Edition, 2022.
3. Dan Petersen, Techniques of Safety Management: A Systems Approach, McGraw-Hill, 2003.
4. Alan Waring, Safety Management Systems, Chapman & Hall, England, 1996.
5. American Society of Safety Professionals (ASSP) ANSI/ASSP Z10 – Occupational Health and Safety Management Systems, Latest Edition, 2019.

E-RESOURCES:

1. ISO 45001:2018 occupational health and safety (OH&S) International Organization for Standardization https://www.iso.org/standard/63787.html
2. Indian Standard code of practice on occupational safety and health audit https://law.resource.org/pub/in/bis/S02/is.14489.1998.pdf
3. Indian Standard code of practice on Hazard Identification and Risk Analysis IS 15656:2006 https://law.resource.org/pub/in/bis/S02/is.15656.2006.pdf

CO's – PO's& PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	1	3	2	3	-	1	3	3	-	-
CO2	2	3	-	-	1	3	3	3	-	1	3	3	-	-
CO3	2	2	-	-	1	2	2	3	-	1	2	3	-	-
CO4	3	3	-	-	2	3	2	3	-	1	3	3	-	-
CO5	3	2	-	-	2	3	2	3	-	2	3	3	-	-
Avg	3	3	-	-	1	3	2	3	-	1	3	3	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS / Mech

23UHV71	UNIVERSAL HUMAN VALUES-II (Common to all branches)	L T P C 2 1 0 3

Course Objectives:

- Transform the students for the essential complementarily between 'VALUES' and 'SKILLS'.
- Develop students towards life and profession as well as towards happiness and prosperity.
- Exploring the difference of Needs of Self and Body.
- To highlight ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
- Exploring Humanistic Models in Education.

UNIT-I **Introduction to Value Education** **6+3**

Lectures - Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations

Tutorials [Practice Session] - Sharing about Oneself - Exploring Human Consciousness - Exploring Natural Acceptance

UNIT-II **Harmony in the Human Being** **6+3**

Lectures - Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body – The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body - Programme to ensure self-regulation and Health

Tutorials [Practice Session] - Exploring the difference of Needs of Self and Body - Exploring Sources of Imagination in the Self - Exploring Harmony of Self with the Body

UNIT-III **Harmony in the Family and Society** **6+3**

Lectures - Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship – 'Trust' – the Foundational Value in Relationship - 'Respect' – as the Right Evaluation - Understanding Harmony in the Society - Vision for the Universal Human Order

Tutorials [Practice Session] - Exploring the Feeling of Trust - Exploring the Feeling of Respect - Exploring Systems to fulfil Human Goal

UNIT-IV **Harmony in the Nature/Existence** **6+3**

Lectures - Understanding Harmony in the Nature - Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature – Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence

Chairman
BoS / S&H

Tutorials [Practice Session] - Exploring the Four Orders of Nature - Exploring Co-existence in Existence

UNIT-V **Implications of the Holistic Understanding** **6+3**

Lectures - Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct – A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics - Holistic Technologies, Production Systems and Management Models-Typical Case Studies - Strategies for Transition towards Value-based Life and Profession

Tutorials [Practice Session] - Exploring Ethical Human Conduct - Exploring Humanistic Models in Education - Exploring Steps of Transition towards Universal Human Order

Total Hours **45**

COURSE OUTCOME

CO's	OUTCOME
CO1 :	Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
CO2 :	Students would become more responsible in life, and in handling problems with sustainable solutions.
CO3 :	Students become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4 :	Students would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.
CO5 :	Students would have better critical ability.

TEXT BOOKS:

- A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-53-2

REFERENCE BOOKS:

- Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
- The Story of Stuff (Book)

Chairman
BoS / S&H

- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Small is Beautiful - E. F Schumacher
- Slow is Beautiful - Cecile Andrews
- Economy of Permanence - J C Kumarappa
- Bharat Mein Angreji Raj – PanditSunderlal
- Rediscovering India - by Dharampal
- Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

E. RESOURCES:

- https://www.youtube.com/watch?v=yxbooB5Senw&utm
- https://www.uhv.org.in?utm
- https://www.aicte-india.org?utm

COs-Pos MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	2	1	1	-	2
CO2	1	2	-	-	-	3	2	1	1	1	2
CO3	-	-	-	-	-	2	3	3	2	-	2
CO4	-	1	-	-	-	2	3	2	2	1	3
CO5	2	3	-	2	-	1	1	-	1	-	3
AVR	1.50	2.00		2.00		2.20	2.20	1.75	1.40	1.00	2.40

1- Low, 2- Medium, 3-High, "-" No Correlation

Chairman
BoS / S&H

23BML71 **HOSPITAL TRAINING** **L T P C**
0 0 0 2

COURSE OBJECTIVES:

- Understand the hospital organization and Management
- Understand the working principle and operation of Medical Equipment
- Observe the connections and recording of the equipment in hospital setting
- Understand the trouble shooting of medical equipment
- Understand the Skills to diagnose and fix common issues in medical equipment

Students need to complete training in Government hospital / any leading Multi-specialty hospital for a period of 8 weeks (2 months). They need to prepare an extensive report and submit. The students should give a detailed presentation of the equipment, laboratory and the facilities in all the departments of the Hospital.

At the end of the course, the students will be able to

CO1 Describe the function, operation and management of medical equipment.
CO2 Troubleshoot the medical equipment
CO3 Implement the basic safety measures
CO4 Manage and dispose Bio waste.
CO5 Prepare technical Report and presentation.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	1	2	-	-	-	-	3	3	3	-	-
CO2	3	2	-	1	2	-	-	-	-	-	3	3	-	-
CO3	-	-	-	1	2	3	3	-	-	-	3	3	-	-
CO4	-	-	-	1	2	-	-	3	-	3	3	3	-	-
CO5	-	-	-	1	2	3	3	-	3	-	3	3	-	-
AVG	3	2	-	1	2	3	3	3	3	3	3	3	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BML72	MINI PROJECT	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To solve the identified problem statement based on the formulated methodology.
- To develop skills to analyze and infer the results, and make conclusions.

The student should carry out literature survey and experimental works on selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners.

COURSE OUTCOMES:
At the end of the course, the students will be able to

CO1: Conceptualize the innovative ideas and formulate the objectives

CO2: Develop proof of concept, validate in a relevant environment and prototype demonstration

CO3: Understand the need for societal role, environment sustainability, professional ethics, and teamwork.

CO4: Gain Collective Knowledge, Interactions and updation.

CO5: Develop Report Writing and Presentation Skills

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	3	3	3	-	3	3	3	3
CO2	3	3	3	3	3	-	-	3	3	-	3	3	3	3
CO3	3	-	-	-	-	3	3	3	3	-	3	3	3	3
CO4	3	-	-	-	-	-	-	3	3	-	3	3	-	-
CO5	3	-	-	-	-	-	-	3	3	-	3	3	-	-
AVG	3	3	3	3	3	3	3	3	3	-	3	3	3	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BML81 **PROJECT WORK** **L T P C**
0 0 20 10

COURSE OBJECTIVES:

To train the students in

- Identifying problem and developing the structured methodology to solve the identified problem in the industry or research problem at research Institution or college.
- Conducting experiments, analyze and discuss the test results, and make conclusions.
- Preparing project reports and presentation.

The students shall individually / or as group work on a specific topic approved by the Department. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 300 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will have

CO1: Formulate and analyze problem / create a new product/ process.
CO2: Design and conduct experiments to verify.
CO3: Develop working/simulation model.
CO4: Analyze the results and provide solution for the identified problem.
CO5: Prepare project report and make presentation.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	1	1	1	1	1	3	2	3
CO2	3	3	3	2	1	1	1	1	1	1	1	3	3	3
CO3	3	3	3	2	1	1	1	1	1	1	1	2	2	2
CO4	3	2	2	2	1	1	1	1	1	1	1	3	2	2
CO5	1	1	1	1	1	1	1	1	1	3	1	1	1	1
AVG	2.6	2.4	2.4	1.8	1	1	1	1	1	1.4	1	2.4	2	2.2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

SUB. CODE	COURSE NAME	L	T	P	C
23MSE71	PRINCIPLES OF MANAGEMENT	3	0	0	3

Course Objectives:

- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

UNIT-I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers-managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

UNIT-II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT-III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT-IV DIRECTING 9

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT-V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

Total Hours 45

COURSE OUTCOME

CO's	OUTCOME
CO1	Upon completion of the course, students will be able to have clear understanding of Managerial functions like planning, organizing, staffing, leading & controlling.
CO2	Have same basic knowledge on international aspect of management.
CO3	Ability to understand management concept of organizing.
CO4	Ability to understand management concept of directing.
CO5	Ability to understand management concept of controlling.

Chairman
BoS / MBA

CO, PO & PSO MAPPING

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	-	-	-	-	1	-	-	-	-	-	2	1	1
2	-	1	1	-	-	-	-	-	-	-	-	2	1	-
3	1	-	-	2	-	-	1	-	2	-	1	-	-	2
4	-	1	1	1	2	-	-	1	2	-	-	1	1	1
5	1	-	-	-	1	1	-	-	-	3	-	1	-	1
AVg.	1	0.4	0.4	0.6	0.6	0.4	0.4	0.2	0.8	0.6	0.2	1.2	0.6	1

TEXT BOOKS:

1. Angelo Kinicki and Brian K. Williams "Management: A Practical Introduction," McGraw-Hill Education, 9th Edition, 2022.
2. Charles W. L. Hill and Steven L. McShane "Principles of Management," McGraw-Hill Education, 13th Edition, 2020.
3. Robert Kreitner and Angelo Kinicki "Management," McGraw-Hill Education, 13th Edition, 2020.
4. Ricky W. Griffin "Fundamentals of Management," Cengage Learning, 10th Edition, 2020.
5. Roberta S. Russell and Bernard W. Taylor "Principles of Management," Pearson Education, 9th Edition, 2019.

Online Sources:

1. http://nptel.ac.in/courses/122105020/9, "Training and Development," Prof. Kalyan Chakravarti, Indian Institute of Technology, Kharagpur.
2. https://onlinecourses.nptel.ac.in/noc22_mg15/preview, "Principles of Management," Prof. S. Ramachandran, Indian Institute of Technology, Madras.

Chairman
BoS / MBA

SUB. CODE	COURSE NAME	L	T	P	C
23MSE72	TOTAL QUALITY MANAGEMENT	3	0	0	3

Course Objectives:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools Benchmarking and FMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization

UNIT-I **INTRODUCTION** **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT-II **TQM PRINCIPLES** **9**

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership –Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT-III **TQM TOOLS & TECHNIQUES I** **9**

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT-IV **TQM TOOLS & TECHNIQUES II** **9**

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality – BPR.

UNIT-V **QUALITY MANAGEMENT SYSTEM** **9**

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

Total Hours **45**

Chairman
BoS / MBA

COURSE OUTCOME

CO's	OUTCOME
CO1	Ability to apply TQM concepts in a selected enterprise.
CO2	Ability to apply TQM principles in a selected enterprise
CO3	Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4	Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR
CO5	Ability to apply QMS and EMS in any organization.

CO, PO & PSO MAPPING

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	3	-	-	-	-	-	-	-	-	-	2	-	3
2	-	-	-	-	-	3	-	-	-	-	-	-	2	-
3	-	-	-	-	3	-	-	-	3	-	-	-	2	3
4	-	2	-	-	3	2	3	2	-	-	-	3	2	-
5	-	-	3	-		3	3	2	-	-	-	-	-	-
AVg.	-	1	0.6	-	1.2	1.4	1.2	0.8	0.6	-	-	1	1.2	1.2

TEXT BOOKS:

1. S. S. Chandra and R. G. Desai "Total Quality Management: Key Concepts and Case Studies," Cambridge University Press, 1st Edition, 2020.
2. Thomas Pyzdek and Paul Keller "The Handbook for Quality Management," McGraw-Hill Education, 3rd Edition, 2018.
3. Dale H. Besterfield, Carol Besterfield-Michna, Robert Besterfield, and Mary Besterfield-Sacre "Total Quality Management," Pearson Education, 5th Edition, 2017.
4. James R. Evans and William M. Lindsay "Managing for Quality and Performance Excellence," Cengage Learning, 10th Edition, 2017.
5. Subir Roy "Total Quality Management: A Practical Approach," Wiley India, 1st Edition, 2016.

Online Sources:

1. https://nptel.ac.in/courses/110105083, "Total Quality Management," Prof. R. K. Gupta, Indian Institute of Technology, Roorkee.
2. https://onlinecourses.nptel.ac.in/noc21_mg54/preview, "Total Quality Management," Prof. S. G. Deshmukh, Indian Institute of Technology, Kharagpur.

Chairman
BoS / MBA

SUB. CODE	COURSE NAME	L	T	P	C
23MSE73	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	3	0	0	3

Course Objectives:

- Understanding the concept of Engineering Economics.
- Implement various micro economics concept in real life.
- Gaining knowledge in the field of macro economics to enable the students to have better
- Understanding the different procedures of pricing.
- Learn the various cost related concepts in micro economics

UNIT-I **DEMAND & SUPPLY ANALYSIS** **9**

Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis. Demand - Types of demand – Determinants of demand - Demand function – Demand elasticity - Demand forecasting - Supply – Determinants of supply - Supply function -Supply elasticity.

UNIT-II **PRODUCTION AND COST ANALYSIS** **9**

Production function - Returns to scale - Production optimization - Least cost input - Isoquants - Managerial uses of production function. Cost Concepts - cost function - Determinants of cost - Short run and Long run cost curves - cost Output Decision - Estimation of cost.

UNIT-III **PRICING** **9**

Determinants of Price - Pricing under different objectives and different market structures Price discrimination - Pricing methods in practice.

UNIT-IV **FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT)** **9**

Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis – Comparative financial statements - Analysis & Interpretation of financial statements.

UNIT-V **CAPITAL BUDGETING (ELEMENTARY TREATMENT)** **9**

Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

Total Hours 45

COURSE OUTCOME

CO's	OUTCOME
CO1	Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions
CO2	Evaluate the economic theories, cost concepts and pricing policies
CO3	Understand the market structures and integration concepts
CO4	Understand the measures of national income, the functions of banks and concepts of globalization
CO5	Apply the concepts of financial management for project appraisal

CO, PO & PSO MAPPING

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	3	-	-	-	-	-	-	-	2	-	1	3	-
2	-	3	-	-	-	-	-	-	1	-	-	-	2	2
3	-	2	-	-	-	-	1	1	-	-	-	-	-	-
4	2	3	3	-	2	-	-	2	-	-	-	2	3	-
5	3	3	3	-	2	-	-	-	-	-	-	2	-	2
AVg.	1	2.8	1.2	-	0.8	-	0.2	0.6	0.2	0.4	-	1	1.4	0.8

TEXT BOOKS:

1. Robert Libby, Patricia Libby, and Frank Hodge "Financial Accounting," McGraw-Hill Education, 10th Edition, 2020.
2. Carl S. Warren, Jefferson P. Jones, and William B. Tayler "Financial Accounting," Cengage Learning, 15th Edition, 2019.
3. James L. Riggs, David D. Bedworth, and Shao-Hsuung Juang "Engineering Economics," McGraw-Hill Education, 7th Edition, 2018.
4. William G. Sullivan, Elin M. Wicks, and Dean R. Koontz "Engineering Economy," Pearson Education, 16th Edition, 2017.
5. Donald G. Newnan, Ted G. Eschenbach, and Jerome P. Lavelle "Engineering Economic Analysis," Oxford University Press, 13th Edition, 2017.

Online Sources:

1. http://nptel.ac.in/courses/112105191, "Engineering Economics," Prof. R. K. Agarwal, Indian Institute of Technology, Roorkee.
2. https://www.coursera.org/learn/financial-accounting-2, "Financial Accounting: Advanced Topics," University of Illinois, Coursera.

Chairman
BoS / MBA

SUB. CODE	COURSE NAME	L	T	P	C
23MSE74	HUMAN RESOURCE MANAGEMENT	3	0	0	3

Course Objectives:

- To provide knowledge about management issues related to staffing,
- To provide knowledge about management issues related to training,
- To provide knowledge about management issues related to performance
- To provide knowledge about management issues related to compensation
- To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements

UNIT-I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT 9

The importance of human resources – Objective of Human Resource Management - Human resource policies - Role of human resource manager

UNIT-II HUMAN RESOURCE PLANNING 9

Importance of Human Resource Planning – Internal and External sources of Human Resources -Recruitment - Selection – Socialization.

UNIT-III TRAINING AND EXECUTIVE DEVELOPMENT 9

Types of training and Executive development methods – purpose – benefits

UNIT-IV EMPLOYEE COMPENSATION 9

Compensation plan – Reward – Motivation – Career Development - Mentor – Protege Relationships

UNIT-V PERFORMANCE EVALUATION AND CONTROL 9

Performance evaluation – Feedback - The control process – Importance – Methods – grievances –Causes – Redressal methods.

Total Hours 45

COURSE OUTCOME

CO's	OUTCOME
CO1	Students would have gained knowledge on the various aspects of HRM
CO2	Students will gain knowledge needed for success as a human resources professional.
CO3	Students will develop the skills needed for a successful HR manager
CO4	Students would be prepared to implement the concepts learned in the workplace.
CO5	Students would be aware of the emerging concepts in the field of HRM

Chairman
BoS / MBA

CO, PO & PSO MAPPING

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	2	1	2	2	2	1	1	2	1	1	1	1	1
2	3	3	2	3	2	2	2	2	3	1	2	1	2	1
3	3	3	3	3	3	3	2	2	3	1	2	1	2	1
4	3	3	2	3	3	2	2	2	2	1	1	1	1	1
5	3	3	1	2	2	2	2	2	2	1	1	1	1	1
AVg.	2.8	2.8	1.8	2.6	2.4	2.2	1.8	1.8	2.4	1	1.4	1	1.4	1

TEXT BOOKS:

1. Gary Dessler "Human Resource Management," Pearson Education, 15th Edition, 2020.
2. Aswathappa K. "Human Resource Management: Text and Cases," McGraw-Hill Education, 9th Edition, 2019.
3. Ian Beardwell, Len Holden, and Tim Claydon "Human Resource Management: A Contemporary Approach," Pearson Education, 8th Edition, 2017.
4. P. Subba Rao "Essentials of Human Resource Management and Industrial Relations," Himalaya Publishing House, 4th Edition, 2019.
5. V. S. P. Rao "Human Resource Management," Excel Books, 3rd Edition, 2018.

Online Sources:

1. https://nptel.ac.in/courses/110105086, "Human Resource Management," Prof. P. Subba Rao, Indian Institute of Technology, Madras.
2. https://www.coursera.org/learn/human-resource-management, "Human Resource Management: HR for People Managers," University of Minnesota, Coursera.

SUB. CODE	COURSE NAME	L	T	P	C
23MSE75	KNOWLEDGE MANAGEMENT	3	0	0	3

Course Objectives:

- Learn the Evolution of Knowledge management.
- Be familiar with tools.
- Be exposed to Applications.
- Be familiar with some case studies

UNIT-I INTRODUCTION **9**

Introduction: An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes-management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT-II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING **9**

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT-III KNOWLEDGE MANAGEMENT-THE TOOLS **9**

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

UNIT-IV KNOWLEDGE MANAGEMENT APPLICATION **9**

Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).

UNIT-V FUTURE TRENDS AND CASE STUDIES **9**

Advanced topics and case studies in knowledge management - Development of a knowledge Management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life - cycles of an organization.

Total Hours **45**

COURSE OUTCOME

CO's	OUTCOME
CO1	Understand the process of acquiry knowledge from experts
CO2	Understand the learning organization.
CO3	Use the knowledge management tools.
CO4	Develop knowledge management Applications.
CO5	Design and develop enterprise applications

Chairman
BoS / MBA

CO, PO & PSO MAPPING

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	1	-	-	-	1	-	-	-	-	1	-	-	-	-
2	-	1	-	-	2	-	-	-	-	-	-	1	-	-
3	1	-	2	-	2	-	1	-	-	-	2	-	2	-
4	2	1	-	1	1	-	-	-	1	-	-	-	1	-
5	-	-	-	1	1	-	-	-	1	-	1	-	1	-
AVg.	0.8	0.4	0.4	0.4	1.4	-	0.2	-	0.4	0.2	0.6	0.2	0.8	-

TEXT BOOK:

1. Eleni Kyriakou, Nicki M. S. and S. K. Sharma "Knowledge Management: A Systems Perspective," Wiley, 2nd Edition, 2021.
2. Sudhir Warier "Knowledge Management: Challenges, Solutions, and Technologies," Pearson Education, 2nd Edition, 2020.
3. David J. Skyrme "Knowledge Management: Making Knowledge Work," Butterworth-Heinemann, 5th Edition, 2020.
4. Debra Z. Lacity and Leslie P. Willcocks "Robotic Process Automation and Cognitive Automation: The Next Phase," Wiley, 1st Edition, 2020. (While focusing on automation, this book integrates key principles of knowledge management.)
5. Hassan Karami "Managing Knowledge for Sustained Competitive Advantage," Pearson Education, 1st Edition, 2019.

Online Sources:

1. https://www.coursera.org/learn/knowledge-management, "Knowledge Management and Big Data in Business," University of California, San Diego, Coursera.
2. https://www.edx.org/course/knowledge-management-for-business-innovation, "Knowledge Management for Business Innovation," University of Colorado Boulder, edX.

Chairman
BoS / MBA

SUB. CODE	COURSE NAME	L	T	P	C
23MSE76	INDUSTRIAL MANAGEMENT	3	0	0	3

Course Objectives:

- To study the basic concepts of Knowledge Management (KM), its foundations, and the evolution from Information Management to Knowledge Management.
- To explore the creation of a culture of learning and knowledge sharing within organizations.
- To study the various tools and technologies that support Knowledge Management.
- To analyze the application of Knowledge Management in real-world organizational scenarios.
- To examine the future trends in Knowledge Management and develop a comprehensive KM strategy.

UNIT-I **INTRODUCTION TO MANAGEMENT** **9**

Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.

UNIT-II **FUNCTIONS OF MANAGEMENT - I** **9**

Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and
Design.

UNIT-III **FUNCTIONS OF MANAGEMENT - II** **9**

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) –Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications

UNIT-IV **ORGANIZATION THEORY** **9**

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory – Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict

UNIT-V **PRODUCTIVITY AND MODERN TOPICS** **9**

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).

Total Hours **45**

Chairman
BoS / MBA

COURSE OUTCOME

CO's	OUTCOME
CO1	Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
CO2	Discuss the planning; organizing and staffing functions of management in professional organization
CO3	Apply the leading; controlling and decision making functions of management in professional organization
CO4	Discuss the organizational theory in professional organization
CO5	Apply principles of productivity and modern concepts in management in professional organization

CO, PO & PSO MAPPING

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	1	-	-	-	-	3	2	3	2	2	1	1	-	-
2	1	-	-	1	1	-	-	-	-	3	1	2	-	-
3	1	1	1	1	1	3	2	-	-	3	-	1	1	1
4	1	-	-	1	1	3	2	3	2	3	-	-	-	1
5	1	-	-	1	1	-	-	3	2	-	1	1	1	2
AVg.	1	1	1	0.8	0.8	1.8	1.2	1.8	1.2	2.2	0.6	1	0.4	0.8

TEXTBOOKS:

1. O.P. Khanna "Industrial Engineering and Management," Dhanpat Rai & Co., 2nd Edition, 2020.
2. Ravi Shankar "Industrial Management: Concepts, Techniques, and Applications," Prentice Hall, 3rd Edition, 2020.
3. Martand Telsang "Industrial Engineering and Production Management," S. Chand Publishing, 5th Edition, 2020.
4. J.P. Gupta and N. R. Jain "Industrial Engineering and Management," Khanna Publishers, 8th Edition, 2019.
5. A. K. Gupta and P. N. Sinha "Industrial Management," Tata McGraw-Hill Education, 1st Edition, 2019.

Online Sources:

1. https://www.edx.org/course/industrial-engineering-and-management, "Industrial Engineering and Management," Purdue University, edX.
2. http://nptel.ac.in/courses/110105097, "Industrial Management," Prof. P. S. A. P. S. Muthu, Indian Institute of Technology, Madras.

Chairman
BoS / MBA

23BME11	BIOMATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn characteristics and classification of biomaterials.
- To understand different metals and its characteristics as biomaterials.
- To learn polymeric materials and its combinations that could be used as a tissue replacement implants.
- To get familiarized with the concepts of Tissue grafting and Technology.
- To understand the concept of biocompatibility and the methods for biomaterials testing.

UNIT-I STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY 9

Definition and classification of bio-materials, mechanical properties, viscoelasticity, wound healing process, body response to implants, blood compatibility, HLA compatibility.

UNIT-II METALLIC BIOMATERIALS 9

Stainless steel, cobalt chromium alloys, titanium based alloys, nitinol, other metals, metallic corrosion, biological tolerance of implant metals, manufacturing of implants, dental materials.

UNIT-III SYNTHETIC AND BIOPOLYMERS 9

Polymers in biomedical use, biodegradable synthetic polymers, silicone rubber, plasma polymerization, microorganism in polymeric implants, bio polymers, polymer sterilization.

UNIT-IV TISSUE REPLACEMENT IMPLANTS 9

Small intestinal submucosa and other decellularized matrix biomaterials for tissue repair. Soft tissue replacements, types of transplant by stem cell, sutures, surgical tapes, Tissue adhesive/glue. Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, point replacements.

UNIT-V TESTING OF BIO MATERIALS 9

Biocompatibility, blood compatibility and tissue compatibility tests, Toxicity tests, sensitization, carcinogenicity, mutagenicity and special tests, Invitro and Invivo testing; Sterilisation of implants and devices: ETO, gamma radiation, autoclaving. Effects of sterilization.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Analyze different types of Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use.

CO2: Identify significant gap required to overcome challenges and further development in metallic and ceramic materials.

CO3: Identify significant gap required to overcome challenges and further development in polymeric materials

CO4: Create combinations of materials that could be used as a tissue replacement implant.

CO5: Understand the testing standards applied for biomaterials.

TEXT BOOKS:

1. William R Wagner (Editor), Shelly E. Sakiyama-Elbert (Editor), Guigen Zhang (Editor), Biomaterials Science: An Introduction to Materials in Medicine, 4th Edition, Academic Press,2020.
2. Richard J. Miron (Editor), M.D. Zhang, Yufeng, Next-Generation Biomaterials for Bone & Periodontal Regeneration, 1st Edition, Quintessence Pub Co,2019.
3. Biomaterials- Basic Theory with Engineering Applications C.Mauli Agarwal, Joo L.Ong, Mark R. Appleford, Gopinath Mani. Cambrige University Press, New York- 2016.

REFERENCE BOOKS:

1. Paul Ducheyne (Editor), Kevin Healy (Editor), Dietmar W. Hutmacher, Comprehensive Biomaterials II,2nd Edition, Elsevier,2017.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/102/106/102106057/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	1	-	-	-
CO2	3	3	1	1	1	-	-	-	-	-	1	1	-	-
CO3	3	3	1	1	1	-	-	-	-	-	1	1	-	-
CO4	3	3	1	1	1	-	-	-	-	-	1	1	-	-
CO5	3	3	1	1	1	-	-	-	-	-	1	-	1	-
AVG	3	3	1	1	1	-	-	-	-	-	1	1	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME12	ARTIFICIAL ORGANS AND IMPLANTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To have an overview of artificial organs & transplants.
- To describe the principles of Implant design and clinical problems.
- To study about soft tissue replacement and hard tissue replacement.
- To study about various blood interfacing implants.
- To explain about implantable medical devices and organs.

UNIT-I ARTIFICIAL ORGANS & TRANSPLANTS 9

ARTIFICIAL ORGANS: Introduction, outlook for organ replacements, design consideration, evaluation process. TRANSPLANTS: Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea.

UNIT-II PRINCIPLES OF IMPLANT DESIGN 9

Principles of implant design, Clinical problems requiring implants for solution, Permanent versus absorbable devices, the missing organ and its replacement, Tissue engineering, scaffolds, cells and regulators criteria for materials selection.

UNIT-III HARD AND SOFT TISSUE REPLACEMENT 9

Dental implants - Fracture plates - Joint and Spinal replacement - Artificial skin: Current treatment for skin loss, Design principles for skin replacement - Ear and Eye implants.

UNIT-IV BLOOD INTERFACING IMPLANTS 9

Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood.

UNIT-V IMPLANTABLE MEDICAL DEVICES AND ORGANS 9

Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation, recent advancement and future directions.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Gain adequate knowledge about artificial organs & transplants.
- **CO2:** Get clear idea about implant design and its parameters and solution.
- **CO3:** Explain different types of hard tissue replacement and soft tissue replacement.
- **CO4:** Have in-depth knowledge about blood interfacing implants.
- **CO5:** Adequate knowledge about Implantable medical devices and organs.

Chairman
BoS/BME

TEXT BOOKS:

1. Prof Philip M. Parker Ph.D,The 2025-2030 World Outlook for Artificial Organs and Bionic Implants , Third Edition, ICON Group International, Inc,2024.
2. Prof Philip M. Parker Ph.D,The 2023-2028 World Outlook for Artificial Organs and Bionic Implants , Second, ICON Group International, Inc,2022.
3. Prof Philip M. Parker Ph.D,The 2021-2026 World Outlook for Artificial Organs and Bionic Implants , First Edition, ICON Group International, Inc,2022.

REFERENCE BOOKS:

1. Bernhard O. Palsson and Sangeeta N.Bhatia, *Tissue Engineering*, Pearson Education, First Edition, 2003.
2. John Enderle and Joseph Bronzino, *Introduction to Biomedical Engineering*, Academic Press, Fourth Edition, 2020.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/112/105/112105305/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	-	-	1	-	-	-
CO2	3	3	1	1	-	-	-	-	-	-	1	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	1	1	-	1
CO4	3	3	1	1	-	-	-	-	-	-	1	1	-	1
CO5	3	3	1	1	1	-	-	-	-	-	1	1	-	1
AVG	3	3	1	1	1	-	-	-	-	-	1	1	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME13	REHABILITATION ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To explain the need and scope of medical aids and rehabilitation services.
- To provide an understanding of sensory augmentation and substitution systems.
- To introduce the principles and applications of orthopaedic prosthetics and orthotics.
- To explore the role of virtual reality and robotic technologies in rehabilitation.
- To develop awareness of rehabilitation medicine and advocacy for people with disabilities.

UNIT-I INTRODUCTION TO REHABILITATION 9

Definition - Impairments, disabilities and handicaps, Primary and secondary disabilities, Activities of daily living, Appropriate Technology, Residual function. Rehabilitation. Rehabilitation team – members and their functions. Rehabilitation care –Need for proper delivery of rehabilitation care, Community based rehabilitation and its aspects.

UNIT-II ENGINEERING CONCEPTS IN SENSORY AUGMENTATION AND SUBSTITUTION 9

Sensory augmentation and substitution- Visual system: Visual augmentation, Tactual vision substitution, and Auditory vision substitution. Auditory system- Auditory augmentation, Hearing aids, cochlear implants, visual auditory substitution, tactual auditory substitution. Tactual system - Tactual augmentation, Tactual substitution

UNIT-III ORTHOPEDIC PROSTHETICS AND ORTHOTICS 9

Engineering concepts in motor rehabilitation, Artificial limbs- body powered, externally powered and controlled orthotics and prosthetics, Myoelectric hand and arm prosthetics. Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

UNIT-IV VIRTUAL REALITY 9

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 REHABILITATION MEDICINE AND ADVOCACY 9

Model of a spread spectrum digital communication system, direct sequence spread spectrum, effect of de-spreading on a narrowband interference, generation of PN sequence, frequency hopped spread spectrum

TOTAL : 45 PERIODS

Chairman
BoS/BME

At the end of the course, the students will be able to

C01 Understand the types of impairments, disabilities, rehabilitation care models, and the role of the rehabilitation team.

C02 Apply sensory rehabilitation techniques and systems for visual, auditory, and tactual augmentation and substitution.

C03 Examine various prosthetic and orthotic devices and evaluate their application in motor rehabilitation.

C04 Analyze the use of virtual reality and robotics in physical and mobility rehabilitation.

C05 Evaluate the key aspects of rehabilitation medicine, community-based care, and advocacy for disability rights.

TEXT BOOKS:

1. Christopher M. Hayre , Dave J. Muller , Marcia J. Scherer , Virtual Reality in Health and Rehabilitation, CRC Press, 2023.
2. Joseph D Bronzino, "The Biomedical Engineering Handbook". 2nd edition, CRC Press, 2000.
3. Robinson C.J, "Rehabilitation Engineering", CRC Press, 2006.

REFERENCE BOOKS:

1. Sashi S Kommu, "Rehabilitation Robotics", 1st edition, CRC Press, 2007.
2. Sunder, "Textbooks of Rehabilitation", Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi, 2nd Edition, Reprint 2007.
3. Horia- Nocholai Teodorecu, L.C.Jain, "Intelligent systems and technologies in rehabilitation Engineering", CRC; December 2000.
4. Etienne Grandjean, Harold Oldroyd, "Fitting the task to the man", Taylor & Francis, 1988.

E-RESOURCES:

1. https://nptel.ac.in/courses/105105213/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1	1	-	-	-	-	1	-	3
CO2	3	1	1	-	-	1	1	-	-	-	-	1	-	3
CO3	3	1	1	-	-	1	1	-	-	-	-	1	-	3
CO4	3	1	1	-	-	1	1	-	-	-	-	1	1	3
CO5	3	1	1	-	-	1	1	-	-	-	-	1	1	3
AVG	3	1	1	-	-	1	1	-	-	-	-	1	1	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME14	NEURAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To be familiar with the nervous system development.
- To understand about Brain and Spinal Cord.
- To be exposed to Neuronal diseases and disorders.
- To aquire knowledge about Neurophysiology and Neuro Radiology.
- To be familiar with nerve reconstruction and repairing.

UNIT-I BASICS OF NEURON STRUCTURE AND FUNCTIONS 9

Nervous system development. Trophic factors, extra cellular matrix components in nervous system development. Neuron: structure – function – classification. Glial cells – myelination. Neurotransmitter – types and functions. Synapses - Transport of materials and impulse in neurons.

UNIT-II BRAIN, BRAIN STEM AND SPINAL CORD 9

Brain: structures – lobes – functional areas. Brain stem: structures – functional areas. Spinal cord: structure – functions. Concepts of nuclei – sensory and motor Tracts - Reticular formation. Blood supply to Brain and spinal cord.

UNIT-III NEUROLOGICAL DISORDERS 9

Pathogenesis, Genetic basis of neurological disorders, Psychiatric Disorders: Psychiatric epidemiology, Unipolar depression, Bipolar depression, Seasonal affective disorder, Panic disorder, Autism, Stroke, Huntington disease.

UNIT-IV NEUROPHYSIOLOGY & NEURORADIOLOGY 9

Physiology of nerve conduction. Peripheral nerves – structure & Functions. Synaptic transmission and cellular signaling of Neurons. Electrical activity of the Brain and recording of brain waves. Evoked potentials. Visualization of nervous system. Neuromotor-machine interface: human voluntary motor control system.

UNIT-V NERVE RECONSTRUCTION AND REHABILITATION 9

Neural plasticity; Neurological dysfunctions - Regeneration of the peripheral nervous system. Neural tissue engineering; Nerve graft; Drug delivery system in CNS. Rehabilitation: Mechanisms for Neuromotor rehabilitation; Robotics and virtual reality in physical therapy; Transcranial magnetic stimulation.

TOTAL : 45 PERIODS

Chai..
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Explain the basic structure and functions of human nervous system.

CO2: Learn about Brain, Brain stem and Spinal cord.

CO3: Understand diseases and degeneration related to nervous system.

CO4: Analyze physiological and radiological assessment of nervous system.

CO5: Apply neural tissue engineering for rehabilitation.

TEXT BOOKS:

1. Stephanie Willerth, Handbook of Neural Engineering: A Modern Approach, 2nd edition, Academic Press,2024.
2. Bin He, Neural Engineering 3rd Edition, Springer, 2020.

REFERENCE BOOKS:

Nancy Arana-Daniel , Alma Y. Alanis , Carlos Lopez-Franco, Neural Networks for Robotics: An Engineering Perspective, 1st Edition, CRC Press,2020.

E-RESOURCES:

1.https://archive.nptel.ac.in/courses/117/108/117108148/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO3	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO4	3	2	3	1	-	-	-	-	-	-	1	1	-	1
CO5	3	2	3	1	-	-	-	-	-	-	1	1	-	1
AVG	3	2	3	1	-	-	-	-	-	-	1	1	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME15	PRINCIPLES OF TISSUE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study the Cell types and differentiation.
- To learn about Fundamentals of Tissue Engineering.
- To study basics about stem cells and its applications.
- To understand the methods and design involved in tissue engineering.
- To aquire knowledge about applications of Tissue engineering.

UNIT-I INTRODUCTION TO CELL BIOLOGY 9

Cell types - Progenitor cells - Cell growth and differentiation - Cell culture: Expansion - Transfer - Storage and Characterization - Cell signalling molecules - Growth factors - Cell attachment: Differential cell adhesion, Receptor-ligand binding - Cell surface markers.

UNIT-II FUNDAMENTALS OF TISSUE ENGINEERING 9

History and scope of tissue engineering - Tissue organization - Tissue types: Epithelial, Connective - Vascularity and angiogenesis - Wound healing - Extra Cellular Matrix: Matrix molecules and their ligands - Tissue culture – Materials in tissue engineering.

UNIT-III STEM CELLS 9

History and scope of tissue engineering - Tissue organization - Tissue types: Epithelial, Connective - Vascularity and angiogenesis - Wound healing - Extra Cellular Matrix: Matrix molecules and their ligands - Tissue culture – Materials in tissue engineering.

UNIT-IV ENGINEERING METHODS AND DESIGN 9

Soft lithography - Self-assembled monolayer, Micro contact printing, Micro fluidic patterning - Laminar flow patterning - Cell interaction with Polymer scaffolds and gels - Polymer scaffolds fabrications: Electro spinning - Solvent casting and particulate leaching - Micro fabrication of cell seeded scaffolds.

UNIT-V APPLICATION OF TISSUE ENGINEERING 9

Replacement Engineering: Bone, cartilage, skin, blood, pancreas, kidney, heart valve and liver - Regenerative engineering: Peripheral Nerve regeneration, Cardiac tissue regeneration, Muscle regeneration – Regulation, Commercialization and Patenting.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the basic concepts of Cells.
CO2: Acquire knowledge about Tissue Engineering.
CO3: Apply the knowledge of professional and ethical responsibility in use of stem cells and gene therapy in creating tissue engineered therapies
CO4: Design and develop different biomaterial in tissue engineering.
CO5: Gain knowledge in research or clinical application on tissue repair/ engineering

TEXT BOOKS:

1. Robert P lanza, Robert Langer, Joseph Vacanti, "Principles of Tissue Engineering", Academic Press, United States, 2020.
2. Donglu Shi, Qing Liu, "Tissue Engineering and Nanotheranostics", World Scientific Publications, Singapore, 2018.

REFERENCE BOOKS:

1. Robert Lanza , Robert Langer , Joseph P. Vacanti , Anthony Atala, Principles of Tissue Engineering, 5th Edition, Academic Press,2020.
2. R. Lanza, Anthony Atala (Eds), "Essential of Stem Cell Biology", Academic Press, USA, 2013.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/102/106/102106081/

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO3	3	2	3	1	-	-	1	1	-	-	1	-	-	-
CO4	3	2	3	1	-	-	1	1	-	-	1	3	-	1
CO5	3	2	3	1	-	-	-	-	-	-	1	3	-	1
AVG	3	2	3	1	-	-	-	-	-	-	1	3	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME16	GENETIC ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understanding the basic concept of rDNA technology.
- To gain knowledge about libraries of DNA.
- To discuss the gene cloning methods, tools and techniques involved in genomics.
- To learn about organization and structure of Genomes.
- To explain the approaches in advanced Genetic engineering.

UNIT-I BASICS OF RECOMBINANT DNA TECHNOLOGY **9**

Manipulation of DNA – Restriction and Modification enzymes - Design of linkers and adaptors - Characteristics of cloning and expression vectors - Introduction of recombinant DNA in to host cells and selection methods.

UNIT-II DNA LIBRARIES **9**

Construction of genomic and cDNA libraries, Artificial chromosomes – Bacteria, Yeast - Chromosomal walking.

UNIT-III SEQUENCING AND AMPLIFICATION OF DNA **9**

Maxam Gilbert's and Sanger's methods of DNA sequencing – PCR: Inverse PCR, Nested PCR, Allele specific PCR, Hot start PCR, Colony PCR, single cell PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beacons. Site directed mutagenesis.

UNIT-IV ORGANIZATION AND STRUCTURE OF GENOMES **9**

Organization and structure of genomes - Genome sequencing methods: Conventional and shotgun genome sequencing methods, Next generation sequencing technologies - Ordering the genome sequence - Genetic maps and Physical maps, STS content based mapping, Hybridization mapping, Optical mapping.

UNIT-V ADVANCED APPROACHES IN GENETIC ENGINEERING **9**

Gene expression in prokaryotes & eukaryotes, Tissue specific promoter, promoter analysis (EMSA and DNA foot printing), gene expression profiling (real time PCR, SAGE, differential display, Microarray); DNA sequencing methods; Molecular markers: RAPD, RFLP, AFLP, SNP; Site directed mutagenesis, gene silencing techniques.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Would be aware of rDNA technology.
CO2: Know the access of DNA library.
CO3: Will be familiarized with gene and genome sequencing techniques.
CO4: Gain knowledge about gene mapping, Analysis of Gene expression and proteomics.
CO5: Acquire ability to work on various advanced techniques in genetic engineering.

TEXT BOOKS:

1. Desmond S. T. Nicholl, "An Introduction to Genetic Engineering, 4th Edition", Cambridge University Press, 2023.
2. Jamie Metzl, Hacking Darwin: Genetic Engineering and the Future of Humanity, First Edition, Sourcebooks; Illustrated edition,2020.

REFERENCE BOOKS:

1. Oksana Ableitner, "Introduction to Molecular Biology: Working with DNA and RNA (essentials)", Springer International, 2022.
2. Arun K. Shukla, "Proteomics in Biology", Academic Press, 2017.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/102/103/102103013/

CO's – PO's & PSO's MAPPING

CO/PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO3	3	2	3	1	-	-	-	-	-	-	1	1	-	1
CO4	3	2	3	1	-	-	-	-	-	-	1	1	-	1
CO5	3	2	3	1	-	-	-	-	-	-	1	1	-	1
AVG	3	2	3	1	-	-	-	-	-	-	1	1	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME17	NUCLEAR MEDICINE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of physics used in nuclear medicine.
- To understand the construction and principle of operation of various nuclear medicine instruments.
- To study the diagnostic applications of nuclear medicine.
- To study the therapeutic applications of nuclear medicine.
- To analyze radiation safety procedures and regulations.

UNIT-I BASICS OF NUCLEAR MEDICINE 9

Radioactivity and Interaction of Radiation; Alpha, Beta and Gamma Emission, Laws of Radioactive Decay, Mechanisms of Radioactive Delay, Radiation Intensity and Exposure, Decay Schemes and Energy Levels.

UNIT-II NUCLEAR MEDICINE INSTRUMENTATION 9

Construction and Principle Operation of Gamma Camera, Rectilinear Scanner, Basic Principles of Pulse Height Analyzer, Radiation Detectors - Ionization Chamber, Geiger Muller Counter, Semiconductor Detectors, Scintillation Detectors.

UNIT-III DIAGNOSTIC APPLICATIONS OF RADIONUCLIDE 9

PET-CT, Single Photon Emission Computed Tomography (SPECT), Radio Iodine Therapy for Thyrotoxicosis, Differentiated Thyroid Cancers, Palliative Treatment for Bone Metastasis - 32P and 89 Strontium Dosage.

UNIT-IV THERAPEUTIC APPLICATIONS OF RADIONUCLIDE 9

Intravascular Particulate Radio Nuclide Therapy, Receptor Targeted Therapy, 131I- MIBG Therapy, Targeted Internal Radiation in HCC: 90 Y, Radio - Synovectomy using Yttrium.

UNIT-V RADIATION SAFETY 9

Radiation Protection in Different Nuclear Isotope Therapy Procedures, Management of Radiation Accidents, Radiation Effect on Pregnancy and Fertility, Diagnosis, Evaluation and Treatment of Radiation Overexposure, Handling of Radioactive Patients, Role of NIB in Radiation Safety, ICRP Recommendations, BARC Regulations Regarding Limits of Radiation Exposure

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

The students will be able to

CO1: Illustrate the principles and mechanisms of radioactivity and radiation interaction in nuclear medicine.

CO2: Interpret nuclear medicine instrumentation effectively, including gamma cameras, radiation detectors and electronic systems.

CO3: Apply diagnostic techniques using radionuclides to diagnose and treat medical conditions.

CO4: Analyze information, identify key issues and propose effective solutions in therapeutic applications of radionuclide.

CO5: Evaluate and implement radiation safety protocols and ethical standards in the use of radioactive materials in healthcare environments.

TEXT BOOKS:

1. Fred A Mettler and Milton J Guiberteau, "Essentials of Nuclear Medicine and Molecular Imaging", 7th Edition, Elsevier, 2018.
2. Essential Nuclear Medicine Physics, Rachel A Powsner and Edward R Powsner, 3rd Edition, Blackwell publishing, 2013.

REFERENCE BOOKS:

1. Max. H. Lombardi, "Radiation Safety in Nuclear Medicine", 2nd Edition, CRC Press, Florida, USA, 2006.
2. Harvey Ziessman, Janis O Malley and James Thrall, "Nuclear Medicine", 4th Edition, Elsevier, 2013.
3. Pete Shackett, "Nuclear Medicine Technology", 2nd Edition, Lipkott William Wilkkins, USA, 2009.
4. Jennifer Prekeges, "Nuclear Medicine Instrumentation", 2nd Revised Edition, John and Barelett Publishers, Inc USA, 2012.

CO's – PO's & PSO's MAPPING

CO/ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	2	2	-	-	-	-	-	-	-	2	-	-
CO4	-	2	-	-	2	-	3	-	-	-	-	-	-	2
CO5	-	-	-	-	-	3	-	-	2	-	-	-	-	-
AVG	3	2	2	2	2	3	3	-	2	-	-	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME18	GENOMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To describe modern sequencing technologies.
- To apply principles of structural genomics to construct chromosome maps.
- To evaluate the ethical implications of genome sequencing projects.
- To apply functional genomics techniques to study gene interactions.
- To assess the role of genomics in predicting disease in pre-symptomatic individuals.

UNIT-I **INTRODUCTION** 9

Introduction, Genomics, Sequencing Technologies: Polymerase Chain Reaction (PCR), Sanger Sequencing, High-Throughput Sequencing Technologies, Illumina, Ion Torrent, PacBio, Microrna, Nanopore.

UNIT-II **STRUCTURAL GENOMICS** 9

Eukaryotic Organelle Genomes (human and other organisms); Assigning Loci to Specific Chromosome; High Resolution Chromosome Mapping; Markers for Mapping (RFLP, Single Nucleotide Polymorphism, Microsatellite Markers, Copy Number Variation, Methods for Detection of Markers), Physical Mapping of Genome; Linkage Mapping.

UNIT-III **GENOME SEQUENCING** 9

Whole Genome Shotgun Sequencing; Introduction to Various Databases, Genome Browsers & Associated Tools: ENSEMBL, Genecards, UCSC Genome Browser, Galaxy and their Application; Overview: HGP, Hapmap Project, 1000 Genome Projects, Expressed Sequence Tag (EST) Project; Ethical, Legal and Social Implications Addressed by HGP; Concept of Epigenomics, , Long Non-Coding RNA; Concept of 3D Genome.

UNIT-IV **FUNCTIONAL GENOMICS** 9

SAGE, Characterize The Proteome by ORF Analysis, Study of Developmental Regulation by Using DNA Chips, Biomedical Genomics: Introduction to NGS-Based Targeted Re-Sequencing; Single Cell Sequencing; Experimental Design: WES, Transcriptome, WGBS, Chip-Seq; Concept of Metabolomics; Identification of Human Biomarkers using Genomics; Concept of (GWAS).

UNIT-V **IMPACTS OF GENOMICS IN HEALTHCARE** 9

Screening for Genomic Disorders: Newborn Screening, Preconception Carrier Screening; Genomics of Cardiovascular Disease and Cancer; Concept of Pharmacogenomics; Concept of Genetic Counseling; Predicting Disease in Healthy (Pre-Symptomatic) People and its Ethical Concern.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Apply genomic sequencing technologies and tools to analyze and interpret genomic data.

CO2: Analyze the importance and necessities to map chromosomes and organize genomic data.

CO3: Evaluate major genome sequencing projects and their impacts.

CO4: Assess methods for genomic screening and molecular markers to help treat genetic disorders.

CO5: Explain advancements and ethical considerations in impact of genomic screening.

TEXT BOOKS:

1. Primrose SB and R. Twyman "Principles Of Gene Manipulation &Geneomics Blackwell Science Publications, 7th edition 2013.
2. Principles of Genome Analysis and Genomics by S.B.Primrose and R.M.Twyman, Third Edition (Blackwell Publishing), 2009.

REFERENCE BOOKS:

1. Ansubel FM, Brent R, Kingston RE, Moore DD, "Current Protocols In Molecular Biology", Greene Publishing Associates, NY, 2008.
2. Berger Sl, Kimmer AR, "Methods In Enzymology", Vol 478, Academic Press, 2011.
3. Genomes 3 by T. A. Brown, Third Edition (Garland Science Publishing), 2007.

CO's – PO's & PSO's MAPPING

CO/ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	1	-	2	2
CO3	-	-	-	3	-	-	-	-	-	-	1	-	-	-
CO4	-	-	2	3	-	-	-	-	-	-	1	2	-	-
CO5	-	-	-	-	-	-	-	3	3	-	3	-	-	-
AVG	3	3	2	3	-	-	-	3	3	-	3	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME21	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of global trends and development methodologies
- To conceptualize, prototype develop product management plan and system design.
- To understand requirement engineering and know how to collect, analyze design specification
- To understand system modeling for system, End of Life support.
- To develop business development for industries.

UNIT-I FUNDAMENTALS OF PRODUCT DEVELOPMENT **9**

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development.

UNIT-II REQUIREMENTS AND SYSTEM DESIGN **9**

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT-III DESIGN AND TESTING **9**

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines – Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems

UNIT-IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT **9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation-Sustenance.

UNIT-V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY **9**

The Industry - Engineering Services Industry - Product Development in Industry versus Academia – The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Formulate Global trends and design methodologies.

CO2: Analyze the specific problems for system design.

CO3: Gain knowledge of the Innovation & Product Development process and design testing.

CO4: Design and develop Work independently as well as in teams and EOL support.

CO5: Analyze the project for business development and industry.

TEXT BOOKS:

1. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2020.
2. Clive L. Dym, Patrick Little, Elizabeth Orwin, Richard E. Frey, "Engineering Design: A Project-Based Introduction", 5th Edition, 2015

REFERENCE BOOKS:

1. Hiriyappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2014.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning –Concepts", Second Edition, Prentice Hall, 2013.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/106/105/106105034/# ,"Foundational Skills in Integrated Product Developmemt".

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	2	-	1	-	1	1	2	-
CO2	3	2	1	1	1	-	2	-	1	-	1	1	2	-
CO3	3	2	1	1	1	-	2	-	1	-	1	1	2	-
CO4	3	2	1	1	1	-	2	-	1	-	1	1	2	-
CO5	3	2	1	1	1	-	2	-	1	-	1	1	2	-
AVG	3	2	1	1	1	-	2	-	1	-	1	1	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME22	MEDICAL DEVICE DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the basic steps of designing a medical device.
- To explore the different techniques in design process.
- To illustrate ideas and concepts.
- To Getting expertise on Evaluation and Supply chain
- To interpret the challenges in post market surveillance.

UNIT-I INTRODUCTION TO MEDICAL DEVICES **9**

Medical Devices-Design Life Cycle-Medical Design Classification-Rules and Modals-EU Classification-USA Classification-case study on classification.

UNIT-II DESIGN PROCESS **9**

Design Process versus Design Control-Design Models-Pahl and Beitz, and Pugh model-Divergent-Convergent Model-Audit/ Review Procedure-Design Process-Product Design Specification-Finding, Extracting and Analyzing the Content.

UNIT-III IDEAS AND CONCEPTS **9**

Creative Space-Generating Concepts/ Ideas-Selecting Concepts and Ideas-Quality in Design-Design of Experiments/2k Factorial Experiments-Failure Mode Effect Analysis-Computer Aided Design-D4X-Design for Usability.

UNIT-IV EVALUATION AND SUPPLY CHAIN **9**

Evaluation-Risk Analysis-Criteria Based Evaluation-Computer Based Evaluation-Clinical Studies and Clinical Trials-Identifying Potential Suppliers-Packaging-Procurement-Labelling and Marking.

UNIT-V POST MARKET SURVEILLANCE **9**

PMS and Its Role in Design-Protecting Your IP-Types-Regulatory Approval to Market – Class I Devices-FDA Process-EC process-Unique Selling Points-Key Opinion Leaders-Insurance.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Infer the basic procedure of Medical device design.
CO2: Classify the various stages of design process
CO3: Illustrate ideas and concepts in device designing.
CO4: Interpret the process for validation and verification of medical devices.
CO5: Identify the challenges after post market survey of product.

Chairman
BoS/BME

TEXT BOOKS:

1. Peter J.Ogrodnik ,"Medical Device Design",Academic press,Elseiver,2nd Edition,2020.
2. DeMarco, Carl T.,,"Medical Device Design and Regulation ", American Society for Quality ASQ1st edition 2011.

REFERENCE BOOKS:

1. Vikki Hazelwood, Foundations and Strategies for Medical Device Design, edition 2021.
2. J.Paulo Davim, "The Design and manufacture of medical devices, 1st edition, 2012.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/106/103/106103116

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	2	-	1	-	1	3	2	-
CO2	3	2	1	1	1	-	2	-	1	-	1	3	3	-
CO3	3	2	1	1	1	-	2	-	1	-	1	3	3	1
CO4	3	2	1	1	1	-	2	-	1	-	1	3	2	1
CO5	3	2	1	1	1	-	2	-	1	-	1	3	1	1
AVG	3	2	1	1	1	-	2	-	1	-	1	3	2.2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME23	PATIENT SAFETY, STANDARDS AND ETHICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the importance of patient safety against electrical hazards
- To explain the patient safety laws and regulations
- To understand the standards and testing of patient
- To know the patient safety specialities in clinical
- To know about the health care organization.

UNIT-I EFFECTS OF ELECTRICITY **9**

Physiological effects of electricity - important susceptibility parameters - microshock - macroshock hazards -patients electrical environment - isolated power system - conductive surfaces.

UNIT-II PATIENT SAFETY LAWS AND REGULATIONS **9**

Mandatory Reporting systems. Anatomy of a patient safety Law: Compliance Tips, Federal patient safety Legislation Initiatives, Medical Device Reporting, Clinical trials and Adverse-Event Reporting, Patient safety Goals and standards, The Quality Assessment and performance Improvement rule.

UNIT-III STANDARDS AND TESTING **9**

Guidelines and safety practices to improve patient safety, Electrical safety codes and standards - IEC 60601-1 2005 standard, Basic Approaches to protection against shock, protection equipment design, Electrical safety analyser - Testing the electric system.

UNIT-IV PATIENT SAFETY IN MAIN CLINICAL SPECIALITIES **9**

Intensive care and Anesthesiology, safety surgery save lives, Emergency department clinical risk, Obstetric safety patient, Patient safety in internal medicine, Patient safety in Radiology.

UNIT-V MEDICAL ETHICS **9**

Definition of Medical ethics, Scope of ethics in medicine, American medical Association code of ethics, CMA code of ethics- Fundamental Responsibilities, The Doctor and The Patient, The Doctor and The Profession, Professional Independence, The Doctor And Society, Case Studies.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Outline the importance of patient safety against electrical hazards.

CO2: Brief out the patient safety laws and regulations.

CO3: Explain the standards and testing of patient

CO4: Understand the concept of the patient safety specialities in clinical

CO5: Know about various healthcare organization

TEXT BOOKS:

1. John G.Webster, "Medical Instrumentation Application and design", 5th edition, Wiley India PvtLtd, New Delhi, 2020.
2. Sukhmeet Panesar, Andrew Carson-Stevens, Sarah Salvilla, Aziz Sheikh, " Patient Safety and Healthcare Improvement at a Glance", Wiley-Blackwell, 1st Edition, 2021

REFERENCE BOOKS:

1. Gabriel I.H. Williams, "Medical Device Safety: The Regulation of Medical Devices for Public Health and Safety", Academic Press (Elsevier), 2nd Edition, 2022.
2. Fay A. Rozovsky, James R. Woods, Jr, " The Handbook of Patient Safety Compliance", 2016.

E-RESOURCES:

1. https://nptel.ac.in/courses/110105097, "Ethics in Engineering Practice",Dr. Susmita Mukhopadhyay

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	2	-	1	-	1	1	1	-
CO2	3	2	1	1	1	-	2	-	1	-	1	1	1	-
CO3	3	2	1	1	1	-	2	-	1	-	1	1	1	-
CO4	3	2	1	1	1	-	2	-	1	-	1	1	1	-
CO5	3	2	1	1	1	-	2	-	1	-	1	1	1	-
AVG	3	2	1	1	1	-	2	-	1	-	1	1	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME24	MEDICAL DEVICE REGULATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study the regulation of medical devices, process of development, ethical and quality considerations.
- To learn the various ISO standards of quality and risk management for regulatory purposes
- To explore the process of approval and marketing of medical devices.
- To comprehend the regulatory process for medical devices in India, US, and EU.
- To familiarize with clinical evaluation and investigation of medical devices.

UNIT-I MEDICAL DEVICE REGULATIONS **9**

History of medical device regulation, regulatory affairs professional's roles, required competencies, medical device classification: scope, definitions, main classifications, Risk based classification, practical examples, labeling of medical devices: definition, elements, risk management, clinical evaluation and labeling, language level and intended users.

UNIT-II ISO STANDARDS **9**

ISO 13485:2016: Requirements for regulatory purposes: Quality Management Systems, certification process. ISO 14971: Application of Risk management to medical Devices.

UNIT-III IEC, REGULATORY SYSTEMS IN USA & EU **9**

IEC international standards and conformity assessment for medical devices, Good submission process, medical device regulatory system in the USA and European Union.

UNIT-IV INDIAN REGULATORY SYSTEM **9**

India: Medical device regulatory system: market environment, functions undertaken by DGGI, central government, FDA and state governments, guidance documents, details of key regulators, IMDRF and CDSCO, regulatory overview in India, product registration on conformity assessment, quality system regulation.

UNIT-V CLINICAL TRIALS AND DIGITAL REGULATIONS **9**

The Industry - Engineering Services Industry - Product Development in Industry versus Academia – The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

CO1: Define and explain the basic concepts of medical device regulations.
CO2: Decipher the meaning of ISO standards from a regulatory.
CO3: Explain US-FDA, IEC and European regulations.
CO4: Discuss regulations in India.
CO5: Explain the regulatory aspects of clinical trials and digital alternatives.

TEXT BOOKS:

1. Susan Onel (Author), Karen M. Becker, Medical Devices Law and Regulation Answer Book, 1st Edition, Practising Law Institute,2022.
2. Medical Regulatory Affairs: An International Handbook for Medical Devices and Healthcare Products, 3rd Edition, Taylor & Francis Group, 2021.
3. Des O'Brien, Medical Device Regulations Roadmap: A Beginners Guide, CreateSpace Independent Publishing Platform, 2017.

REFERENCE BOOKS:

1. Elijah Wreh, Medical Device Regulation: FDA-CDRH Manufacturing, Policies and Regulation Handbook, Academic Press, 2023.
2. Various, Fundamentals of Medical Device Regulations, Third Edition, Regulatory Affairs Professionals Society (RAPS), 2020.

E-RESOURCES:

1. Regulatory requirements for medical devices including in vitro diagnostics in India (Version 2.0), IIT Madras, Prof. Arun B.Ramteke, Prof. Aseem Sahu, Prof. Malay Mitra. https://nptel.ac.in/courses/127106136
2. World Health Organization. (2003). Medical device regulations : global overview and guiding principles .World Health Organization. https://apps.who.int/iris/handle/10665/42744

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	2	-	1	-	1	1	1	-
CO2	3	2	1	1	1	-	2	-	1	-	1	1	-	-
CO3	3	2	1	1	1	-	2	-	1	-	1	1	1	1
CO4	3	2	1	1	1	-	2	-	1	-	1	1	-	1
CO5	3	2	1	1	1	-	2	-	1	-	1	1	-	1
AVG	3	2	1	1	1	-	2	-	1	-	1	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME25	MEDICAL INNOVATION AND ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn fundamentals of entrepreneurship
- To apply the methods of entrepreneurship in medical field.
- To learn new venture for Business Models.
- To evaluate the medical devices and market trends.
- To apply Marketing process for entrepreneurship.

UNIT-I CREATIVITY, INNOVATION AND IPR 9

The role of creativity – The innovation Process – Sources of New Ideas – Methods of Generating Ideas – Creative Problem Solving – Entrepreneurial Process. Patents – Copyright – Trademark-Geographical indications – Ethical and social responsibility and challenges.

UNIT-II SCOPE FOR BIOMEDICAL ENGINEERING ENTREPRENEURSHIP 9

Definition- Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs. Fundamentals and models, Advancements in biomedical field, Supporting societies and professional activities. Impact of innovation in medical devices. Case study.

UNIT-III NEW VENTURE 9

Developing an Effective Business Model: The Importance of a Business Model – Starting a small¬ scale industry - Components of an Effective Business Model. Assessing the venture, establish venture invention, market research, presenting the business plan. Forms of Business Organization: Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives, case study.

UNIT-IV FINANCING THE NEW VENTURE AND GLOBALIZATION 9

Evaluating Various options and future investments – Medical Device entrepreneurship incentives and subsidies – Determining Financial Needs – Sources of Financing: support for product development, funding agencies, collaborative initiatives, and angel investors. Impact of Globalization: Medical product manufacturing, marketing, leadership, quality management. Case studies.

UNIT-V MARKETING FUNCTION 9

Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process. Case study.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Describe the role of biomedical engineers in entrepreneurship
- **CO2:** Interpret the background for biomedical engineers in entrepreneurship
- **CO3:** Acquire the skills and techniques required towards innovation
- **CO4:** Categorize the resources and funding agencies and judge the right product based on market needs
- **CO5:** Compile and quantify the opportunities and challenges

TEXT BOOKS:

1. Bernadette Mazurek Melnyk PhD APRN-CNP FAANP FNAP FAAN, Tim Raderstorf DNP RN, Evidence-Based Leadership, Innovation, and Entrepreneurship in Nursing and Healthcare: A Practical Guide for Success, 2nd Edition, Springer Publishing Company,2024.
2. Robert D. Hisrich (Author), Claudine Kearney, Managing Innovation and Entrepreneurship, 1st Edition, SAGE Publications, Inc,2013.

REFERENCE BOOKS:

1. Brant Cooper, Patrick Vlaskovits, "The Lean Entrepreneur", Wiley, 2nd edition, New Jersy, 2016.
2. Nathan Furr, Jeff Dyer, "The Innovator's Method: Bringing the Lean Start-up into Your Organization", Harvard Business Press, Boston, 2014.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/110/107/110107094/ Innovation business models and entrepreneurship , Prof.Rajat Agarwal.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	2	-	1	-	1	1	-	1
CO2	3	2	1	1	1	-	2	-	1	-	1	1	-	1
CO3	3	2	1	1	1	-	2	-	1	-	1	1	-	1
CO4	3	2	1	1	1	-	2	-	1	-	1	1	-	1
CO5	3	2	1	1	1	-	2	-	1	-	1	1	-	1
AVG	3	2	1	1	1	-	2	-	1	-	1	1	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME26	RAPID PROTOTYPING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the need and fundamentals of rapid prototyping
- To understand the concepts of design and assembling of various parts
- To study the process of photo polymerization and powder bed fusion processes.
- To investigate the process of fused deposition moulding and sheet lamination
- To explore droplet formation and beam deposition process.

UNIT-I INTRODUCTION TO RAPID PROTOTYPING 9

Overview –Need -Development of Additive Manufacturing Technology -Principle – AM Process Chain-Classification –Rapid Prototyping-Rapid Tooling –Rapid Manufacturing – Applications-Benefits –Case studies.

UNIT-II DESIGN FOR ADDITIVE MANUFACTURING 9

Design tools: Data processing -CAD model preparation –Part orientation and support structure generation –Model slicing –Tool path generation-Design for Additive Manufacturing: Concepts and objectives-AM unique capabilities –DFAM for part quality improvement-Customised design and fabrication for medical applications.

UNIT-III PHOTO POLYMERIZATION AND POWDER BED FUSION PROCESSES 9

Photo polymerization: SLA-Photo curable materials –Process -Advantages and Applications. Powder Bed Fusion: SLS-Process description –powder fusion mechanism –Process Parameters – Typical Materials and Application. Electron Beam Melting.

UNIT-IV EXTRUSION BASED AND SHEET LAMINATION PROCESSES 9

Extrusion Based System: FDM-Introduction –Basic Principle –Materials –Applications and Limitations –Bio extrusion. Sheet Lamination Process: LOM-Gluing or Adhesive bonding – Thermal bonding.

UNIT-V PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES 9

Droplet formation technologies –Continuous mode –Drop on Demand mode –Three Dimensional Printing –Advantages –Bioplotter -Beam Deposition Process: LENS-Process description –Material delivery –Process parameters –Materials –Benefits –Applications.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

CO1: Demonstrate the basics of Rapid prototyping.
CO2: Design and assembling of various parts of CAD model.
CO3: Explain the process of photo polymerization and powder bed fusion processes.
CO4: Illustrate the process of fused deposition moulding and sheet lamination
CO5: Support droplet formation and beam deposition process.

TEXT BOOKS:

1. Matthew Smith, Andrew Peterson, The Rapid Prototyping Game ,1st Edition, CRC Press,2021.
2. Fuewen Frank Liou, Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Second Edition, CRC Press,2019.

REFERENCE BOOKS:

1. Kalpesh Kamble, A Textbook of Rapid Prototyping Technology, Kalpesh Sunil Kamble,2023.
2. M. Adithan, Rapid Prototyping 1st Edition, Atlantic Publishers and Distributors Pvt Ltd,2015.
3. Tom Page Design for Additive Manufacturing, LAP Lambert Academic Publishing, 2012.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/106/103/106103116

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	2	-	1	-	1	-	1	-
CO2	3	2	1	1	1	-	2	-	1	-	1	-	1	-
CO3	3	2	1	1	1	-	2	-	1	-	1	-	1	-
CO4	3	2	1	1	1	-	2	-	1	-	1	-	1	-
CO5	3	2	1	1	1	-	2	-	1	-	1	-	1	-
AVG	3	2	1	1	1	-	2	-	1	-	1	-	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME27	BIOMEDICAL DEVICE DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the design and development of biomedical products and processes
- To familiarize the processes to ensure quality, testing, and approval of biomedical product development.
- To Implement signal processing techniques required for product development.
- To analyze the parameters of medical device standards and regulations.
- To understand the design Software development process.

UNIT-I PRODUCT DESIGN **9**

Product Development process - Market Survey - Design lifecycle - Classification of medical Devices - Design process- Product specification - Design Evaluation - Risk Assessment - Product Life cycle - Design History File - Case studies: ECG System design.

UNIT-II PRODUCT DEVELOPMENT **9**

Process to Design Realization - Computer Aided Design - Rapid prototyping - 3D Visualization- Prototype Development - Risk Analysis and Management - Clinical Validation - Medical Device Calibration - Scalability – Commercialization - Case studies on development of ECG system.

UNIT-III SIGNAL PROCESSING **9**

Discrete Representation of Analog systems - Discrete Fourier Transform - Spectrum, Power spectral density function - Signal De noising using Filtering - Case studies on signal de noising.

UNIT-IV MEDICAL DEVICE STANDARDS AND REGULATIONS **9**

Medical Device Quality Management System - ISO 13485, Technical Standards for Medical Devices -Safety requirement of Medical Devices - Electromagnetic Compatibility test - IEC 60601-1 - IEC 60601-2, Medical Device Regulations - Medical Device Certification - Case studies on Medical Device Standards.

UNIT-V MEDICAL SOFTWARE **9**

Guidelines on Software design - Software development process - Standards for Medical Software- Risk management in Software - Cloud Computing Model - Case studies on Medical Software.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the design and development of biomedical products and processes at the systems level

CO2: Apply the processes to ensure quality, testing, and approval of biomedical products

CO3: Implement signal processing techniques required for product development.

Chairman
BoS/BME

CO4: Analyze the knowledge in medical device standards and regulations
CO5: Explain the knowledge in Software development process

TEXT BOOKS:

1. Ulrich, K.T., and Eppinger, S.D., "Product Design and Development", McGraw Hill, 7 th Edition,2020.
2. Peter J.Ogrodnik, "Medical Device Design Innovation from Concept to Market", Elsevier, Academic Press, 2019.

REFERENCE BOOKS:

1. Paul H. King, Richard C. Fries, Arthur T. Johnson, "Design of Biomedical Devices and Systems", CRC Press 4th Edition, 2021
2. Claudio Becchetti, Alessandro Neri, "Medical Instrument Design and Development from Requirements to Market Placements", Wiley, 2013.

E-RESOURCES:

NPTEL-Online Courses and Video lectures: https://nptel/courses/video/102108344

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	-	-	2	2	2	3	2	3
CO2	3	3	2	2	2	1	-	-	2	2	2	3	3	2
CO3	3	3	2	2	2	3	-	-	2	3	2	2	2	2
CO4	3	3	2	2	2	3	-	-	2	2	2	1	2	1
CO5	3	3	2	2	3	3	-	-	2	2	2	1	2	1
AVG	3	3	2	2	2.2	2.4	-	-	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME28	OPHTHALMOLOGY AND DENTISTRY EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To analyze Ophthalmic Instruments and OCT.
- To evaluate the techniques in ophthalmology.
- To investigate clinical practices under ophthalmology department.
- To understand the concepts of imaging technique of dentistry.
- To able to understand the instruments used for dental purposes.

UNIT-I OPHTHALMIC INSTRUMENTS **9**

Indirect Ophthalmoscope - Direct Ophthalmoscope- Slit Lamp: Haag-Streit - Photo-slit lamp Lensometer Lens gauge - Tonometer - Fundus Camera - External eye photography - Auto-refractometer – Haploscope, Perimetry - Principles of OCT.

UNIT-II OPHTHALMIC TECHNIQUE **9**

Head posture and its significance - Specular Microscopy- Squint - Keterometer - Retinoscope Exophthalmometer - Dark adaptometer - Paediatric Refraction - eye bank specular - Rehabilitation of the visually handicapped.

UNIT-III CLINICAL OPHTHALMOLOGY **9**

Congenital Glaucoma - Scleral Buckling- Paralytic Squint- Retinal Hole – Occuloplasty - Refractive Surgery – Keratitis - Non-proliferative Diabetic Retinopathy treatment - RelexSmile Surgery- Enucleation – Evisceration.

UNIT-IV DENTAL RADIOGRAPHY **9**

Foundation of radiography - Discovery of X-radiation - Radiation physics - The Dental x-ray machine - Dental chair system - Lighting system - Trolley or delivery system - Tumbler and spittoon system - spare parts.

UNIT-V DENTISTRY INSTRUMENTATION **9**

Lasers in Dentistry - Dental equipment repair and maintenance – Handpieces - Burs and rotary attachment Tooth numbering system - Infection control in dentistry - Instruments used in Periodontal Procedures & Basic Restoration procedures.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand about the Ophthalmic Instruments

CO2: Discuss about the techniques followed in ophthalmology

CO3: Explains about the clinical practices under ophthalmology department.

CO4: Analyze the imaging technique of dentistry..

CO5: Explain about the instruments used for dental purposes.

TEXT BOOKS:

1. Linda Bartolomucci Boyd," Dental Instruments", Elsevier,Edition 8, 2024.
2. Abhiyan Kumar , Anita Panda ," Handbook of Opthalmic Instruments "CBS Publishers & Distributors,1st Edition, 2017.

REFERENCE BOOKS:

1. Nikolai V. Tkachenko, "Optical Spectroscopy: Methods and Instrumentations", Elsevier, 5th Edition, 2006.

E-RESOURCES:

1. https://drive.google.com/file/d/1ZfnUB-lVXudr27-N1oE5OZxD1R2BqynT /view Dr. Pranesh Balasubramaniam and Dr. Subhashini Manoharan, ophthalmologists.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	-	-	1	1	1	3	2	3
CO2	3	3	2	2	2	1	-	-	1	1	1	3	3	2
CO3	3	3	2	2	2	3	-	-	1	1	1	2	2	2
CO4	3	3	2	2	2	3	-	-	1	1	1	1	2	1
CO5	3	3	2	2	3	3	-	-	1	1	1	1	2	1
AVG	3	3	2	2	2	2	-	-	1	1	1	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME31	CLINICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To the fundamental concepts, roles, and historical evolution of clinical engineering and its significance in healthcare.
- To the principles and practices of strategic medical technology planning and assessment in healthcare institutions..
- To the concept of Essential Health Care Technology Package (EHTP) and its implementation in healthcare technology management.
- To describe clinical engineering performance measurement and management using program indicators and databases.
- To examine advanced technologies, risk assessment techniques, and error-prevention models that enhance patient safety in healthcare.

UNIT-I INTRODUCTION **9**

Clinical engineering: Definition, Evolution, Role, Responsibilities, Functional status, History of clinical engineering and Technology in Health Care System, Enhancing patient safety.

UNIT-II MEDICAL TECHNOLOGY MANAGEMENT PRACTICES **9**

Strategic Medical Technology Planning, Scope , Clinical necessity operational support, strategic planning process – Technology assessment: Technology audit, Budget strategies, Prerequist for medical technology assessment – Management Practice for Medical Equipment – Device evaluation, Risk reduction, Asset management, ESHTA.

UNIT-III ESSENTIAL HEALTH CARE TECHNOLOGY PACKAGE (EHTP) **9**

Introduction – Health care technology management – Package development: Methodology, Logical framework, Implementation, Information promotion and dissemination – EHTP Justification – EHTP matrix – EHTP advantages – Impact Analysis.

UNIT-IV CLINICAL ENGINEERING PROGRAM INDICATOR **9**

Program services, Program database – Clinical Engineering Program management, Program indicator, Managing clinical engineering performance using program indicators – Indicator management process.

UNIT-V ADVANCED TECHNOLOGY FOR PATIENT SAFETY **9**

Factors Contributing to Medical Errors: Heath Care Reimbursement, Health Care Failure Mode and Effect Analysis (HFMEA), Patient Safety Best Practices Model: Bar coding, Computerized Physician Order Entry (CPOE), and Clinical data repositories – Process analysis, Methodology. Computerized medical equipment management systems.

TOTAL: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the definitions, roles, responsibilities, and evolution of clinical engineering within the healthcare system.

CO2: Understand the components and processes of strategic medical technology planning, audits, and equipment management.

CO3: Apply the methodology of developing and implementing an Essential Health Care Technology Package (EHTP).

CO4: Examine clinical engineering program indicators and management strategies for performance evaluation.

CO5: Apply methods like HFMEA and CPOE in developing strategies for minimizing medical errors and enhancing patient safety.

TEXT BOOKS:

1. Leigh W. Cellucci, Carla Wiggins, and Michael J. Garman, Essentials of Healthcare Management: Cases, Concepts, and Skills, 2nd Edition, Health Administration Press, 2025.
2. S. A. Tabish, Health Care Management: Principles and Practice, Springer, 2024.
3. Michael G. Harris, "Managing Medical Devices within a Regulatory Framework", WHO Publications, 2022.

REFERENCE BOOKS:

1. ECRI Institute, Health Technology Assessment and Safety, ECRI Publications, 2021.
2. Yadin David, Melissa Madsen, Ayesha Hasan, Clinical Engineering Handbook, 2nd Edition, Academic Press, 2020.

E-RESOURCES:

1. https://search.library.stonybrook.edu/
2. https://en.wikipedia.org/wiki/Clinical_engineering

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3	2	2	1	1	-	-	-	-	-	2	2	3	-
CO 2	2	2	3	1	2	-	-	-	-	-	2	2	2	-
CO 3	2	3	2	2	2	-	-	-	-	-	1	2	1	1
CO 4	2	2	1	2	1	-	-	-	2	-	2	1	1	1
CO 5	1	2	2	2	3	-	-	-	2	2	1	1	1	1
AVG	2	2	2	1	1	-	-	-	2	2	1	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME32 HOSPITAL PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To the fundamental principles and challenges of hospital administration and its distinction from industrial management.
- To provide Foundational knowledge of human resource management in the hospital context.
- To develop an understanding of marketing research practices and consumer behavior specific to the healthcare sector.
- To equip students with knowledge of hospital information systems and supportive technical services essential for hospital operations.
- To provide an understanding of quality and safety standards applicable in healthcare, including international certifications and audits.

UNIT-I OVERVIEW OF HOSPITAL ADMINISTRATION **9**

Distinction between Hospital and Industry, Challenges in Hospital Administration –Hospital Planning , Equipment Planning, AMC , Functional Planning , Current Issues in Hospital Management , Telemedicine , Bio-Medical Waste Management

UNIT-II HUMAN RESOURCE MANAGEMENT IN HOSPITAL **9**

Principles of HRM, Functions of HRM, Profile of HRD Manager, Tools of HRD, Human Resource Inventory, Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines ,Methods of Training , Evaluation of Training, Leadership grooming and Training.

UNIT-III MARKETING RESEARCH AND CONSUMER BEHAVIOUR **9**

Marketing information systems , assessing information needs, developing & disseminating information - Market Research process , Consumer Markets & Consumer Buyer behaviour , The buyer decision process , Model of business buyer behaviour , Major types of buying situations , global marketing in the medical sector.

UNIT-IV HOSPITAL INFORMATION SYSTEMS AND SUPPORTIVE SERVICES **9**

Management Decisions and Related Information Requirement , Clinical Information Systems, Administrative Information Systems , Support Service Technical Information Systems, Medical Transcription, Pharmacy, Food Services , Laundry Services.

UNIT-V QUALITY AND SAFETY ASPECTS IN HOSPITAL **9**

Quality system , Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 , 9004 , Features of ISO 9001 , ISO 14000 , ISO 13485. NABA, JCI, NABL, NABH. Security, Loss Prevention, Fire Safety, Alarm System, Safety Rules. Health Insurance & Managing Health Care - Medical Audit, Hazard and Safety in a hospital Setup.

TOTAL: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the distinctions between hospital and industrial administration, and identify core hospital functions.

CO2: Understand the principles and tools of HRM in hospitals, including recruitment, training, and leadership development.

CO3: Analyze marketing research methods and consumer behavior models in the healthcare sector.

CO4: Understand the role of hospital information systems and technical support services in decision making.

CO5: Analyze hospital safety systems and medical auditing for healthcare risk mitigation.

TEXT BOOKS:

1. Tabish, S. A. "Hospitals and Nursing Homes: Planning, Organization and Management", Jaypee Brothers Medical Publisher, 2024.
2. Amir H. Winter, Elske Ammenwerth, Reinhold Haux, et al., Health Information Systems: Technological and Management Perspectives, 3rd Ed, Springer, 2023.
3. Sumit Nayek, Health Care Administration and Management, AGPH Books, 1st Ed, 2023.

REFERENCE BOOKS:

1. Fortenberry, J. L, "Healthcare Marketing: A Case Study Approach (2nd Edition) Jones & Bartlett Learning", 2022.
2. McKee, M., Healy, J., & Grundy, E. "Managing Hospitals: Challenges and Strategies", Oxford University Press,2020

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/110/104/110104095/

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3	2	2	2	-	1	-	-	-	-	-	2	3	-
CO 2	2	3	2	2	-	2	-	3	2	-	-	3	1	-
CO 3	2	2	3	2	-	2	-	2	-	-	-	2	2	2
CO 4	2	3	2	2	-	1	-	-	3	-	-	2	1	1
CO 5	2	3	2	1	2	2	2	-	2	3	2	1	2	1
AVG	2	2	2	1	2	2	2	2	1	3	2	2	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME33	MEDICAL WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the fundamentals of healthcare hazard control, including hazard analysis, ergonomics, PPE, and accident prevention.
- To provide knowledge on biomedical waste management and safe disposal methods in healthcare.
- To explain the handling and regulation of hazardous materials in compliance with OSHA and healthcare standards..
- To create awareness of facility safety standards, equipment safety, and workplace hazard control practices.
- To emphasize infection control and patient safety through immunization, sterilization, and quality improvement measures.

UNIT-I HEALTHCARE HAZARD CONTROL 9

Healthcare Hazard Control : Introduction, Hazard Control, Hazard Control Management, Hazard Control Responsibilities, Addressing Behaviors, Hazard Control Practice, Understanding Hazards, Hazard Analysis, Hazard Control and Correction, Personal Protective Equipment, Hazard Control Committees, Hazard Control Evaluation, Hazards, System Safety, Ergonomics.

UNIT-II BIOMEDICAL WASTE MANAGEMENT 9

Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste, Categories and classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labeling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT-III HAZARDOUS MATERIALS 9

Hazardous Materials : Hazardous Substance Safety, OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

UNIT-IV FACILITY SAFETY 9

Facility Safety : Introduction, Facility Guidelines Institute, Administrative Area Safety, Slip, Trip, and Fall Prevention, Safety Signs, Colors, and Marking Requirements, Scaffolding, Fall Protection, Tool Safety, Machine Guarding, Compressed Air Safety, Electrical Safety.

UNIT-V INFECTION CONTROL, PREVENTION AND PATIENT SAFETY 9

Healthcare Immunizations, Centers for Disease Control and Prevention, Disinfectants, Sterilants, and Antiseptics, OSHA Bloodborne Pathogens Standard, Tuberculosis, Healthcare Opportunistic Infections, Medical Waste. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures, Patient-Centered Healthcare, Quality Improvement Tools and Strategies, Healthcare-Associated Infections, Medication Safety.

TOTAL: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Understand the fundamental concepts and responsibilities in healthcare hazard control, including hazard analysis, PPE, and ergonomics.
- **CO2:** Examine the classification, segregation, and safe disposal processes of biomedical waste in clinical settings.
- **CO3:** Demonstrate an understanding of hazardous material handling, OSHA safety regulations, and emergency response protocols.
- **CO4:** Apply facility safety practices including equipment safety, signage, fall prevention, and electrical hazard control.
- **CO5:** Analyze infection control strategies and patient safety initiatives using CDC guidelines, error reporting systems, and quality improvement tools.

TEXT BOOKS:

1. Neha Suyal , Prasenjit Debbarma , Manali Singh , Anita Mishra , Roop S. Bora, Biomedical Waste Management: Bioremediation and Recycling, 1st Edition, De Gruyter,2024.
2. Jason Roy, Industrial Hazard Control & Safety Management Study, 1st Edition, 2022

REFERENCE BOOKS:

1. Yang Chen , Qinzhong Feng , Zhongkui ZhangInnovative," Disposal Technology and Management Practice for Medical Waste",1st Edition, Springer Verlag,2023.

E-RESOURCES:

1. http://tnenvis.nic.in/Database/Waste_1169.aspx
2. https://ebooks.inflibnet.ac.in/esp11/chapter/biomedical-wastes-definition-sources-classification-collection-segregation-treatment-and-disposal/

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3	2	2	1	1	3	2	1	1	1	1	3	2	2
CO 2	3	2	2	2	1	3	2	1	1	1	1	2	2	1
CO 3	3	3	2	2	1	2	2	2	1	1	1	2	1	1
CO 4	3	3	3	2	2	3	2	2	1	1	1	1	1	1
CO 5	3	2	2	3	2	2	3	2	2	1	1	1	1	1
AVG	3	2	2	2	1	2	2	1	1	1	1	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME34 ECONOMICS AND MANAGEMENT FOR ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts of Economics with respect to the demand and supply analysis.
- To analyze the theory of production and the analysis of the cost parameter by using the Elasticity.
- To manage and plan the situation with the help of the available strategies to support the Decision making process.
- To acquire knowledge on basic financial management aspects.
- To sketch the Evolution of Management.

UNIT-I FUNDAMENTALS OF ECONOMICS **9**

Wealth, Welfare and Scarce Definitions of Economics; Micro and Macro Economics; Demand- Law of Demand, Elasticity of Demand, Types of Elasticity and Factors determining price elasticity of Demand: Utility- Law of Diminishing Marginal Utility, its limitations and exceptions.

UNIT-II DEMAND AND SUPPLY ANALYSIS **9**

The Law of Demand , The Law of Supply , Elasticities of Demand and Supply: Price Elasticity of Demand , Price Elasticity and Consumption Expenditure, Cross Elasticity of Demand , Income Elasticity of Demand , The Elasticity of Price Expectations , The uses of Elasticity, Price Elasticity of Supply.

UNIT-III INTRODUCTION TO MANAGEMENT **9**

Functions of Management- Taylor's Scientific Management; Henry Fayol's Principles of Management; Human Resource Management ,Basic functions of Human Resource Management. Production Management: Production Planning and Control, Plant Location, Break-Even Analysis- Assumptions, limitations and applications.

UNIT-IV FINANCIAL MANAGEMENT **9**

Types of Capital: Fixed and Working Capital and Methods of Raising Finance; Final Accounts- Trading Account, Statement of Profit and Loss and Balance Sheet (simple problems).

UNIT-V MARKETING MANAGEMENT AND ENTREPRENEURSHIP **9**

Marketing Management: Functions of marketing and Distribution Channels. Entrepreneurship: Definition, Characteristics and Functions of an Entrepreneur.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Impart knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions.
- **CO2:** Discuss the demand and supply process for a market analysis using Price elasticity, Cross elasticity and Income elasticity.
- **CO3:** Understand needs, functions, roles, scope and evolution of Management
- **CO4:** Apply managerial skills to make decisions and solve problems for achieving organizational objectives.
- **CO5:** Express the principles of effective planning for survival and success of all organizations using standing and single use planning methods.

Chairman
BoS/BME

TEXT BOOKS:

1. J.R. Monga , Raj Bahadur , Financial Accounting, 1st Edition, scholar tech press 2024.
2. Lila J. Truett, Dale B. Truett , Name Leela Rani, " Managerial Economics, Wiley, 2022.
3. D.R.Patel, Principle of Economics and Management, 1st Edition, Atul Prakashan, 2020.
4. Banga & Sharma, Industrial Organization & Engineering Economics, 2nd Edition, Khanna Publishers, 2018.

REFERENCE BOOKS:

1. New Age International Pvt. Ltd, Managerial Economics and Financial Analysis, 2nd Edition, New Age International Pvt. Ltd, 2019.

E-RESOURCES:

1. https://www.wileyindia.com/engineering-economy-and-management.html
2. https://inzeko.ktu.lt/index.php/EE

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3	3	2	2	1	2	1	1	1	1	2	2	3	2
CO 2	3	3	2	3	2	2	1	1	1	1	2	3	2	2
CO 3	2	2	3	2	2	2	2	3	2	2	2	2	2	2
CO 4	2	3	3	3	2	3	2	3	2	3	3	1	1	1
CO 5	2	3	3	3	2	2	2	2	2	3	3	2	1	2
AVG	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**1**

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME35	BIOSTATISTICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To understand the statistical methods for the data.
- To comprehend the fundamental of mathematical and statistical theory in the application of biomedical field.
- To apply the regression and correlation analyze in the physiological data.
- To understand the source of Medical data.
- To understand the Visual analytics of Healthcare data.

UNIT-I INTRODUCTION **6**

Introduction, Some basic concepts, Measurement and Measurement Scales, Simple random sample, Computers and medical data analysis, Introduction to probability, likelihood & odds, Distribution variability.

UNIT-II STATISTICAL PARAMETERS **6**

Statistical parameters p-values, computation, level chi square test and distribution and hypothesis testing -single population proportion, difference between two population proportions, single population variance, ratio of two population variances and tests of goodness of fit, tests of independence, tests of homogeneity.

UNIT-III REGRESSION AND CORRELATION ANALYSIS **6**

Introduction, regression model, sample regression equation, evaluating the regression equation, using the regression equation, correlation model, correlation coefficient.

UNIT-IV INTERPRETING DATA **6**

Interpreting life tables clinical trials, epidemical reading and interpreting of epidemical studies, application in community health

UNIT-V ANALYSIS OF VARIANCE **6**

META analysis for research activities, purpose and reading of META analysis, kind of data used for META analysis, completely randomized design, randomized complete block design, repeated measures design, factorial experiment.

THEORY: 30 PERIODS

LAB EXPERIMENTS

Students need to use appropriate software tools to implement the following,

1. Identify quantitative, ordinal, and categorical measurements from the data.
2. Construct and interpret stem plots and histograms.
3. Construct and interpret frequency tables, calculate and interpret means, standard deviations, medians, and quartiles.
4. Calculate and interpret Normal probabilities and values.
5. Calculate and interpret confidence intervals for means.
6. Calculate hypothesis test means and power or sample size estimates when testing means.
7. Tests of goodness of fit tests of independence, tests of homogeneity.

PRACTICAL: 30 PERIODS

TOTAL (30+30) =60 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand basic statistical concepts and their application in medical data analysis.

CO2: Apply hypothesis testing and statistical parameters to analyze population data.

CO3: Interpret regression and correlation models for medical research.

CO4: Analyze clinical and epidemiological data for community health.

CO5: Evaluate research findings using ANOVA and META analysis techniques.

TEXT BOOKS:

1. Heather Mattie, Kimberlee Gauvreau, Marcello Pagano, Principles of Biostatistics, 3rd Edition, CRC Press, 2022.
2. David Baronov, Biostatistics: An Introduction and Conceptual Critique, 1st Edition, Taylor & Francis Ltd, 2022.
3. Chandan K. Reddy, Charu C. Aggarwal, Healthcare Data Analytics, 1st Edition, Chapman and Hall/CRC, 2020.

REFERENCE BOOKS:

1. Charan Singh Rayat, Statistical Methods in Medical Research, Soft cover reprint of the original 1st Edition, Springer Verlag, 2019.
2. K. Janardhan P. Hanmanth Rao, Fundamentals of Biostatistics, 2nd Edition, Dream tech Press2019.

E-RESOURCES:

1. https://nptel.ac.in/courses/106/107/106107220/
2. https://www.jove.com/education/3602/

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3	2	1	1	-	-	-	1	1	-	1	3	2	-
CO 2	3	3	2	2	1	-	-	1	1	-	1	2	2	-
CO 3	3	3	3	2	1	-	-	1	2	-	1	2	1	1
CO 4	3	2	2	3	2	1	-	2	2	1	2	1	1	2
CO 5	3	3	3	2	2	-	-	2	2	1	2	2	1	1
AVG	3	2	2	2	1	1	-	1	1	1	1	2	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME36	FORENSIC SCIENCE IN HEALTHCARE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals and history of forensic science with real-world case applications.
- To develop crime scene observation and deductive reasoning skills.
- To learn the use of forensic microscopes and basics of forensic anthropology.
- To explore techniques for blood stain analysis and DNA/RNA profiling.
- To gain knowledge of fingerprint analysis and automated identification systems.

UNIT-I BASICS OF FORENSIC SCIENCE **9**

Forensic science, Introduction to the Forensic Sciences, History and Development of Forensic Science, Deductive Reasoning, Organization of a Crime Laboratory Case Studies: The Enrique Camarena Case. A Forensic Nightmare Organization of forensic science laboratories of center and state -NCRA AND NICFS, fundamental rights, criminal profiling, concept of quality control management in forensic institutions.

UNIT-II OBSERVATION AND CRIME SCENE **9**

Observational Skills - Sherlock Holmes and Deductive Reasoning - Observations by Witnesses. Case Studies. The Crime Scene -Locard's Exchange Principle, Securing and Recording the Crime Scene, Legal Considerations at the Crime Scene, Evidence Collection and Recordation Techniques. Mock Crime Scene: Processing and Documenting a Crime Scene.

UNIT-III FORENSIC MICROSCOPE AND ANTHROPOLOGY **9**

Forensic Use of the Microscope -The Compound, Comparison, and Stereoscopic Microscope, The Scanning Electron Microscope (SEM). Forensic Anthropology- Introduction, Human Anatomy–The Skeletal System, Skeletal Determination of Demographic Data from Skeletal Remains, Determining Types of Trauma and Disease from Skeletal Remains, Case Studies.

UNIT-IV BLOOD STAIN IDENTIFICATION **9**

Detection and identification of Blood stains, Determination of species of origin, Blood Group systems, Techniques of Determination of Blood groups of Blood stains, Determination of seminal and other fluids and their Blood Grouping, DNA, DNA Phenotyping and RNA Profiling & their applications. Wildlife forensics.

UNIT-V FINGERPRINT APPLICATION **9**

Fingerprints -Fundamental Principles of Fingerprint Analysis, Classification of Fingerprints, Collection of Fingerprint Evidence, Automated Fingerprint Identification Systems (AFIS), Track marks, Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Understand the fundamentals and structure of forensic science and crime labs.
- **CO2:** Apply observational and crime scene processing techniques.
- **CO3:** Apply forensic microscopy and anthropology for human identification.
- **CO4:** Analyze biological evidence like blood, fluids, DNA, and RNA.
- **CO5:** Evaluate and classify fingerprints using identification systems.

Chairman
BoS/BME

TEXT BOOKS:

1. Nathan Kvrestad, Joakim, Birath, Marcus Clarke, "Fundamentals of Digital Forensics: a Guide to Theory, Research and Applications, 3rd edition, Proquest Black Box B&t, 2025.
2. James T. Spencer, "Introduction to Forensic Science: The Science of Criminalistics", 1st Edition, CRC Pr I Llc, 2024.
3. Anthony J. Bertino, Patricia Nolan Bertino," Forensic Science: Fundamentals & Investigations", 3rd Edition, Cengage Learning, 2020.

REFERENCE BOOKS:

1. B R Sharma, Forensic Science in Criminal Investigation and Trials, Sixth Edition, Lexis Nexis, 2019.
2. Suzanne Bell, Forensic Science an Introduction to Scientific and Investigative Techniques with access Code, 5th Edition, CRC Press, 2019.

E-RESOURCES:

1. https://ser-infotech.com/category/index/506
2. https://www.hsls.pitt.edu/e-journals/Forensic%20Sciences
3. https://www.jove.com/education/3602/

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3	2	1	1	1	2	-	1	2	1	2	2	1	2
CO 2	3	3	2	2	2	1	-	2	2	-	2	3	1	1
CO 3	3	2	3	2	1	-	-	1	2	-	1	2	2	1
CO 4	3	3	3	2	2	1	-	1	1	1	2	1	3	1
CO 5	3	2	3	2	1	-	-	1	2	-	2	2	2	2
AVG	3	2	2	1	1	1	-	1	1	1	1	2	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME37 DATA ANALYTICS FOR HEALTHCARE TECHNIQUES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To explore the various forms of electronic health care information.
- To learn the techniques adopted to analyse health care data.
- To understand the natural language based analytics.
- To understand the predictive models for clinical data.
- To gain knowledge health care analytics and its applications.

UNIT-I HEALTHCARE MONITORING **9**

Introduction to Healthcare Data Analytics- Electronic Health Records–Components of EHR-Coding Systems- Benefits of EHR- Barrier to Adopting EHR-Challenges- Phenotyping Algorithms.

UNIT-II DATA ANALYSIS **9**

Biomedical Image Analysis- Mining of Sensor Data in Healthcare- Biomedical Signal Analysis-Genomic Data Analysis for Personalized Medicine.

UNIT-III ANALYTICS **9**

Natural Language Processing and Data Mining for Clinical Text- Mining the Biomedical -Social Media Analytics for Healthcare.

UNIT-IV ADVANCED ANALYTICS **9**

Advanced Data Analytics for Healthcare– Review of Clinical Prediction Models- Temporal Data Mining for Healthcare Data- Visual Analytics for Healthcare- Predictive Models for Integrating Clinical and Genomic Data- Information Retrieval for Healthcare- Privacy- Preserving Data Publishing Methods in Healthcare.

UNIT-V APPLICATIONS OF HEALTHCARE SYSTEM **9**

Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the structure, components, and challenges of Electronic Health Records and healthcare data analytics.

CO2: Analyze biomedical signals, images, genomic and sensor data for personalized healthcare applications.

CO3: Apply NLP and data mining techniques to extract insights from clinical text and biomedical social media data.

CO4: Evaluate advanced healthcare analytics methods including predictive modeling, temporal mining, and privacy-preserving data publishing.

CO5: Apply data analytics techniques in real-world healthcare applications such as fraud detection, drug discovery, and decision support systems.

Chairman
BoS/BME

TEXT BOOKS:

1. Mohamed Abdel-Basset, Ripon K Chakrabortty , Reda Mohamed, "Application of Advanced Optimization Techniques for Healthcare Analytics", 1st Edition, CRC Press, 2024.
2. Leyla Özgür Polat and Olcay Polat, AI-Driven Innovation in Healthcare Data Analytics, First Edition, IGI Global, 2024.
3. Tiko Iyamu, Advancing Big Data Analytics for Healthcare Service Delivery,1st Edition, Taylor & Francis Ltd,2022.

REFERENCE BOOKS:

1. Pantea Keikhosrokiani, "Big Data Analytics for Healthcare: Datasets, Techniques, Life Cycles, Management, and Applications", Academic Press, 2022.

E-RESOURCES:

1. https://www.coursera.org/courses?query=understanding%20iot%20technologies.
2. https://www.jove.com/education/3602/

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	-	1	2	-	2	3	2	2
CO 2	3	3	3	3	2	1	-	2	2	1	2	3	3	2
CO 3	3	3	2	2	2	1	-	1	2	1	2	2	2	2
CO 4	3	3	3	2	2	2	-	2	3	1	1	2	2	1
CO 5	3	3	3	3	3	1	-	2	2	1	1	3	2	2
AVG	3	2	2	2	2	1	-	1	2	1	1	2	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME38	HEALTH POLICY AND EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the structure and functioning of national, state, and city-level health systems.
- To learn the importance of national health policies, primary care, insurance, and intersectoral cooperation.
- To acquire knowledge of biomedical equipment maintenance and procurement procedures.
- To understand logistics, failure analysis, and reliability in hospital equipment maintenance.
- To study the principles and suppression methods of EMI in hospital equipment.

UNIT-I HEALTH SYSTEM **9**

Health organization of the country, the state and cities, health financial system, teaching cum research hospitals, General Hospital, PHC reference system, Ambulatory Care.

UNIT-II NATIONAL HEALTH POLICY **9**

Need for evaluating a health policy, need for providing primary health care, Health education, health insurance, health legislation, inter sectoral cooperation.

UNIT-III EQUIPMENT MAINTENANCE MANAGEMENT **9**

Organizing the maintenance operation, biomedical equipment procurement procedure, proper selection, compatibility, testing and installation, purchase and contract procedure, trained medical staff, on proper use of equipment and operating instructions.

UNIT-IV LOGISTIC SUPPORT & RELIABILITY **9**

Maintenance equipment and Tools, failure analysis, spare parts and maintenance materials. Reliability fundamentals.

UNIT-V EMI IN HOSPITAL EQUIPMENT **9**

Principles of EMI, computation of EMI, Method of suppressing and isolating the unit from interference.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Understand the structure and financial organization of health systems at various administrative levels.
- **CO2:** Evaluate national health policies and recognize the importance of primary care, insurance, and legislation.
- **CO3:** Apply procedures for biomedical equipment maintenance, procurement, and staff training.
- **CO4:** Analyze logistics, failure modes, and reliability aspects of hospital equipment.
- **CO5:** Apply EMI principles and methods to suppress and isolate interference in hospital equipment.

Chairman
BoS/BME

TEXT BOOKS:

1. Jerry H Swift, Health, Hospital, and Equipment Management, First Edition, Noah J. Hicks, 2023.
2. S. D. Gupta, Healthcare System Management: Methods and Techniques,1st Edition, Springer Verlag, Singapore,2022.

REFERENCE BOOKS:

1. Francis Hegarty, John Amoore, Paul Blackett, Justin McCarthy, Richard Scott, Healthcare Technology Management - A Systematic Approach, First Edition, CRC Press, 2020.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/110/104/110104095/
2. https://www.asianhhm.com/technology-equipment/medical-equipment-management.
3. https://www.jove.com/education/3602/

CO's – PO's & PSO's MAPPING

CO/PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	1	1	1	-	2	3	2	3
CO 2	3	2	2	2	2	2	1	2	2	1	2	2	3	2
CO 3	2	2	3	2	3	2	-	1	2	1	2	1	2	2
CO 4	2	3	3	3	2	1	-	1	2	1	2	1	1	2
CO 5	3	3	3	2	3	1	-	1	2	1	2	1	1	1
AVG	2	2	2	2	2	1	1	1	1	1	2	1	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME41	VIRTUAL REALITY AND AUGMENTED REALITY IN HEALTHCARE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
- To know the intricacies of these platform to develop PDA applications with better optimality.
- To learn the various applications of VR.
- To learn the possibilities of implementing target-specific VR applications on mobile.

UNIT I INTRODUCTION **9**

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

UNIT II VR DEVELOPMENT PROCESS **9**

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model management.

UNIT III CONTENT CREATION CONSIDERATIONS **9**

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 VR ON THE WEB & VR ON THE MOBILE **10**

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)-frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics.

UNIT V APPLICATIONS **8**

Medical applications-military applications-robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations, therapy.

TOTAL HOURS: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Analyze and Design a system or process to meet given specifications with realistic engineering constraints.
- **CO2:** Apply different modeling for VR development process.
- **CO3:** Analyze the implications and issues pertaining to VR
- **CO4:** Formulate technical documents and give technical oral presentations related to design VR mini project results.
- **CO5:** Create simple and portable VR applications using appropriate software

TEXT BOOKS:

1. Rajendra Kumar, Vishal Jain, Garry Tan Wei Han, Adberezak Touzene, Immersive Virtual and Augmented Reality in Healthcare: An IoT and Blockchain Perspective, Ist Edition, Hardcover – Import, 2023.
2. C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc.,2008
3. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

REFERENCE BOOKS:

1. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575
2. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.

E-RESOURCES:

1. https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/?v=c86ee0d9d7ed, "Foundation Course on Virtual Reality and Augmented Reality"

CO's – PO's & PSO's MAPPING

CO/PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	1	-	-	-	-	1	-	1
CO2	3	2	1	1	2	-	1	-	-	-	-	1	-	1
CO3	3	2	1	1	2	-	1	-	-	-	-	1	-	1
CO4	3	2	1	1	2	-	1	-	-	-	-	1	-	1
CO5	3	2	1	1	2	-	1	-	-	-	-	1	-	1
AVG	3	2	1	1	2	-	1	-	-	-	-	1	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME42	BIOMEDICAL OPTICS AND PHOTONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the physical properties of light and optical properties of tissues.
- To learn the design and working principle of various optical components.
- To understand the principles and applications of Surgical lasers.
- To interpret the engineering and practical applications of optics related to diagnostic and surgical applications.
- To summerize the phenomenon of laser tissue interaction and practical applications of optics related to therapeutic applications.

UNIT-I OPTICAL PROPERTIES **9**

Basic principles of light - Reflection - Refraction - Absorption - Polarization - Interference - Coherence, Basic laws of light - Beer Lambert law - Snell's law, Optical properties of tissues - Absorption - Scattering - Anisotropy.

UNIT-II BIOMEDICAL DIAGNOSTICS **9**

Functional imaging with diffusing light, Photon migration spectroscopy frequency - domain techniques, Atomic spectrometry in biological and clinical analysis, Fluorescence spectroscopy, Raman spectroscopy, Elastic Scattering Spectroscopy.

UNIT-III SURGICAL APPLICATIONS OF LASERS **9**

Lasers in ophthalmology, Dermatology, Dentistry, Urology, Otolaryngology, Laser induced breakdown spectroscopy (LIBS), Photoacoustic tomography.

UNIT-IV NON THERMAL DIAGNOSTIC APPLICATIONS **9**

Phototherapy, Photodynamic therapy (PDT), Principle and mechanism, Oncological and non, oncological applications of PDT, Bio stimulation effect, applications, Laser Safety Procedures.

UNIT-V LASER TISSUE INTERACTION **9**

Laser tissue interactions via photochemical, Photothermal, Photomechanical techniques, Photodynamic therapy (PDT) - Oncological and non-oncological applications, Low level laser therapy (LLLT) - Biostimulation applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the various physical properties of light and optical properties of tissues.
CO2: Consolidate the working principles of optical components.
CO3: Apply the various Surgical laser applications of biosensors in medicine.
CO4: Demonstrate the Non thermal diagnostic applications medicine.
CO5: Analyze the laser tissue interaction and various therapeutic applications of lasers.

Chai
BoS/BME

TEXT BOOKS:

1. Caroline Boudoux, Fundamentals of Biomedical Optics: From light interactions with cells to complex imaging systems, 1st Edition, Blurb,2024.
2. Gerd Keiser, Biophotonics: Concepts to Applications, 2nd Edition, Springer, 2022.
3. Tuan Vo Dinh, "Biomedical Photonics – Handbook, CRC Press, Bocaraton, 2014.

REFERENCE BOOKS:

1. Aaron Ho-Pui Ho , Donghyun Kim , Michael G. Somekh, Handbook of Photonics for Biomedical Engineering, 1st Edition, Springer,2017.
2. Jurgen Popp, Valery V. Tuchin, Arthur Chiou and Stefen Heinemann, Handbook of Biophotonics, Vol 2: Photonics for Healthcare, John Wiley and Sons, 1st Edition, 2011.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ge13/preview
2. https://www.youtube.com/results?search_query=biomedical+photonics+and+optics

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	2	-	1
CO3	3	2	3	1	-	-	1	1	-	-	1	2	-	-
CO4	3	2	3	1	-	-	1	1	-	-	1	2	-	1
CO5	3	2	3	1	-	-	-	-	-	-	1	2	-	-
AVG	3	2	3	1	-	-	1	1	-	-	1	2	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME43	PHYSIOLOGICAL MODELLING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the application of Physiological models and vital organs.
- To formulate the methods and techniques for analysis and synthesis of dynamic models
- To describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.
- To describe nonlinear models of physiological systems
- To compute the Simulation of physiological systems

UNIT-I INTRODUCTION TO PHYSIOLOGICAL MODELING **9**

Approaches to modelling: The technique of mathematical modelling, classification of models, characteristics of models. Time invariant and time varying systems for physiological modelling. Introduction to physiology (homeostasis, cell biology), Transfer functions and block diagram analysis Physiology.

UNIT-II MODELING OF DYNAMIC PHYSIOLOGICAL SYSTEM **9**

Dynamic systems and their control, modelling and block diagrams, the pupil control systems(Human Eye), general structure of control systems, the dynamic response characteristics of the pupil control system, open &close loop systems instability, automatic aperture control.

UNIT-III NONLINEAR MODELS OF PHYSIOLOGICAL SYSTEMS **9**

Nonparametric Modelling-Volterra Models. Wiener Models. Efficient Volterra Kernel Estimation. Parametric Modelling - Basic Parametric Model Forms and Estimation Procedures- Volterra Kernels of Nonlinear Differential Equations. Discrete-Time Volterra Kernels of NARMAX Models.

UNIT-IV COMPARTMENTENTAL PHYSIOLOGICAL MODEL **9**

Modeling the body as compartments, behaviour in simple compartmental system, pharmacokinetic model, and multi compartmental system. Physiological modelling: Electrical analogy of blood vessels, model of systematic blood flow and model of coronary circulation. Mathematical modelling of the system: Thermo regulation, Thermoregulation of cold bloodedness& warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples.

UNIT-V SIMULATION OF PHYSIOLOGICAL SYSTEMS **9**

Simulation of physiological systems using Open CV / MATLAB software. Biological receptors: - Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity. Neuromuscular model, Renal System, Drug Delivery Model.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the application of Physiological models

CO2: Demonstrate the methods for analysis and synthesis of Linear system

CO3: Apply the Nonlinear models of physiological systems

CO4: Analyze the compartmental physiological model

CO5: llustrate the Simulation of physiological systems

TEXT BOOKS:

1. Soltesz, Kristian, "Dynamic Modelling of Physiology", 2024.
2. Konstantinos Michmizos, Konstantina Nikita, "Physiological Systems Modeling, Simulation, and Control", Chapter: 17Publisher: IGI Global, 2012.

REFERENCE BOOKS:

1. Benjamin C Kuo, "Automatic control systems", Tenth Edition, McGraw-Hill Education, 2017.
2. MinruiFei, Shiwei Ma, Xin Li, Xin Sun, Li Jia and Zhou Su,"Advanced Computational Methods in Life System Modeling and Simulation", Springer,2017.
3. DavidTWestwick, Robert E. Kearney, Identification of Nonlinear PhysiologicalSystems, Wiley-IEEE Press, 2003.

E-RESOURCES:

1. https://nptel.ac.in/courses/112107214

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	2	1	2
CO2	3	1	1	1	1	-	-	-	-	-	-	2	1	-
CO3	3	1	1	1	1	-	-	-	-	-	-	2	1	-
CO4	3	1	1	1	1	-	-	-	-	-	-	2	1	2
CO5	3	1	1	1	1	-	-	-	-	-	-	2	1	-
AVG	3	1	1	1	1	-	-	-	-	-	-	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME44	ROBOTICS IN MEDICINE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduction to the fundamental of robotics and position analysis.
- To learn about Parallel robots, different types of motions and force analysis
- To understand the concepts of robotics of surgery.
- To understand the specific design requirements for integrating robotic systems with medical imaging devices.
- To acquainted to Fuzzy control and Applications of Robotics in Medicine

UNIT-I INTRODUCTION TO ROBOTICS AND AUTOMATION **9**

Introduction Automation and Robots, Classification, Specification, Notations, Direct Kinematics Dot and cross products, Coordinate frames, Rotations, Homogeneous coordinates Link coordination arm equation, Four-axis robot.

UNIT-II KINEMATICS **9**

Inverse Kinematics – General properties of solutions tool configuration, Five axis robots, Workspace analysis and trajectory planning work envelope and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

UNIT-III ROBOT IN SURGERY **9**

Minimally invasive surgery and robotics integrations, Surgical robotic sub systems, synergistic control, Control modes, Orthopedic surgery, Cardiac Surgery, Neurosurgery.

UNIT-IV IMAGE GUIDED INTERVENTIONS **9**

Robot compatibility with medical imagers, Image segmentation and modeling, Tracking devices, Frames and Transformations, Surgical navigation.

UNIT-V ROBOTS IN PATIENT CARE **9**

Rehabilitation for Limbs, Assistive robots, Types of Assistive robots, Biologically inspired robots, Application in Rehabilitation, interactive therapy, Bionic Arm.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Infer with the basics of robotics system

CO2: Elucidate the kinematics, motion planning and control involved in design of robotics system

CO3: Outline the concepts of robotics of surgery

CO4: Analyze the technical aspects of robotic technology in image guided interventions

CO5: Illustrate the role of robotics in assistive technology

Chairman
BoS/BME

TEXT BOOKS:

1. Douglas P. Murphy, Robotics in Physical Medicine and Rehabilitation, Elsevier - Health Sciences Division, 2023.
2. S. B. Niku, Introduction to Robotics, Analysis, Control, Applications, Pearson Education, 2020
3. Robert Schilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India, 2003.
4. J Craig, Introduction to Robotics, Pearson Education, 2005.

REFERENCE BOOKS:

1. Ronan Rowell, Robots in Medicine, Cavendish Square, 2021.
2. Grover, Wiess, Nagel and Oderey, Industrial Robotics, McGraw Hill, 2012.
3. Paula gomes, "Medical robotics minimally invasive surgery", Woodhead, 1st Edition, 2012.
4. Matthew, Mauro M.D, " image- Guided Intervention", Saunders, 2nd Edition, 2013.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/112/105/112105249/
2. https://onlinecourses.nptel.ac.in/noc20_me03/preview

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO3	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO4	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO5	3	2	1	1	1	-	-	-	-	-	-	1	-	-
AVG	3	2	1	1	1	-	-	-	-	-	-	1	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME45	ERGONOMICS FOR HEALTHCARE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To get exposed to principles of visual capabilities.
- To learn the mechanics of muscle physiology and significance of rest cycle.
- To learn spatial compatibility and the relation between control orders and control response.
- To know about the measurements and proportions of the human body.
- To familiar with the mathematical models, analysis and design of biomedical devices using case studies.

UNIT-I VISUAL AND AUDITORY ERGONOMICS 9

Process of seeing – visual capabilities – factors affecting visual acuity and contrast sensitivity – human factor aspects of hard copy text and computer screen text, factors in selecting graphic representations symbols, qualitative visual display – process of hearing – principles of auditory display. Measures for monitoring control & mitigation.

UNIT-II MUSCLE PHYSIOLOGY 9

Muscle physiology – muscle metabolism – respiratory response – joint motion study – measure of physiological in-efficiency and energy consumption – work rest cycles – aspects of manual and posture study, material handling (MMH) Bio-mechanical recommended limits of MMH.

UNIT-III CONTROLS AND DISPLAYS 9

Spatial compatibility and physical arrangement of displays and controls - Design of displays and controls – movement capability – rotary controls and rotor displays movement of displays orientation of the operator and movement relationships control orders and control responses – human limitations in tracking task.

UNIT-IV ANTHROPOMETRY 9

Anthropometry – anthropometric design principles – Physical work load and energy expenditure - work space envelope – factors in design of work space surfaces – principles of seat design – principles of control panel. Ergonomic implications. Organization classification of human errors theories of accident causation-reducing accidents by altering behavior.

UNIT-V CASE STUDIES 9

Case Study 1: computer design, control panel design of an electronic instrument, computer key board, hand drill etc.

Case Study 2: Biomedical Application, Design optimization of Medical Equipment.

TOTAL: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand principles of ergonomics.
CO2: Paraphrase the significance of posture
CO3: Analyze the tracking tasks.
CO4: Illustrate the ergonomics and its implications to various domain
CO5: Perform case studies on electronic instruments and medical equipment.

TEXT BOOKS:

1. Vaz, Guyton & Hall Textbook of Medical Physiology, Third South Asia Edition, Elsevier Health Science, 2020.
2. Pascale Carayon, "Handbook of Human Factors and Engineering", Second Edition, CRC Press, 2011.
3. Martin Helander, "Guide to Human Factors and Ergonomics", Second Edition, CRC Press,2005.

REFERENCE BOOKS:

1. Shrawan Kumar, Biomechanics in Ergonomics, Second Edition, CRC Press2007.
2. George Kanawaty, "Introduction to work study", ILO, 3rd edition, Oxford & IBH publishing, 2001.
3. Stephen Pheasant, Christine M. Haslegrave, Bodyspace: Anthropometry, Ergonomics and the Design of Work, CRC Press, 2005.

E-RESOURCES:

1. https://nptel.ac.in/courses/107103004/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	1	-	1
CO2	3	1	1	1	1	-	-	-	-	-	-	1	-	-
CO3	3	1	1	1	1	-	-	-	-	-	-	1	-	1
CO4	3	1	1	1	1	-	-	-	-	-	-	1	-	1
CO5	3	1	1	1	1	-	-	-	-	-	-	1	-	-
AVG	3	1	1	1	1	-	-	-	-	-	-	1	-	1

1 - Low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME46	HAPTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To expose the basic principles of Haptics and their property.
- To give knowledge on machines in haptics.
- To learn the types of sensors and actuators.
- To understand the basic concepts of human locomotion, biomechanical analysis using Finite Element Analysis.
- To understand the principles, practices and application Medical Simulations

UNIT-I HUMAN HAPTICS **9**

Somatosensory System; Motor System, Muscle Physiology; Haptics Psychophysical experiments.

UNIT-II MACHINE HAPTICS **9**

Design Haptic devices; Human factors involved.

UNIT-III HAPTIC SENSORS AND ACTUATORS **9**

Barriers in human haptics; Ergonomics.

UNIT-IV COMPUTATIONAL HAPTICS **9**

Haptic Rendering; Rigid bodies, Deformable bodies, Stability Rendering effects, Human performance and evaluation; Biomechanics of manipulation; Neuromuscular Models.

UNIT-V HAPTICS FOR MEDICAL APPLICATIONS **9**

Applications: Telemedicine; Rehabilitation; Medical Simulations for education.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the laws of principles of haptics for human
CO2: Discuss the behavior of machines in haptics
CO3: Analyze the suitable sensor and actuator for haptics.
CO4: Identify suitable computation for haptics
CO5: Interpret the finite element analysis, design the work station depending upon the haptics

Chairman
BoS/BME

TEXT BOOKS:

1. Thorsten A. Kern, Christian Hatzfeld, Alireza Abbasimoshaei, Engineering Haptic Devices (Springer Series on Touch and Haptic Systems), Springer International Publishing AG, 3rd ed. 2023.
2. Hasti Seifi, Astrid M. L. Kappers, Knut Drewing, Claudio Pacchierotti, Alireza Abbasimoshaei ,Gijs Huisma, Thorsten A. Kern (Eds.)," Haptics: Science, Technology, Applications", Hamburg, Germany, May 22–25, 2022, Proceedings

REFERENCE BOOKS:

1. Chang Liu, Foundations of MEMS, Pearson Education Inc., 2012.
2. Chang Liu, Foundations of MEMS, Pearson Education International, New Jersey, USA, 2006.
3. Nitaigour Premch and Mahalik, MEMS, Tata McGraw Hill Publishing Company, New Delhi, 2007.

E-RESOURCES:

1. https://nptel.ac.in/courses/121106013/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	2	1	3
CO2	3	1	1	1	1	-	-	-	-	-	-	2	1	-
CO3	3	1	1	1	1	-	-	-	-	-	-	2	1	-
CO4	3	1	1	1	1	-	-	-	-	-	-	2	1	3
CO5	3	1	1	1	1	-	-	-	-	-	-	2	1	-
AVG	3	1	1	1	1	-	-	-	-	-	-	2	1	3

1 - Low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME47	ARTIFICIAL INTELLIGENCE IN HEALTHCARE (For B.E- ECE and BME)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the Artificial intelligence and medical visualization and healthcare applications.
- To analyze the concept of artificial Intelligence to diagnose and predict cancer.
- To understand the concept of medical imaging applications.
- To apply the concepts of Artificial Intelligence assisted surgery.
- To know the concept of Artificial Intelligence algorithms

UNIT-I INTRODUCTION **9**

Artificial intelligence and medical visualization, Intelligent personal health records, Robotics and artificial intelligence-powered devices , Ambient assisted living, Review of state of Artificial Intelligence in Healthcare.

UNIT-II DISEASE DIAGNOSTICS AND TREATMENT DECISIONS USING ARTIFICIAL INTELLIGENCE **9**

Machine Learning and Deep learning for disease diagnosis and staging, Artificial intelligence to predict cancer treatment response and cancer recurrence and survival, Alzheimer disease detection, Neuro developmental disorders, Case studies.

UNIT-III ARTIFICIAL INTELLIGENCE FOR MEDICAL IMAGING **9**

Artificial Intelligence in Radiology, Data Augmentation, Transfer Learning, Clinical findings in Radiological Images using Deep learning- artificial intelligence in Ultrasound imaging and visualization of Arteries.

UNIT-IV ARTIFICIAL INTELLIGENCE ASSISTED SURGERY **9**

Artificial Intelligence in Preoperative diagnosis, Preoperative staging, Intraoperative, Autonomous surgery, Computer vision, and Detection of post-operative complications, Case studies.

UNIT-V REMOTE PATIENT MONITORING USING ARTIFICIAL INTELLIGENCE **9**

Remote Patient Monitoring, Sensors, Smart phones, Apps and Devices, Natural language processing, Virtual reality, Augmented reality and voice powered virtual assistants, Monitoring of Dementia and Migraine, Cardiac monitoring, Diabetes prediction and monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Understand the potential of Artificial Intelligence in Healthcare application.
- **CO2:** Apply Artificial Intelligence to diagnose and predict cancer treatment response.
- **CO3:** Analyze the Artificial Intelligence for medical imaging applications.
- **CO4:** Understand the concepts of Artificial Intelligence assisted surgery.
- **CO5:** Develop Artificial Intelligence algorithms for remote patient monitoring.

Chairman
BoS/BME

TEXT BOOKS:

1. Tianhua Chen, Jenny Carter, Mufti Mahmud, Arjab Singh Khuman, "Artificial Intelligence in Healthcare Recent Applications and Developments", Springer,2022
2. Adam Bohr, Kaveh Memarzadeh, "Artificial Intelligence in Healthcare", Elsevier,2020.
3. Bernard Nordlinger, Cedric Villani, Daniela Rus, "Healthcare and Artificial Intelligence", Springer, 2020.

REFERENCE BOOKS

1. Kayvan Najarian, Delaram Kahrobaei, Enrique Dominguez, Reza Soroushmehr, "Artificial Intelligence in Healthcare and Medicine", CRC Press, 2022.
2. Chee Peng Lim, Ashlesh Vaidya, Kiran Jain, Virag U, Mahrokar, Lakhmi C Jain, "Handbook of Artificial Intelligence in Healthcare Vol 1- Advances and Applications, Springer, 2022

E-RESOURCES:

1. https://nptel.ac.in/domains/discipline/106?course=106_0
2. https://www.youtube.com/watch?v=j6EB9HO6acE

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	3	-	-	1	1	3
CO2	3	2	1	1	1	-	-	-	3	-	-	1	1	3
CO3	3	2	1	1	1	-	-	-	3	-	-	1	1	3
CO4	3	2	1	1	1	-	-	-	3	-	-	1	1	3
CO5	3	2	1	1	1	-	-	-	3	-	-	1	1	3
AVG	3	2	1	1	1	-	-	-	3	-	-	1	1	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME48	HEALTHCARE INFORMATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the concept of health informatics with its sub clauses addresses.
- To explain the concepts of the application future health-related careers and nano-technologies.
- To understand the concept of imaging informatics Technologies.
- To illustrate, how the healthcare improved diversity issues in health informatics and consumer informatics.
- To know the concept of the clinical information system and applications.

UNIT-I INTRODUCTION TO HEALTH INFORMATICS **9**

Historical highlights and Evolution of Health informatics, Hospital Information System –its characteristics and functional online and offline modules, Health Informatics, Bioinformatics, Medical Informatics, Clinical Informatics, imaging Informatics, Nursing Informatics, Public Health Informatics and Consumer Health Informatics.

UNIT-II BIOINFORMATICS AND TECHNOLOGIES **9**

Bio-information technologies, Semantic web and Bioinformatics, Genome projects - Nano technology in Healthcare - CNT based Nano sensor, BioCom chip, Medical Nanorobo – Bioinformatics software tools.

UNIT-III IMAGING INFORMATICS **9**

Imaging Informatics Technology, Standard protocols in Imaging Informatics, key technologies – PACS, DICOM – Architectures -EHR with image distribution, Image aided detection and diagnosis.

UNIT-IV NURSING AND CONSUMER INFORMATICS **9**

Nursing Informatics – Definition – Components – Perspectives, Competencies, Applications - Roles and responsibilities, Data, Information and Knowledge - Consumer Informatics – Bringing medical knowledge to consumers–EHR accessible to patients, Decision aids to support consumer choices.

UNIT-V CLINICAL AND PUBLIC HEALTH INFORMATICS **9**

History of Clinical and Public Health Informatics, Clinical information system applications in health care, patient management systems, clinical data mining. Public Health Informatics–Surveillance, Information Network, Geographic Information System(GIS),Challenges and Emerging solutions.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Develop knowledge about problems and challenges that health informatics with its sub clauses addresses
- **CO2:** Demonstrate Basic Skills and knowledge in health informatics for application future health-related careers and nano technologies.
- **CO3:** Ability to identify and understand imaging informatics technologies and their applications
- **CO4:** Analyze the key technologies that improved healthcare delivery and diversity

Chairman
BoS/BME

issues in health informatics

CO5: Develop the clinical information system in the process of developing and implementing Health Informatics

TEXT BOOKS

1. A Practical Approach for Health Care Management (5th Edition) by Karen A. Wager, Frances W. Lee, and John P. Glaser. Published in December 2021.
2. Hoyt,REandYoshihashi,A,Eds.,HealthInformatics:PracticalGuideforHealthcare and Information Technology Professionals, Sixth Edition.Pensacola,FL,Lulu.com, 2014.

REFERENCE BOOKS

1. Ramachandra Lele, Computers in Medicine Progress in Medical Informatics, Tata McGraw Hill Publishing Company, New Delhi, 2005
2. MohanBansalMS,MedicalInformatics,TataMcGrawHillPublishingCompany, New Delhi, 2005.
3. Yi-Ping Phoebe, Bioinformatics Technologies, Springer International, New Delhi, 2007.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_bt06/preview

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	1	2	-	-	2	-	1	3	1	-
CO2	3	3	3	-	1	2	-	-	2	-	1	3	1	-
CO3	3	3	3	-	1	2	-	-	2	-	1	3	1	-
CO4	3	3	3	-	1	2	-	-	2	-	1	3	1	-
CO5	3	3	3	-	1	2	-	-	2	-	1	3	1	-
AVG	3	3	3	-	1	2	-	-	2	-	1	3	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME51	PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Learn about supervised and unsupervised pattern classifiers.
- To Familiarize about different feature extraction techniques.
- To Learn about structural pattern recognition.
- To Explore the role of Hidden Marko model and SVM in pattern recognition.
- To Understand the application of Fuzzy logic and genetic algorithms for pattern classifier.

UNIT-I PATTERN CLASSIFIER **9**

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT-II CLUSTERING **9**

Clustering for unsupervised learning and classification–Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UNIT-III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION **9**

Principle component analysis, Independent component analysis, Linear discriminant analysis, Feature selection through functional approximation – Elements of formal grammars, Syntactic description – Stochastic grammars – Structural Representation.

UNIT-IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE **9**

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine – Feature Selection.

UNIT-V RECENT ADVANCES **9**

Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Differentiate between supervised and unsupervised classifiers

CO2: Classify the data and identify the patterns.

CO3: Extract feature set and select the features from given data set.

CO4: Identify Hidden Markov Models.

CO5: Apply fuzzy logic and genetic algorithms for classification problems.

Chairman
BoS/BME

TEXT BOOKS:

1. Pattern Recognition Techniques and Applications 1st Edition, Kindle Edition, 2005.
2. Pattern Recognition, 2ed, An Indian Adaptation, 2021.

REFERENCE BOOKS:

1. M. Narasimha Murthy and V. Susheela Devi, "Pattern Recognition", Springer 2011.
2. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley, 2001
3. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press. 2009.
4. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

E-RESOURCES:

1. https://archive.nptel.ac.in.
2. https://www.jove.com/librarians/resources.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	1	1	-
CO2	-	2	-	-	-	-	-	-	-	-	-	1	1	-
CO3	-	-	3	2	-	3	-	-	-	-	-	1	1	-
CO4	-	-	3	-	3	3	-	-	-	-	-	1	2	-
CO5	3	-	-	3	2	-	-	-	-	-	-	1	2	-
AVG	3	2	3	2.5	2.5	3	-	-	-	-	-	1	1.4	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME52	COMPUTER VISION	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- Review image processing techniques for computer vision.
- Understand various features and recognition techniques.
- Learn about histogram and binary vision.
- Apply three-dimensional image analysis techniques.
- Study real world applications of computer vision algorithms.

UNIT-I INTRODUCTION AND IMAGE MATTING 6

Computer Vision , What is Computer Vision - Low-level, Mid-level, High-level ; Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Matting Terminology – Blue–Screen – Green-Screen and Difference Matting .

UNIT-II FEATURE EXTRACTION 6

Feature Extraction -Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space 69 Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters.

UNIT-III COLOR IMAGES, BINARY VISION 6

Simple pinhole camera model – Sampling – Quantisation – Colour images – Noise – Smoothing – 1D and 3D histograms- Back-projection - k-means Clustering – Thresholding - Threshold Detection Methods - Variations on Thresholding - Mathematical Morphology – Connectivity.

UNIT-IV RECOGNITION AND 3D VISION 6

Recognition – object detection, face recognition, Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction.

UNIT-V MOTION 6

Introduction to motion – – Motion Editing – Facial Motion Capture – Markless Motion Capture, triangulation – bundle adjustment – translational alignment – parametric motion–spline-based motion-optical flow–layered motion.

THEORY : 30 PERIODS

PRACTICAL EXERCISES:

1. Document Image Analysis
2. Biometrics based Recognition
3. Object Recognition
4. Object Tracking
5. Medical Image Analysis
6. Content-Based Image Retrieval
7. Video Data Processing

Chairman
BoS/BME

PRACTICAL: 30 PERIODS
TOTAL (30+30) =60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Explain low level processing of image and transformation techniques applied to images.
- **CO2:** Develop the feature extraction and object recognition methods.
- **CO3:** Apply Histogram transform for detection of geometric shapes like line, ellipse and objects.
- **CO4:** Illustrate 3D vision process image analysis techniques.
- **CO5:** Apply motion estimation techniques to real time applications.

TEXT BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, 2nd Edn., Springer-Verlag London Ltd., 2022.
2. Mark Nixon and Alberto S. Aquado (2014). Feature Extraction & Image Processing for Computer Vision. Third Edition. Academic Press.
3. Forsyth D. A. and Ponce J., "Computer Vision – A Modern Approach", Second Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. Richard J Radke (2013). Computer Vision for Visual effects. First Edition Cambridge University Press
2. 2 Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012..
3. Concise Computer Vision: An Introduction into Theory and Algorithms, by Reinhard Klette, 2014.
4. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview
2. https://nptel.ac.in/courses/106105216
3. https://www.jove.com/librarians/resources.

CO's – PO's & PSO's MAPPING

CO/PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	1	1	-	1
CO2	3	2	1	1	2	-	-	-	-	-	1	1	-	1
CO3	3	2	1	1	2	-	-	-	-	-	1	1	-	1
CO4	3	2	1	1	2	-	-	-	-	-	1	1	-	1
CO5	3	2	1	1	2	-	-	-	-	-	1	1	-	1
AVG	3	2	1	1	2	-	-	-	-	-	1	1	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME53	SPEECH AND AUDIO SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To familiarize the basic mechanism of speech production and parametric representation of speech.
- To Present basic principles of speech analysis and synthesis.
- To Study linear predictive analysis of speech.
- To Acquire knowledge on speech coding techniques.
- To Give an overview of speech processing applications including, speech recognition and speaker recognition.

UNIT-I PRINCIPLE CHARACTERISTICS OF SPEECH **9**

Linguistic information, Speech and Hearing, Speech production mechanism, Acoustic characteristic of speech Statistical Characteristics of speech. Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model.

UNIT-II SPEECH ANALYSIS AND SYNTHESIS SYSTEMS **9**

Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction.

UNIT-III LINEAR PREDICTIVE CODING ANALYSIS **9**

Principle of LPC analysis, Maximum likelihood spectral estimation, Source parameter estimation from residual signals, LPC Encoder and Decoder, PARCOR analysis and Synthesis, Line Spectral Pairs, LSP analysis and Synthesis.

UNIT-IV SPEECH CODING **9**

Reversible coding, Irreversible coding and Information rate distortion theory, coding in time domain: PCM, ADPCM, Adaptive Predictive coding, coding in Frequency domain: Sub band coding, Adaptive transform coding, Vector Quantization, Code Excited Linear Predictive Coding (CELP).

UNIT-V SPEECH RECOGNITION **9**

Principles of speech recognition, Speech period detection, Spectral distance measure, Structure of word recognition system, Dynamic Time Warping (DTW), Theory and implementation of Hidden Markov Model (HMM). Speaker recognition: Human and Computer speaker recognition Principles Text dependent and Text Independent speaker recognition systems, applications of speech processing.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand different characteristics of speech signals.

CO2: Identify and analyze different speech analysis and synthesis systems.

CO3: Know Linear Predictive analysis of speech signal and different pitch period estimation methods.

CO4: Analyze the coding techniques used in audio processing.

CO5: Understand the applications of speech processing including speaker recognition and speech recognition.

TEXT BOOKS:

1. U Zoelzer, Digital Audio Signal Processing, 3rd Edition, Hardcover – Import, 2022.
2. Andreas Spanias, Ted Painter, Venkatraman AttiWayne Tomasi, "Audio signal processing and coding", John Wiley & Sons, 2007.
3. Dr.Shaila D.Apte - Speech and Audio Processing, First Edition, WILEY Precise Textbook, 2015

REFERENCE BOOKS:

1. B. Gold, N. Morgan, D. Ellis, Speech, and Audio Signal Processing: Processing and Perception of Speech and Music, Wiley, 2011
2. Dr.Shaila D.Apte - Speech and Audio Processing, First Edition, WILEY Precise Textbook, 2015.
3. Douglas O' Shaughnessy - Speech Communications: Human & Machine, Second Edition, Oxford University Press, 2004.

E-RESOURCES:

1. https://nptel.ac.in/courses/117105145
2. https://www.jove.com/librarians/resources
3. https://www.classcentral.com/course/youtube-digital-speech-processing-47859

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	-	-	-	1	-	1
CO2	3	2	2	1	2	-	-	-	-	-	-	1	-	1
CO3	3	2	2	1	2	-	-	-	-	-	-	1	-	1
CO4	3	2	2	1	2	-	-	-	-	-	-	1	-	1
CO5	3	2	2	1	2	-	-	-	-	-	-	1	-	1
AVG	3	2	2	1	2	-	-	-	-	-	-	1	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME54	MEDICAL IMAGING SYSTEMS (For B.E- ECE and BME)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the generation of X-ray and principle of Computed Tomography and its uses in Medical imaging.
- To Learn the principles of different radio diagnostic equipment in Imaging.
- To Explore various imaging techniques for visualizing internal sections of the human body.
- To Gain knowledge of the basic principles and instrumentation used in ultrasound and thermographic imaging..
- To Give an overview of principle of Radio therapy techniques and isotopes.

UNIT-I X-RAYS AND COMPUTED TOMOGRAPHY 9

Principle and production of X – Rays, Selection of anodes, heel pattern, Scattered Radiation, Porter-Bucky systems, Digital Radiography, principles of Angiography and Fluoroscopic Techniques, Image Intensifiers, digital subtraction angiography, mammography, dental X- ray units. Computerized Axial Tomography, Principle, Detectors, image reconstruction, Spiral CT, 3D Imaging.

UNIT-II EMISSION IMAGING 9

Alpha, Beta, Gamma Emission, different types of Radiation Detectors, G.M. & Proportional Counters, Pulse Height Analyzers, Isotopic, Scanners, Principle of PET and SPECT, PET/CT.

UNIT-III MAGNETIC RESONANCE IMAGING 9

Principle of MRI, Relaxation processes and their measurements, Pulse sequencing and MR image acquisition, MRI instrumentation, Magnets, gradient coils, Imaging Different Sections of the Body, Tissue Characterization, MR Spectroscopy, Functional MRI.

UNIT-IV ULTRASOUND IMAGING AND THERMOGRAPHY 9

Wave propagation and interaction in Biological tissues, Acoustic radiation fields, continuous and pulsed excitation, Transducers and imaging systems, Scanning methods, Imaging Modes- A, B & M, Principles and theory of image generation. Thermography Principle, detectors and applications.

UNIT-V THERAPY USING X – RAYS AND ISOTOPES 9

Direct and Indirect effects of high energy radiation, Units for radiation Exposure, Depth Dose curves, Linear Accelerator Betatron, Cobalt and Cesium Therapy, Computation of Absorbed Dose Level, Automatic Treatment Planning, ICRP regulation, Hazardous Effects of Radiation, Radiation measuring units, Allowed Levels, Protection Methods.

TOTAL : 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the principle and working of various radiography and tomography concept and image reconstruction techniques.

CO2: Examine the concept of nuclear imaging techniques and radiation detectors

CO3: Interpret the technique used for visualizing various sections of the body using Magnetic Resonance Imaging.

CO4: Describe the basic principle involved in Ultrasound Imaging technique and Thermography.

CO5: Analyze the effects of radiation, radiation safety and the principle of Radio therapy techniques.

TEXT BOOKS:

1. Dey N, Smart Medical Imaging for Diagnosis and Treatment Planning, Hardcover – 1 Chapman and Hall/CRC , 2024.
2. Isaac Bankman, I. N. Bankman , Handbook Of Medical Imaging: Processing and Analysis(Biomedical Engineering),Academic Press,2000

REFERENCE BOOKS:

1. 1.Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw – Hill, New Delhi, 2003.
2. Dougherty, Geoff (Ed.), "Medical Image Processing - Techniques and Applications ",Springer-Verlag New York, 2011.
3. 3.Medical Devices and Human Engineering (The Biomedical Engineering Handbook, Joseph D. Bronzino, Donald R. Peterson, CRC Press, 2014.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_bt50/preview
2. https://archive.nptel.ac.in/courses/102/105/102105090/
3. https://www.jove.com/librarians/resources.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	1	-	1
CO2	3	2	1	1	2	-	-	-	-	-	-	1	2	1
CO3	3	2	1	1	2	-	-	-	-	-	-	1	1	1
CO4	3	2	1	1	2	-	1	-	-	-	-	1	1	1
CO5	3	2	1	1	2	-	1	-	-	-	-	1	1	1
AVG	3	2	1	1	2	-	1	-	-	-	-	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME55	BRAIN COMPUTER INTERFACE AND APPLICATIONS (For B.E- ECE and BME)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Introduce the concepts of Brain Computer Interfacing (BCI).
- To Study the various signal acquisition methods.
- To Enhance the understanding on BCI signal Processing and parameter extraction.
- To Enable the knowledge on classification of cognitive task from BCI parameter.
- To Design the brain computer interface system using brain signals.

UNIT-I INTRODUCTION **9**

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 **9**

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 task.

UNIT-III FEATURE EXTRACTION METHODS **9**

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 **9**

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 **9**

Functional restoration using Neuroprosthesis - Functional Electrical Stimulation, Visual Feedback and control - External device control, Case study: Brain actuated control of mobile Robot.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Understand the basic concepts of EEG and BCI.
- **CO2:** Analyze event related potentials and sensory motor rhythms.
- **CO3:** Select appropriate for feature extraction methods.
- **CO4:** Allocate functions appropriately to the human and to the machine.
- **CO5:** Implement BCI for various applications.

Chairman
BoS/BME

TEXT BOOKS:

1. Benjamin Evans, The Brain-Computer Interface Revolution: Applications, Ethics, and the Future of Humanity, Paperback – Import, 2024.
2. Azar, A. T. (2015). Brain-Computer Interfaces: Current Trends and Applications. Germany:Springer International Publishing.
3. Rajesh.P.N.Rao, "Brain-Computer Interfacing: An Introduction", Cambridge University Press, First edition, 2013.

REFERENCE BOOKS:

1. Bernhard Graimann, Brendan Allison, Gert Pfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010.
2. Jonathan Wolpaw, Elizabeth Winter Wolpaw, Brain Computer Interfaces Principles and practice, Oxford University Press, USA, Edition 1, January 2012.
3. Recent Advances in Brain-Computer Interface Systems. (2011). Croatia: InTech.

E-RESOURCES:

1. https://nptel.ac.in/courses/108108167
2. https://onlinecourses.nptel.ac.in/noc24_ee01/preview
3. http://learn.neurotechedu.com/introtobci/
4. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	1	2	2
CO2	3	2	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	1	2	-	-	-	-	-	-	1	-	2
CO4	3	2	1	1	2	-	-	-	-	-	-	1	-	3
CO5	3	2	1	1	2	-	-	-	-	-	-	1	-	3
AVG	3	2	1	1	2	-	-	-	-	-	-	1	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME56	BIOMETRIC SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Gain knowledge of iris recognition systems, including their structure and operation.
- To Understand the general principles of design of biometric systems and the underlying trade-off.
- To Recognize personal privacy and security implications of biometrics based identification technology.
- To Analyze the technologies of IRIS recognition.
- To Learn the voice scan technologies.

UNIT-I INTRODUCTION TO BIOMETRICS 9

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 systems.

UNIT-II FINGERPRINT TECHNOLOGY 9

Finger print feature processing techniques – fingerprint sensors using RF imaging techniques –fingerprint quality assessment – computer enhancement and 111imulink111 of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching.

UNIT-III FACE RECOGNITION AND HAND GEOMETRY 9

Face recognition from correspondence maps – Hand geometry – scanning – Feature Extraction – Adaptive Classifiers -Visual- Based Feature Extraction and Pattern Classification – feature extraction – types of algorithm.

UNIT-IV IRIS RECOGNITION 9

Introduction, Anatomical and Physiological underpinnings, Iris sensor, Iris representation and localization- Daugman and Wilde's approach, Iris matching, Iris scan strengths and Weaknesses, System performance, future directions.

UNIT-V VOICE SCAN TECHNIQUES 9

Introduction, components ,features and models, Addition method for managing variability, Measuring performance, Alternative approaches, Voice san strength and weakness,NIST Speaker Recognition Evaluation Program, Biometric system Integration.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Demonstrate the principles of biometric systems.
- **CO2:** Illustrate the various methodologies involved in fingerprint technology.
- **CO3:** Develop techniques for face recognition and hand geometry biometrics.
- **CO4:** Design Iris representation system.

Chairman
BoS/BME

CO5: Classify the different voice scan techniques.

TEXT BOOKS:

1. Rashmi Gupta and Manju Khari, Multimodal Biometric Systems, CRC Press, 2024.
2. James Wayman& Anil Jain, "Biometric Systems- Technology Design and Performance Evaluation", SPRINGER (SIE), 1st Edition, 2011.
3. S.Y. Kung, S.H. Lin, M.W., "Biometric Authentication: A Machine Learning Approach", Prentice Hall, 2004.

REFERENCE BOOKS:

1. Paul Reid, "Biometrics for Network Security", Pearson Education, 2004.
2. Nalini K Ratha, Ruud Bolle, "Automatic fingerprint Recognition System",Springer, 2003.
3. L C Jain, I Hayashi, S B Lee, U Halici, "Intelligent Biometric Techniques in Fingerprint and Face Recognition" CRC Press, 1999.

E-RESOURCES:

1. https://nptel.ac.in/courses/106104119
2. https://www.jove.com/librarians/resources
3. https://egyankosh.ac.in/bitstream/123456789/89053/1/Unit-4.pdf

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-	1	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-	1	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-	1	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-	1	-	-
AVG	3	2	1	1	2	-	-	-	-	-	-	1	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME57 DEEP LEARING FOR BIOMEDICAL APPLICATIONS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To Gain knowledge on the concepts of deep learning.
- To Provide insight into recent CNN architectures and deep models
- To Enable the students to know Recurrent Neural Networks
- To Apply the concepts of deep generative models for different applications.
- To Enable the students to know deep learning techniques to support real-time applications

UNIT-I FOUNDATION OF NEURAL NETWORKS AND DEEP LEARNING 9

Neural Networks-Training neural networks, Activation Functions, Loss functions, Hyper parameters, Fundamentals of Deep Networks-Defining Deep Learning, Common Architectural Principles of Deep Networks, Parameters, Layers, Activation Functions, Loss Functions

UNIT-II CONVOLUTION NEURAL NETWORKS 9

Architectural Overview – Input Layers, Convolutional Layers, Pooling Layers, Fully Connected Layers – Filters – Parameter sharing – Regularization, Popular CNN Architectures: ResNet,AlexNet

UNIT-III RECURRENT AND RECURSIVE NETS - SEQUENCE MODELLING. 9

Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder, Sequence to Sequence architectures - BPTT for training RNN

UNIT-IV AUTO ENCODERS AND DEEP GENERATIVE MODELS 9

Introduction to Android, Creating Android Activities, Android User interface design, Access Wi-fi and Bluetooth with mobile applications-Web based App for e-health applications.

UNIT-V RECENT TRENDS IN DEEP LEARNING 9

Recent Models of Deep Learning, Genomics, Predictive Medicine, Clinical Imaging, Lip Reading, Visual Reasoning.

THEORY : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Differentiate the concept of machine learning with deep learning techniques.
- **CO2:** Understand and visualize Convolutional Neural Networks for real-world applications.
- **CO3:** Demonstrate the use of Recurrent Neural Networks and Transformer based for time series prediction.
- **CO4:** Illustrate autoencoder and deep generative models to solve problems with high dimensional data.
- **CO5:** Analyse the latest trends in deep learning.

Chairman
BoS/BME

TEXT BOOKS:

1. Deep Learning: A Practitioner's Approach" by Adam Gibson and Josh Patterson ,2020.

2. Wei Di, Anuragh Bharadwaj, "Deep Learning Essentials", Jianing Wei, Packt Publishers,2018.

REFERENCE BOOKS:

1. Nikhil Buduma, Nicholas, "Fundamentals of Deep Learning", O Reilly Media, 2017
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016. Suraj Sawant. "Deep Learning", IGI Global, 2018

E-RESOURCES:

1. https://pmc.ncbi.nlm.nih.gov/articles/PMC6455466/
2. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	-	-	-	-	-	-	1	2	-
CO2	3	2	1	2	1	-	-	-	-	-	-	1	2	-
CO3	3	2	1	1	1	-	-	-	-	-	-	-	2	-
CO4	3	2	1	1	1	-	-	-	-	-	-	-	2	-
CO5	3	2	1	1	1	-	-	-	-	-	-	-	2	-
AVG	3	2	1	1	1	-	-	-	-	-	-	1	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME58	BIO INSPIRED COMPUTING (FOR B.E-ECE AND BME)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Learn adequate knowledge on genetic algorithm.
- To Explore the concepts and methodologies used in multi-objective optimization techniques.
- To Acquire sound knowledge on particle swarm optimization algorithm
- To Provide comprehensive knowledge of genetic algorithms and their role in evolutionary computation.
- To Enlighten about hybrid optimization in the Neural Network Models.

UNIT-I EVOLUTIONARY COMPUTATION AND GENETIC ALGORITHM 9

Evolutionary Computation (EC), Features of EC, Genetic Algorithms, Crossover and Mutation Operators, Selection Mechanism – Fitness Proportionate- Ranking and Tournament selection- Building Block – Hypothesis and Schema Theorem- Application

UNIT-II ANT COLONY OPTIMIZATION 9

Ant Colony Optimization - From real to artificial ants, ACO Algorithm, ACO and model based search, ACO Pheromone Updation and Evaporation, Applications

UNIT-III PARTICLE SWARM OPTIMIZATION 9

Particle Swarm Optimization-Anatomy of a Particle, Velocity and Position Updation, PSO topologies, Control Parameters, Application.

UNIT-IV MULTI-OBJECTIVE OPTIMIZATION 9

Multi-Objective Optimization- Ranking and Diversity, Classical Multi-Objective Optimization Methods, Non-Dominated Genetic Algorithm, Strength Pareto Evolutionary algorithm, Performance assessment of Multi-Objective EC Techniques

UNIT-V RECENT ADVANCES IN SWARM INTELLIGENCE TECHNIQUES 9

Grey-Wolf Optimization- Crow Search Optimization, Salp Swarm Algorithm, Case Studies on Hybrid Optimization Methods for Neural Networks Evolution for real-world application.

THEORY : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

- **CO1:** Implement and apply genetic algorithms.
- **CO2:** Build and apply ANT colony optimization technique
- **CO3:** Implement and apply particle swarm optimization algorithm.
- **CO4:** Implement and apply multi-objective optimization method.
- **CO5:** Apply hybrid optimization in the Neural Network Models for real-world applications.

Chairman
BoS/BME

TEXT BOOKS:

1. David E.Goldberg, "Genetic Algorithms in search, Optimization & Machine Learning", Pearson Education,2020.
2. Xin Xin-She Yang, "Recent Advances in Swarm Intelligence and Evolutionary Computation", Springer International Publishing, Switzerland, 2019.
3. Kenneth A De Jong, "Evolutionary Computation A Unified Approach", Prentice Hall of India, New Delhi,2006

REFERENCE BOOKS:

1. Marco Dorigo and Thomas Stutzle, "Ant Colony optimization", Prentice Hall of India, New Delhi, 2004
2. N P Padhy, "Artificial Intelligence and Intelligent Systems",Oxford University Press, 2019
3. Engel brecht, A.P., "Fundamentals of Computational Swarm Intelligence",Wiley,2020.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs54/preview
2. http://www.digimat.in/nptel/courses/video/102101068/L19.html
3. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	-	1	-	1	-	-	1	2	1
CO2	3	3	2	3	1	-	1	-	1	-	-	1	2	2
CO3	3	3	2	3	1	-	1	-	1	-	-	1	-	2
CO4	3	3	2	3	1	-	1	-	1	-	-	1	-	2
CO5	3	3	2	3	1	-	1	-	1	-	-	1	-	2
AVG	3	2.8	2	3	1	-	1	-	1	-	-	1	2	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME61	COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the principles and techniques of various analog modulation schemes
- To Learn different digital communication methods and their performance characteristics
- To Gain knowledge of pulse modulation techniques and their applications in communication systems.
- To Study the principles and methods of demodulation for analog and digital signals
- To Analyze the effects of noise in communication systems and evaluate receiver performance

UNIT I ANALOG MODULATION **9**

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – Angle modulation – PM and FM –Modulators and Demodulators

UNIT II BANDPASS SIGNALING **9**

Geometric representation of signals – Correlator and matched filter – ML detection – generation and detection, PSD, BER of coherent BPSK, BFSK, QPSK – Principles of QAM – Structure of non-coherent receivers – BFSK, DPSK

UNIT III PULSE MODULATION TECHNIQUES **9**

Pulse modulation Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Digital Multiplexers, Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Width Modulation

UNIT IV DEMODULATION TECHNIQUES **9**

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission – Intersymbol Interference, Optimum demodulation of digital signals over band-limited channels.

UNIT V RECEIVER CHARACTERISTICS **9**

Noise sources and types – Noise figure and noise temperature – Noise in cascaded systems – Single tuned receivers – Super heterodyne receivers.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Gain knowledge in amplitude modulation techniques

CO2: Understand the concept of band pass signals

Chairman
BoS/BME

CO3: Gain knowledge in Pulse Modulation techniques
CO4: Understand the importance of demodulation techniques
CO5: Knowledge on various types of noises during transmission

TEXT BOOKS:

1. Simon Haykin; Michael Moher; Ajay Singh Raghuvanshi; Shweta Shah,"Communication Systems" , 5ed, ISV, An Indian Adaptation, 2022.
2. B.P.Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 3rd Edition, 2007
3. H Taub, D L Schilling, G Saha, "Principles of Communication Systems", TMH, 3rd Edition, 2007

REFERENCE BOOKS:

1. H P Hsu, Schaum "Outline Series, Analog and Digital Communications", TMH, 2006
2. B.Sklar, "Digital Communications Fundamentals and Applications", Pearson Education, 2nd Edition, 2007

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee05/preview2, " Principles of Communication Systems", Prof. Aditya K. Jagannatham
2. https://archive.nptel.ac.in/courses/108/104/108104091/, "Communication Systems", Prof. Aditya K. Jagannatham
3. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	1	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	1	-	-	-	-	-	-	-	1	-	-
AVG	3	2	1	1	-	-	-	-	-	-	-	1	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME62	WEARABLE DEVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Learn the hardware requirement of wearable systems
- To Understand the communication and security aspects in the wearable devices
- To Analyze the concept of signal processing to wearble devices
- To Study about application of wearable device in textile industry
- To Describe the applications of wearable devices in the field of medicine

UNIT I INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS 9

Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor.

UNIT II SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES 9

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles

UNIT III WIRELESS HEALTH SYSTEMS 9

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 IV SMART TEXTILE 9

Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks.Case study-smart fabric for monitoring biological parameters - ECG, respiration.

UNIT V APPLICATIONS OF WEARABLE SYSTEMS 9

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

TOTAL HOURS: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the concepts of wearable system.
CO2: Apply the energy harvestings in wearable device.
CO3: Apply the concepts of BAN in health care.
CO4: Illustrate the concept of smart textile
CO5: Analyze the various wearable devices in healthcare system

TEXT BOOKS:

1. Ram K. Gupta, Flexible and Wearable Sensors, Ist edition, Hardcover – Import, 2023
2. Zhang and Yuan-Ting, Wearable Medical Sensors and Systems,Springer, 2013
3. Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation and Applications, Elsevier, 2014

REFERENCE BOOKS:

1. Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013.
2. Guang-Zhong Yang, Body Sensor Networks, Springer, 2006.
3. Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementation applications,Pan Stanford Publishing Pte.Ltd, Singapore, 2012

E-RESOURCES:

1. https://onlinecourses.swayam2.ac.in/nou23_bt05/preview,"Biomedical Instrumentation & Sensors", Dr. Piyush Lotia
2. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	1	-	-	-	-	2	1	2
CO2	3	2	1	1	2	-	1	-	-	-	-	2	1	2
CO3	3	2	1	1	2	-	1	-	-	-	-	2	1	2
CO4	3	2	1	1	2	-	1	-	-	-	-	2	1	2
CO5	3	2	1	1	2	-	1	-	-	-	-	2	1	2
AVG	3	2	1	1	2	-	1	-	-	-	-	2	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME63	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds.

UNIT II VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyper jacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

TOTAL HOURS: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the design challenges in the cloud.
CO2: Apply the concept of virtualization and its types.
CO3: Experiment with virtualization of hardware resources and Docker.
CO4: Develop and deploy services on the cloud and set up a cloud environment.
CO5: Explain security challenges in the cloud environment.

TEXT BOOKS:

1. Thomas Erl, Eric Barceló Monroy, "Cloud Computing: Concepts, Technology, Security & Architecture," 2nd edition, Pearson Education, 2024.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 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. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_cs107/preview

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	2	3	1	3	2	1	3
CO2	3	1	2	2	1	-	-	1	2	1	3	2	2	1
CO3	2	3	2	3	1	-	-	3	1	1	3	1	1	1
CO4	1	2	3	3	3	-	-	3	3	1	2	1	3	3
CO5	2	3	3	1	3	-	-	2	2	1	2	2	2	3
AVG	2	2	2	2	2	-	-	2	2	1	2	1	1	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME64	FUNDAMENTALS OF HEALTHCARE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the statistical methods for the design of biomedical research.
- To Study the fundamental of mathematical and statistical theory in the application of Healthcare.
- To Apply the regression and correlation analyze in the healthcare data.
- To Understand the Meta analysis and variance analysis.
- To Interpret the results of the investigational methods.

UNIT-I INTRODUCTION **9**

Introduction, Computers and bio statistical analysis, Introduction to probability, likelihood & odds, distribution variability. Finding the statistical distribution using appropriate software tool like R/ Python.

UNIT-II STATISTICAL PARAMETERS **9**

Statistical parameters p-values, computation, level chi square test and distribution and hypothesis testing -single population proportion, difference between two population proportions, single population variance, tests of homogeneity. Testing of statistical parameters using appropriate software R / Python.

UNIT-III REGRESSION AND CORRELATION ANALYSIS **9**

Regression model, evaluating the regression equation, correlation model, correlation coefficient. Finding regression, correlation for the data using appropriate software like R / Python.

UNIT-IV ANALYSIS OF VARIANCE **9**

META analysis for research activities, purpose and reading of META analysis, kind of data used for META analysis, completely randomized design, factorial experiment. Testing the variance using appropriate software tool like R / Python.

UNIT-V CASE STUDIES **9**

Epidemical reading and interpreting of epidemical studies, application in community health, Case study on Medical Imaging like MRI, CT. Respiratory data and ECG data.

TOTAL: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the new and existing statistical methodology for their research problem.

CO2: Apply p- values for different statistical test.

CO3: Analyze the biomedical research data and able to report the study results.

CO4: Enumerate the Meta analysis and variance analysis.

CO5: Describe problems of human health and disease for the interest of the public's Health.

TEXT BOOKS:

1. Himani Bansal, Balamurugan Balusamy, T. Poongodi, Firoz Khan KP, Machine Learning and Analytics in Healthcare Systems, CRC Press,2021.
2. Wayne W. Daniel, Biostatistics-A Foundation for Analysis in the Health Sciences, John Wiley & Sons Publication, 10th Edition, 2013.
3. Peter Armotage, Geoffrey Berry and J.N.S.Mathews, Statistical methods in Medical Research, Wiley-Blackwell, 4th Edition, 2001.

REFERENCE BOOKS:

1. Marcello Pagano and Kimberlee Gauvreu, Principles of Biostatistics, Chapman and Hall/CRC, 2ndEdition, 2018.
2. Ronald N Forthofer and EunSul Lee, Introduction to Biostatistics, Academic Press, 1st Edition, 2014.
3. Animesh K. Dutta, Basic Biostatistics and its Applications, New Central Book Agency, 1st Edition, 2006.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_hs62/
2. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	1	1	-	1
CO2	3	3	1	1	1	-	-	-	-	-	1	1	-	1
CO3	3	3	1	1	1	-	-	-	-	-	1	1	-	1
CO4	3	3	1	1	1	-	-	-	-	-	1	1	-	1
CO5	3	3	1	1	1	-	-	-	-	-	1	1	-	1
AVG	3	3	1	1	1	-	-	-	-	-	1	1	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME65	TELEHEALTH TECHNOLOGY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To learn the key principles for telemedicine and health
- To understand telemedical technology.
- To learn about the infrastructure for telemedicine
- To know telemedical standards, mobile telemedicine and it applications
- To learn about the applications of telemedicine.

UNIT I FUNDAMENTALS OF TELEMEDICINE 6

History of telemedicine, definition of telemedicine, tele-health, tele-care, scope, Telemedicine Systems, benefits & limitations of telemedicine.

UNIT II TYPE OF INFORMATION & COMMUNICATION INFRASTRUCTURE FOR TELEMEDICINE 6

Audio, video, still images, text and data, internet, air/ wireless communications, GSM satellite, micro wave, Mobile health and ubiquitous healthcare.

UNIT III ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE 6

Confidentiality, patient rights and consent: confidentiality and the law, the patient-doctor relationship, access to medical records, consent treatment - data protection and security, jurisdictional issues.

UNIT IV PICTURE ARCHIVING AND COMMUNICATION SYSTEM 6

Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

UNIT V APPLICATIONS OF TELEMEDICINE 6

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery.

THEORY: 30 PERIODS

PRACTICALS:

1. Porting sensor data on mobile devices
2. IoT for healthcare monitoring
3. Porting medical data on cloud platform
4. Cloud computing applications in health informatics
5. Study of telemedicine tools
6. Design of an application for mobile devices

PRACTICAL: 30 PERIODS

TOTAL (30+30) =60 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Analyze the benefits and limitations of telemedicine.
CO2: Apply multimedia technologies in telemedicine.
CO3: Explain protocols behind encryption techniques for secure transmission of data.
CO4: Develop radiology based information system.
CO5: Apply telemedicine in various healthcare domains

TEXT BOOKS:

1. Mamta Mittal, Gopi Battineni, Information and Communication Technology (ICT) Frameworks in Telehealth, Springer International Publishing AG, 1st ed. 2022.
2. Olga Ferrer Roca, Marcelo Sosa Iudicissa, "Handbook of Telemedicine", IOS Press, Netherland, 2002
3. Khandpur R S, "TELEMEDICINE – Technology and Applications", PHI Learning Pvt Ltd., New Delhi, 2017

REFERENCE BOOKS:

1. K Huang, "PACS and Imaging Informatics: Basic Principles and Applications" Wiley, New Jersey, 2010.
2. Khandpur R S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003
3. Keith J Dreyer, Amit Mehta, James H Thrall, "Pacs: A Guide to the Digital Revolution", Springer, New York, 2002.

E-RESOURCES:

1. https://elearn.nptel.ac.in/shop/nptel/fundamentals-of-telehealth-and-virtual care/?v=c86ee0d9d7ed, "Fundamentals of Telehealth and Virtual Care ",Mr. Chandramouli

CO's – PO's & PSO's MAPPING

CO PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	2	-	2
CO2	3	2	1	1	2	-	-	-	-	-	-	2	-	2
CO3	3	2	1	1	2	-	-	-	-	-	-	2	-	2
CO4	3	2	1	1	2	-	1	-	-	-	-	2	-	2
CO5	3	2	1	1	2	-	1	-	-	-	-	2	-	2
AVG	3	2	1	1	2	-	1	-	-	-	-	2	-	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME66	MEDICAL INFORMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the structure of medical informatics and its systems
- To Explore the patient record digitisation techniques
- To Study the clinical approaches and advancements in applying informatics using computers in imaging
- To Understand the structure of medical informatics and its systems analyze the theories and practices adopted in Hospital Information Systems
- To Learn ICT applications in medicine with an introduction to health informatics

UNIT I MEDICAL INFORMATICS **9**

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues, Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, e-health services, Health Informatics – Medical Informatics, Bioinformatics

UNIT II COMPUTERISED PATIENT RECORD **9**

Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT III COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING **9**

Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computerized ECG, EEG and EMG, Computer assisted medical imaging- nuclear medicine, ultrasound imaging ultrasonography-computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance

UNIT IV COMPUTER ASSISTED MEDICAL DECISION-MAKING **9**

Neuro computers and Artificial Neural Networks application, Expert system – General model of CMD, Computer –assisted decision support system-production rule system cognitive model, semester networks, decisions analysis in clinical medicine-computers in the care of critically patients-computer assisted surgery-designing, Deep learning algorithms- CNN, MLP.

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS **9**

Virtual reality applications in medicine, IOT healthcare and medical information distribution Computer assisted surgery , Surgical simulation Telemedicine - Tele surgery computer aids for the handicapped, computer assisted instrumentation in Medical Informatics – Computer assisted patient education and health - Medical education and health care information.

TOTAL: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Gain knowledge on the structure of medical informatics an its functioning

CO2: Learn about the clinical information system computerization

CO3: Discuss about automatic computerization in different bio signal acquisition.

CO4: Explain the function of Hospital Information Systems

CO5: Analyze about health informatics and different ICT applications in medicine

TEXT BOOKS:

1. Pijush Samui, Sanjiban Sekhar Roy, Wengang Zhang, Y H Taguchi, Machine Learning and IoT Applications for Health Informatics, CRC Press,2024.
2. R.D.Lele Computers in medicine progress in medical informatics, Tata McGraw Hill Publishing computers Ltd,2005, New Delhi

REFERENCE BOOKS:

1. OrpitaBosu and Simminder Kaur Thukral, "Bioinformatics Databases, Tools and Algorithms", Oxford University press, 2007
2. Yi Ping Phoebe Chen, "Bioinformatics Technologies", Springer International Edition, New Delhi, 2007
3. Mohan Bansal, Medical informatics Tata McGraw Hill Publishing computers Ltd, 2003 New Delhi

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_bt34/preview, "Medical Image Analysis", Prof. Ganapathy krishnamurthi
2. https://onlinecourses.nptel.ac.in/noc21_bt06/preview, "BioInformatics", Prof. Michael Gromiha
3. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	1	-	-	-	-	1	1	1
CO2	3	2	1	1	2	-	1	-	-	-	-	1	1	1
CO3	3	2	1	1	2	-	1	-	-	-	-	1	1	1
CO4	3	2	1	1	2	-	1	-	-	-	-	1	1	1
CO5	3	2	1	1	2	-	1	-	-	-	-	1	1	1
AVG	3	2	1	1	2	-	1	-	-	-	-	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME67	AMBULATORY SERVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Analyze artifacts and apply denoising techniques in patient monitoring systems
- To Design ambulance vehicles and comply with regulations for patient transportation.
- To Analyze efficient lift mechanisms for patient transport in ambulances.
- To Assess the design and regulatory aspects of mobile diagnostic equipment in ambulances.
- To Evaluate smart safety systems and automated alert systems in accident care.

UNIT-I PATIENT MONITORING SYSTEMS **9**

Artifacts - Denoising techniques - Advancements in Wireless patient Monitoring system - Case study.

UNIT-II DESIGN OF AMBULANCE **9**

Vehicle Design - Ambulance Train - Disaster Relief Squad - Regulation for Patient Transportation - Case Study.

UNIT-III LIFT MECHANISM **9**

Design of Lift Mechanism for Patient - Design of Lift in Ambulance - Computer Based Systems - Case Study.

UNIT-IV DESIGN OF MOBILE DIAGNOSTIC EQUIPMENT **9**

Devices with Battery Backup - Mobile X-Ray Unit - Nursing - Medical Gas Handling – Regulations - GPS In Ambulance Networked Services - Case Study.

UNIT-V ACCIDENT CARE SYSTEMS **9**

Automated Alert System - Smart Safety Systems - Fire Protection - Maintenance And Regulation -Accreditation for Ambulance Services - Case Study.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Demonstrate advanced medical devices and systems for patient monitoring, diagnosis, and emergency care.

CO2: Apply principles of biomedical engineering to create innovative solutions for patient transportation and care

CO3: Analyze safety and regulatory standards for medical devices and healthcare systems.

CO4: Evaluate the efficiency and effectiveness of healthcare equipment and technology in clinical settings.

CO5: Deduce insights from seminar presentations to improve the design and functionality of patient monitoring and emergency care systems.

Chairman
BoS/BME

TEXT BOOKS:

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. Andreas F. Molisch, "Wireless Communications", 2nd Edition, John Wiley & sons, USA, 2010.

REFERENCE BOOKS:

1. Jochen Schiller, "Mobile Communications", Addison Wesley Publishers, 2000.
2. Yi-Bing Lin and Imrich Chlamtac, "Wireless and Mobile Network Architecture", 2nd Edition, John Wiley and Sons, New Delhi, 2001.
3. Feher K., "Wireless Digital Communications", Prentice Hall of India, New Delhi, 1995.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/114/106/114106046/
2. https://nptel.ac.in/courses/112104160
3. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	2	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	2
CO4	-	3	-	3	-	-	-	-	-	-	-	-	-	2
CO5	-	-	-	-	-	-	-	3	3	-	2		-	-
AVG	3	3	3	3	-	-	-	3	3	-	2	2	-	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME68	BIOTELEMETRY AND TELEMEDICINE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Provide a foundational understanding of telemetry principles
- To Familiarize with basic concepts of Biotelemetry & Telemedicine
- To Equip students with the knowledge to utilize telemedicine in healthcare delivery
- To Provide students with a comprehensive understanding of the telemedical technologies
- To Study about the application of Biotelemetry & Telemedicine

UNIT-I BASICS OF TELEMETRY 9

Introduction, fundamental of RF telemetry, basic telemetry, system components of coding resolution, pulse code modulation, PCM multiplexing and conversion, PCM data transmission, PCM PSD system. Theoretical comparison of telemetry systems, sub modulation methods.

UNIT-II BIOTELEMETRY 9

Measurement of Blood pressure – Direct Methods and Indirect Methods -Temperature - Respiration rate - Heart rate measurement - Apnea detectors -Oximetry -Pulse oximeter, Ear oximeter - Computerized patient monitoring system– Bedside, Central Monitoring system – Biotelemetry: Basics components, and its different types.

UNIT-III TELEMEDICINE AND HEALTH 9

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Telehealth, Tele care, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine

UNIT-IV TELEMEDICAL TECHNOLOGY 9

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, GSM satellite, and Micro wave, Modulation techniques, LAN and WAN technology. Satellite communication. Mobile hand held devices and mobile communication. Internet technology and telemedicine using world wide web (www).

UNIT-V TELEMEDICAL APPLICATIONS 9

Telemedicine access to health care services – health education and self care. · Introduction to robotics surgery, telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand basic Telemetry, Biotelemetry & Telemedicine system/ subsystems

CO2: Describe basic components and different methods of telemetry

CO3: Analyze the basics of telemedicine and health

CO4: Identify and describe modern telemedical technologies

CO5: Understand the application of Biotelemetry & Telemedicine in modern healthcare technology

Chairman
BoS/BME

TEXT BOOKS:

1. Rajarao C and Guha S.K. "Principles of Medical Electronics and Bio-medical Instrumentation", Universities press (India) Ltd, First Edition, Orient Longman Ltd, 2022.
2. Wootton, R., Craig, J., Patterson, V. (Eds.), "Introduction to Telemedicine. Royal Society of Medicine" Press Ltd, Taylor & Francis 2019

REFERENCE BOOKS:

1. Ferrer-Roca, O., Sosa - Iudicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2022.
2. Simpson, W. Video over IP. A practical guide to technology and applications. Focal Press Elsevier, 2020.

E-RESOURCES:

1. https://elearn.nptel.ac.in/shop/nptel/fundamentals-of-telehealth-and-virtual-care/?v=c86ee0d9d7ed
2. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/biotelemetry
3. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	3	-	-	-	3	2	3	2	-
CO2	3	-	3	-	-	3	2	-	2	2	2	3	2	-
CO3	1	-	3	-	-	3	2	-	2	2	2	2	2	2
CO4	3	-	3	-	-	3	2	-	2	3	2	-	-	2
CO5	1	-	3	-	-	3	2	-	2	2	2	-	-	-
AVG	2.2	-	3	-	-	3	2	-	2	2.4	2	2.6	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME71	BIO MEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To understand various mechanical and thermal sensors and actuators and their principles of operation at the micro scale level.
- To understand various electrostatic and piezoelectric sensors and actuators at the micro scale level.
- To introduce microfluidic systems.
- To know on the applications of MEMS in different field of medicine.

UNIT-I MEMS MATERIALS AND FABRICATION 9

MEMS and microsystems-Silicon and its Compounds – Photolithography- Ion implanation-Diffusion –Oxidation- CVD-PVD-Etching-Surface micromachining –Bulk micromachining-LIGA.

UNIT-II MECHANICAL AND THERMAL SENSORS AND ACTUATORS 9

Mechanical sensors and actuators – beam and cantilever –microplates, strain, pressure and flow measurements, Thermal sensors and actuators- actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys- Inertia sensor, flowsensor.

UNIT-III ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATOR 9

Electrostatic 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 MICROFLUIDIC SYSTEMS 9

Laminar flow in circular conduits, fluid flow in micro conduits, in submicrometer and nanoscale. microfluidic components (filters, mixers, valves, and pumps)

UNIT-V APPLICATIONS OF BIOMEMS 9

CAD for MEMS - Micro Total Analysis system - Lab-on-Chip devices - Microactuators and Drug delivery - DNA microarrays - Implantable microelectodes - Microtools for surgery.

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1	Understand various MEMS fabrication techniques.
CO2	Elucidate different types of mechanical and thermal sensors and actuators and their principles of operation at the micro Scale level.
CO3	Apply different types of various electrostatic and piezoelectric sensors and actuators and their principles of operation at the micro Scale level.
CO4	Explain microfluidic systems
CO5	Illustrate MEMS in different field of medicine.

Chairman
BoS/BME

TEXT BOOKS:

1. TaiRan Hsu,MEMS and Microsystems Design and Manufacture, Tata McGrawHill Publishing Company, New Delhi, 2020.
2. WanjunWang and Stephen A.Soper, BioMEMS:Technologies and Applications, CRC Press, NewYork, 2007.
3. Chang Liu, Foundations of MEMS, Pearson Education International, New Jersey, USA, 2011.

REFERENCE BOOKS:

1. Alok Pandya ,Vijai Singh, Micro/Nanofluidics and Lab-on-Chip Based Emerging Technologies for Biomedical and Translational Research Applications - Part B, Academic Press, 2022
2. Ellis Meng, Biomedical Microsystems, CRC Press, Boca Raton, FL, 2011.
3. P. Tabeling, S .Chen, Introduction to microfluidics, Oxford University Press, 2010.

E-RESOURECES:

1. https://nptel.ac.in/courses/112104181
2. https://nptel.ac.in/courses/117105082
3. https://archive.nptel.ac.in/content/syllabus_pdf/112104029.pdf

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	1	-	1
CO2	3	2	1	1	2	-	-	-	-	-	-	1	1	-
CO3	3	2	1	1	2	-	-	-	-	-	-	1	-	1
CO4	3	2	1	1	2	-	-	-	-	-	-	1	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-	1	1	-
AVG	3	2	1	1	2	-	-	-	-	-	-	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME72	CRITICAL CARE AND OPERATION THEATRE EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To offer clear understanding of various intensive care equipment and their working.
- To understand the Critical Care Equipment and their working.
- To understand the necessity of different operation theatre equipment.
- To know about different Centralised Systems.
- To know about Patient electrical safety .

UNIT-I INTENSIVE CARE UNIT EQUIPMENT **9**

Suction apparatus, Different types; Sterilizers, Chemical, Radiation, Steam for small and large units. ICU ventilators. Automated drug delivery systems, Infusion pumps, components of drug infusion system, closed loop control infusion system, implantable infusion system. BMD Measurements – SXA – DXA - Quantitative ultrasound bone densitometer

UNIT-II CRITICAL CARE EQUIPMENT **9**

Defibrillators, Hemodialysis Machine, Different types of Dialyzers, Membranes, Machine controls and measurements. Heart Lung Machine, different types of oxygenators, peristaltic pumps, Incubators.

UNIT-III OPERATION THEATRE EQUIPMENT **9**

Craniotomy, Electrosurgical Machines (ESU), electrosurgical analyzers, surgical aspirator,, Instruments for operation. Anesthesia Machine, Humidification, Sterilization aspects, Boyles apparatus. Endoscopy – Laparoscopy - Cryogenic Equipment - Anesthesia gas, Anesthesia gas monitor, - surgical microscope.

UNIT-IV CENTRALISED SYSTEMS **9**

Centralized Oxygen, Nitrogen, Air supply & Suction. Centralized Air Conditioning, Operation Theatre table & Lighting. C Arm.

UNIT-V PATIENT SAFETY **9**

Patient electrical safety, Types of hazards, Natural protective mechanisms against electricity, Leakage current, Inspection of grounding and patient isolation, Hazards in operation rooms, ICCU and IMCUs, Opto couplers and Pulse transformers.

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1: Apply the knowledge acquired, in designing new monitoring devices for ICU and assist the medical personnel's during emergency situations

CO2: Design the devices for the Critical Care Equipment based on given specifications.

CO3: Assess the merits of the operation theatre equipment based on its applications

CO4: Compare the various techniques for Centralised System and its recent methods

CO5: Understand various Types of Patient Safety technology.

Chairman
BoS/BME

TEXT BOOKS:

1. John G. Webster, "Medical Instrumentation Application and Design", 5th edition, Wiley India Pvt Ltd, New Delhi, 2020
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2012
3. Khandpur. R.S.,"Handbook of Biomedical Instrumentation". Second Edition. Tata McGrawHill Pub. Co.,Ltd. 2003

REFERENCE BOOKS:

1. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008.
2. Antony Y.K.Chan,"Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2008.
3. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	2	-	1
CO2	3	2	1	1	1	-	-	-	-	-	-	2	-	1
CO3	3	2	1	1	1	-	-	-	-	-	-	2	-	1
CO4	3	2	1	1	1	-	-	-	-	-	-	2	-	1
CO5	3	2	1	1	1	-	-	-	-	-	-	2	-	1
AVG	3	2	1	1	1	-	-	-	-	-	-	2	-	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME73	HUMAN ASSISTIVE DEVICES (For B.E- ECE and BME)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study the role and importance of machines that takes over the functions of the heart and lungs.
- To study various mechanical techniques that help a non-functioning heart.
- To learn the functioning of the unit which does the clearance of urea from the blood.
- To understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
- To study about recent techniques used in modern clinical applications

UNIT-I HEART LUNG MACHINE AND ARTIFICIAL HEART **9**

Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for Cardiac Transplant, Driving Mechanism, Blood Handling System, Functioning and different types of Artificial Heart, Schematic for temporary bypass of left ventricle.

UNIT-II CARDIAC ASSIST DEVICES **9**

Assisted through Respiration, Right and left Ventricular Bypass Pump, Auxiliary ventricle, Open Chest and Closed Chest type, Intra Aortic Balloon Pumping, Prosthetic Cardiac valves, Principle of External Counter pulsation techniques.

UNIT-III ARTIFICIAL KIDNEY **9**

Indication and Principle of Haemodialysis, Membrane, Dialysate, types of filter and membranes, Different types of hemodialyzers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type.

UNIT-IV RESPIRATORY AND HEARING AIDS **9**

Ventilator and its types-Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types of Deafness, Hearing Aids, SISI, masking techniques, wearable devices for hearing correction.

UNIT-V RECENT TRENDS **9**

Transcutaneous electrical nerve stimulator, bio-feedback, Diagnostic and point-of-care platforms.

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

- **CO1:** Examine the principles and construction of artificial heart
- **CO2:** Understand various mechanical techniques that improve therapeutic technology
- **CO3:** Explain the functioning of the membrane or filter that cleanses the blood.
- **CO4:** Analyze the tests to assess the hearing loss and development of wearable devices for the same.
- **CO5:** Analyze and research on electrical stimulation and biofeedback techniques in rehabilitation and physiotherapy.

Chairman
BoS/BME

TEXT BOOKS:

1. Mr. K. Gopal Ram, Mrs. D.K. Kalaivani, Mr. G. Pratheep, Dr. M. Sivaprakash," Human Assist Devices", San International Scientific Publication, 2024.
2. Gray E Wnek, Gray L Browlin – Encyclopedia of Biomaterials and Biomedical Engineering –Marcel Dekker Inc New York 2008.
3. John. G . Webster – Bioinstrumentation - John Wiley & Sons (Asia) Pvt Ltd - 2014

REFERENCE BOOKS:

1. Andreas.F. Von racum, "Hand book of bio material evaluation", Mc-Millan publishers, 2014.
2. Joseph D.Bronzino, The Biomedical Engineering Handbook, Fourth Edition: Three Volume Set, CRC Press, 2018

E-RESOURCES:

1. https://www.youtube.com/watch?v=MyW6Hpekfio
2. https://archive.nptel.ac.in/courses/112/106/112106248/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	1	-	1
CO2	3	2	1	1	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	1	-	-	-	-	-	-	-	1	-	1
CO4	3	2	1	1	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	1	-	-	-	-	-	-	-	1	1	-
AVG	3	2	1	1	-	-	-	-	-	-	-	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME74	ADVANCEMENTS IN HEALTHCARE TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Learn the concepts in digital health care and digital hospitals
- Understand the needs for digital radiology
- Learn the concepts in E-health
- Understand the needs for wearable devices and the technology
- Apply the tools in design, testing and developing digital health care equipment

UNIT-I DIGITAL HEALTH **9**

Digital Health: Requirements and best practices, Laws and regulations in Digital health, Ethical issues, barriers and strategies for innovation.

UNIT-II DIGITAL RADIOLOGY **9**

Digital radiology for digital hospital, picture archiving and communication, system integration, digital history of radiology, medical image archives, storage and networks.

UNIT-III E-HEALTH **9**

E-Health: Health care networking, medical reporting using speech recognition, physiological tests and functional diagnosis with digital methods, tele-consultation in medicine and radiology.

UNIT-IV M-HEALTH CARE AND WEARABLE DEVICES **9**

Introduction to mobile healthcare devices-economy-average length of stay in hospital, outpatient care, health care costs, mobile phones, 4G, smart devices, wearable devices, Uptake of e-health and m-health technologies. Standards, system Design and case study.

UNIT-V MODALITY AND STANDARDS FOR INTER-OPERABILITY **9**

Multimodality registration in daily clinical practice. Mobile healthcare. Selection and Implementation in e-Health project, design of medical equipment based on user needs. Security and privacy in digital health care. Case study.

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1: Interpret the need for digital methods of handling medical records

CO2: Apply the Digital radiology for digital hospital

CO3: Apply the tools and methods for work flow in E-Health

CO4: Examine the available technology for wearable healthcare devices

CO5: Analyze various standards for inter-operability of devices, quality and safety standards for developing healthcare systems

TEXT BOOKS:

1. Dr. Bhumika Gupta, Dr. Devendra Singh, Dr. Rohit, Ms. Pragya Baluni, "Advancement in Healthcare Applications Using Biomedical Signal Processing", Book Rivers,2024.
2. Christoph Thuemmler, Chunxue Bai, "Health 4.0: How Virtualization and Big Data are Revolutionizing Healthcare", Springer, 1st ed. 2017

Chairman
BoS/BME

REFERENCE BOOKS:

1. Khandpur,R.S,"Handbook of Biomedical Instrumentation ",Second Edition. Tata Mc Graw Hill Pub. Co., Ltd. 2021
2. Rick Krohn (Editor), David Metcalf, Patricia Salber, "Health-e Everything: Wearables and The Internet of Things for Health, ebook. 2013.

E-RESOURCES:

1. https://e-courses.epo.org/course/view.php?id=315
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9963556/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO2	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO3	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO4	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO5	3	2	1	1	1	-	-	-	-	-	-	1	1	-
AVG	3	2	1	1	1	-	-	-	-	-	-	1	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME75	HEALTHCARE EQUIPMENT MAINTENANCE AND TROUBLE SHOOTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide knowledge of the causes of failure and testing procedures for various electrical equipment
- To understand various testing methods, calibration, and troubleshooting techniques for electronic components, sensor probes, and power supplies.
- To learn the functions, testing, and maintenance procedures of critical medical equipment such as ventilators, monitors, and surgical devices.
- To enable the students to gain knowledge on common issues in medical equipment and apply troubleshooting techniques following maintenance and safety standards.
- To infer the impact and utilization of principles of equipment management and quality assurance in a laboratory or clinical environment.

UNIT-I TESTING OF ELECTRICAL EQUIPMENT 9

Causes of Equipment Failure, testing of electrical equipment: 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, Megger-Testing equipment and instruments.

UNIT-II TESTING AND TROUBLESHOOTING 9

Testing of electronic components: Troubleshooting of PCB boards, Calibration of analog and digital sensor probes, Display interface, DC Power supply design, testing, Safe electrical practice, Cables, and standard, Fuse.

UNIT-III TESTING OF MEDICAL EQUIPMENT 9

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

UNIT-IV TROUBLESHOOTING OF MEDICAL EQUIPMENT 9

Troubleshooting of equipments: X-ray machines, Troubleshooting of ECG recorders, Ultrasound machines incubator, baby warmer, infusion pumps, Patient Monitors, annual maintenance, contract requirements, vendor services, quality and safety standards.

UNIT-V MAINTENANCE MANAGEMENT 9

Objectives, Maintenance Policy, Contracts and Provisions, Essentials of a Good Equipment Program, Installation Procedures, Service and Maintenance laboratory, Documentation, Professional Qualities, and Work Habits.

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1: Understand the instruments used to recognize faults in equipment

Chairman
BoS/BME

CO2: Apply general testing and troubleshooting of equipment.
CO3: Analyze faults occurring in operation theatre instruments.
CO4: Discuss the troubleshooting of medical equipment and safety standards.
CO5: Summarize how to manage the maintenance files and documents.

TEXT BOOKS:

1. Philip Kiameh, "Electrical Equipment Handbook: Troubleshooting and Maintenance", McGraw-Hill, Latest Reprint, 2021
2. Shakti Chatterjee, Aubert Miller, "Biomedical Equipment Repair", Cengage Learning Technology & Engineering, 2018.
3. David Herres, "Troubleshooting and Repairing Commercial Electrical Equipment", McGraw Hill Professional edition, 2016.

REFERENCE BOOKS:

1. Francis Hegarty, John Amoore, "Health care technology management – A systematic approach" CRC Press, USA, 2017.
2. Rao S, "Testing, Commissioning, Operation and Maintenance of Electrical Equipment", Khanna Publishers, New Delhi, 2014.

E-RESOURCES:

1. https://app.jove.com/v/51881/catheterization-carotid-artery-jugular-vein-to-perform-hemodynamic

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	1	-	-	-	-	1	-	2
CO2	3	3	2	2	3	-	-	-	-	-	-	1	2	-
CO3	2	3	3	2	3	2	1	-	1	-	-	1	-	-
CO4	3	3	3	2	3	2	2	2	2	1	-	1	3	2
CO5	2	2	3	2	2	3	2	3	2	3	2	1	-	-
AVG	3	3	3	2	3	2	2	3	2	2	2	1	2	2

1 - Low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME76	SPECIALIZED THERAPEUTIC EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the principles of cardiac assist devices.
- To understand the need and use of extracorporeal devices
- To learn about body care equipment
- To understand the need and use of lasers in medicine.
- To enable the students to gain knowledge on the working of therapeutic clinical equipment.

UNIT-I CARDIAC AND RESPIRATORY THERAPY EQUIPMENT 9

Cardiac Pacemaker: Internal and External Pacemaker– Programmable pacemakers. Cardiac Defibrillators: AC and DC Defibrillator- Internal and External Defibrillators - Protection Circuit, Defibrillator analyzers. Cardiac ablation catheter.

Types of Ventilators – Pressure, Volume, and Time controlled. Basic principles of electromechanical, pneumatic and electronic ventilators, Patient Cycle Ventilators, Ventilator testing. Humidifiers, Nebulizers, Inhalators.

UNIT-II BIOMECHANICAL THERAPEUTIC EQUIPMENT 9

Electro diagnosis, Therapeutic radiation, Electrotherapy, Electrodes, Stimulators for Nerve and Muscle, Functional Electrical Stimulation. peripheral nerve stimulator, ultrasonic stimulators, Stimulators for pain and relief - Inferential Therapy Unit, TENS. GAIT Assessment and Therapy. Continuous Passive Motion unit, Cervical / Lumber Traction Machine -Traction Table.

UNIT-III BODY CARE EQUIPMENT 9

Skin Treatment: Ultrasonic spot remover, vacuum therapy unit, Skin tightening, Wrinkle Reduction, Facial and Rejuvenation. Laser hair therapy machine. Body Slimmer/Shaper – Deep Heat Therapy, Massager, Fitness – Treadmill, Bike.

UNIT-IV DENTAL CARE EQUIPMENT 9

Dental Chair - Dental Hand pieces and Accessories: Evolution of rotary equipment, Low-speed handpiece, High-speed handpiece, Hand piece maintenance. Vacuum and Pneumatic techniques: Vacuum techniques, Oral evacuation systems, Vacuum pump, Pneumatic techniques, Dental compressor. Decontamination Unit and constant fumigation unit. Dental Radiography: Dental X-ray Machine.

UNIT-V HEAT AND PHOTON THERAPY EQUIPMENT 9

High frequency heat therapy, Principle, Short wave diathermy, Microwave diathermy, Ultrasonic therapy, Lithotripsy. Therapeutic UV and IR Lamps. Basic principles of Biomedical LASERS: Applications of lasers in medicine, CO2laser, He-Ne laser, Nd-YAG and Ruby laser.

TOTAL: 45 PERIODS

Chairman
BoS/BME

At the end of the course, the students will be able to

CO1: Suggest suitable therapeutic devices for ailments related to cardiology, pulmonology, neurology.

CO2: Analyze the different types of therapies for suitable applications.

CO3: Comprehend the principles of body care equipment

CO4: Understand the operation of dental care equipment.

CO5: Appreciate the application of lasers in biomedical applications.

TEXT BOOKS:

1. Rkv. Murugan, "Diagnostic and Therapeutic Equipment- II", 1st Edition, Notion Press, 2021.
2. John.G.Webster. "Medical Instrumentation, Application and Design". 5th Edition Wiley & sons, Inc., NewYork. 2020
3. Khandpur. R.S.,"Handbook of Biomedical Instrumentation". 3rd Edition. Tata McGrawHill Pub. Co., Ltd. 2014

REFERENCE BOOKS:

1. Leslie Cromwell, Fred. J. Weibell & Erich. A.Pfeiffer. "Biomedical Instrumentation and Measurements". Second Edition. Prentice Hall Inc.2010.
2. John Low & Ann Reed. "Electrotherapy Explained, Principles and Practice" 4th Edition. Butterworth Heinemann Ltd. 2006.
3. Joseph. J. Carr, John Michael Brown, "Introduction to Biomedical Equipment Technology", Prentice Hall and Technology, 2008.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/127/106/127106136/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	-	1
CO3	3	2	1	1	-	-	-	-	-	-	-	1	-	1
CO4	3	2	1	1	-	-	-	-	-	-	-	1	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	1	-	-
AVG	3	2	1	1	-	-	-	-	-	-	-	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME77	NANO TECHNOLOGY IN MEDICINE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know about the concept of Nanotechnology
- To study about the fundamentals of Nanoscience.
- To study about materials and properties used for MEMS & NEMS.
- To know about the medical use of nanomaterials.
- To study about the medical applications.

UNIT-I Introduction to Nanotechnology 9

Introduction to Nanotechnology: Nanomaterials, Fullerenes and carbon forms. Nanoparticles and Colloids, structure and bonding in nanoparticles, Nanomaterials fabrication by Bottom-up and Top down approaches, Classification of nanodevices based on the characteristics, Quantum dots and their properties.

UNIT-II FUNDAMENTALS OF NANOSCIENCE 9

Size dependence of properties – Particle size determination – Bulk to nanotransition – Semiconducting nanoparticles – Carbon nanostructures – Mechanical properties (hardness, ductility, elasticity) – Optical properties of nanotubes – Electrical properties of nanotubes.

UNIT-III MEMS & NEMS 9

Definition of MEMS, materials for MEMS (Silicon, Polymers and metals) and their properties, Deposition processes, Photolithography, and etching processes, Limitations of MEMS, NEMS, difference between MEMS and NEMS, properties of NMES, fabrication processes, applications.

UNIT-IV NANOMEDICINE 9

Nanomedicine: Medical use of Nanomaterials, Drug delivery systems. Cancer treatment, Surgery. Drug tracking systems. Targeted drug delivery systems. Applications of Nanomaterials in Medical imaging. Neuro-electronic interfaces.

UNIT-V BIO MOLECULAR NANOTECHNOLOGY 9

Nanorobots and their application, nanosensors based on biomolecules such as DNA and proteins, nanoparticles for gene delivery systems, Computational genes, Biosensors for Glucose and measurement, Optical biosensors and their application .

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1	Understand the basic science behind the properties of materials
CO2	Examine the basics properties of Nanoscience.
CO3	Explain the basics properties of MEMS & NEMS.
CO4	Outline the applications of nanomedicine.
CO5	Analyze the biomolecular components with nanotechnology.

TEXT BOOKS:

1. Karthik Loganathan, Pushpamalar Janarthanan, Vishnu Kirthi Arivarasan, "Nanotechnology in Medicine", Springer International Publishing, 2021.
2. Bharat Bhushan ,"Handbook of Nanotechnology", Springer, Fourth Edition, 2017

Chairman
BoS/BME

3. Kishore Cholkar, AbhirupMandal, AshimMitra, "Emerging nanotechnologies for diagnostics, drug delivery and medical devices", Elsevier, 2017.

REFERENCE BOOKS:

1. Pieter Stroeve and MortezaMahmoudi, "Drug Delivery Systems, World", Scientific Series: From Biomaterials towards Medical Devices, Vol I, 2018.

2. Maxine A Papadakis, "Current Medical Diagnosis and Treatment", McGraw Hill Education, 2017.

3. Malay K. Das, Yashwant V. Pathak," Nano Medicine and Nano Safety Recent Trends and Clinical Evidences", Springer Nature Singapore, 2020

E-RESOURCES:

https://archive.nptel.ac.in/courses/118/107/118107015/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	-	-	-	-	-	3	3	2	2
CO2	3	2	-	1	-	-	-	-	-	-	3	3	2	2
CO3	3	1	-	2	-	-	-	-	-	-	3	2	2	2
CO4	3	1	2	3	-	-	-	-	-	-	3	2	3	2
CO5	3	1	2	3	-	-	-	-	-	-	3	2	3	2
AVG	3	1	2	2	-	-	-	-	-	-	3	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BME78	HOME MEDICARE TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To analyze the historical development and ethical issues in home health care
- To apply homecare strategies tailored to diverse client needs.
- To demonstrate proficiency in operating and managing medical devices commonly used in home healthcare settings.
- To identify and discuss recent advancements in medical health technologies relevant to home care.
- To infer the impact and utilization of wireless technology in improving healthcare delivery at home.

UNIT-I INTRODUCTION TO HOME HEALTH NURSING **9**

Home Health Care – Purpose - Organization of Homecare System - Historical Development of Home Care - Environmental Influences of Home Care -Home Care Organization - Role of Home Care Nurse and Orientation Strategies - Environmental Influences on Home Care - Infection Control in Home - Patient Education in Home.

UNIT-II WORKING WITH CLIENTS **9**

Basic Human Needs - Communication and Interpersonal Skills - Caregiver Observation - Recording and Reporting, Confidentiality. Working with Elderly – Aging and Body Systems. Working with Children - Need for Home Care - Mobility Transfers and Ambulation - Range of Motion Exercises - Skin Care and Comfort Measures.

UNIT-III MEDICAL DEVICES AT HOME **9**

Medical Devices at Home - ECG Monitors - Smart Watch - Wireless Infant Monitoring System - PCG Monitors, Medical Alert Services. Activity Monitors - Automatic Wireless Healthcare Monitoring System - Device for Patient with Chronic Obstructive Pulmonary Disease - Device for Patient with Diabetic.

UNIT-IV ADVANCEMENT IN MEDICAL TECHNOLOGIES **9**

Advances and Trends in Health Care Technologies - Driver Impacting the Growth of Medical Technologies - Impact of Moore's Law of Medical Imaging - E-Health and Personal Healthcare - Defining the Future of Health Technology - Inventing the Future -Tools for Self-Health - Future of Nano Fabrication Molecular Scale Devices - Future of Telemedicine - Future of Medical Computing.

UNIT-V WIRELESS TECHNOLOGY **9**

Wireless Communication Basics - Types of Wireless Network - Body Area Network - Emergency Rescue - Remote Recovery – General health assessments Technology in medical information processing- Future Trends in Healthcare Technology.

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1: Apply effective strategies for infection control, patient education, and home care management.

CO2: Analyze the advancements in health care technologies to enhance patient care,

Chairman
BoS/BME

emergency response and remote monitoring capabilities.

CO3: Deduce personalized care plans for elderly, children and mobility-impaired patients, including mobility transfers and comfort measures.

CO4: Assess the functionality and impact of various medical devices and recommend suitable devices based on patient needs.

CO5: Develop critical thinking and problem-solving skills in addressing complex issues related to home health care systems, patient management.

TEXT BOOKS:

1. Kim Cooper, Kelly Gosnell, "Foundations of Nursing", Elsevier, Kelly Gosnell,2022.
2. Scott Josephson," Home Healthcare for Seniors", Amazon Digital Services LLC – Kdp,2024.
3. LodewijkBos, "Handbook of Digital Homecare: Successes and Failures", Springer, 2018.
4. Victoria D. Weisfeld, Tracy A. Lustig, "The Future of Home Health Care", National Academies Press, 2015.

REFERENCE BOOKS

1. Mary A. Nies, Melanie McEwen, "Community/Public Health Nursing", Elsevier,2023.
2. George R. Kim, Joan M. Kiel, Marion J. Ball," Healthcare Information Management Systems", Springer International Publishing,2022.
3. Kenneth J. Turner, "Advances in Home Care Technologies: Results of the match Project", Springer, 2016.
4. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph. D. Bronzino, "Clinical Engineering", CRC Press, 2015.

E-RESOURCES:

1. https://www.digimat.in/nptel/courses/video/110104095/L31.html

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	-	1	1	-
CO2	3	2	2	1	-	-	-	-	1	-	-	1	1	-
CO3	3	2	2	1	-	-	-	-	1	-	-	1	1	-
CO4	3	2	2	1	-	-	-	-	1	-	-	1	1	-
CO5	3	2	2	1	-	-	-	-	1	-	-	1	1	-
AVG	3	2	2	1	-	-	-	-	1	-	-	1	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BMO11	BIOSENSORS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the principles and purposes of measurement, methods used, and errors involved.
- To Learn the types, working principles, and classifications of biosensors used in biomedical applications.
- To Analyze the characteristics of biosignals and understand their physiological origins.
- To Comprehend the configurations and functions of electrodes used in biopotential measurements.
- To Understand the design and functioning of bio-amplifiers for signal acquisition and conditioning.

UNIT-I FUNDAMENTALS OF MEASUREMENTS 9

Measurement System – Instrumentation - Classification and Characteristics of Transducers – Static and Dynamic - Errors in Measurements and their statistical analysis- methods of error analysis-Calibration - Primary and secondary standards.

UNIT-II BIOSENSORS 9

Biosensors: transduction mechanism in a biosensor and Classification -Electronic nose. Biological Sensors- baro receptors-Hemo receptors-Sensory receptors for smell-vision-Taste, and Olfactory-Bio chemical Sensors for medicine-Fiber optic sensors-Light sensors in medicine-Bio mechanical sensor.

UNIT-III BIOPOTENTIAL MEASUREMENT 9

Bio signals characteristics – Origin of bio potential and its propagation- Frequency and amplitude ranges- Electrode configurations: Electrode-electrolyte interface, electrode–skin interface impedance, polarization effects of electrode – non-polarizable electrodes- Unipolar and bipolar configuration, classification of electrodes.

UNIT-IV ELECTRODE CONFIGURATIONS 9

ECG Electrode system - Einthoven's triangle, standard 12 lead system. EEG –10-20 electrode system, unipolar, bipolar and average mode- EMG–unipolar and bipolar mode- EMG - Electrode configuration-unipolar and bipolar mode.

UNIT-V BIO AMPLIFIERS 9

Need for bio-amplifier- Differential bio-amplifier– Single ended amplifier- Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier- Power line interference.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Analyze and interpret various electrical measurement parameters such as accuracy, precision, and resolution.

CO2: Select and utilize appropriate measurement tools including multimeters, CROs, and data recorders for biomedical applications.

Chairman
BoS/BME

CO3: Explain the origin and characteristics of biosignals and apply appropriate methods for biopotential measurement.

CO4: Demonstrate understanding of different electrode configurations used in ECG, EEG, and EMG recordings.

CO5: Design and analyze bio-amplifier circuits for effective acquisition and transmission of biosignals in medical instrumentation.

TEXT BOOKS:

1. Uma Mukherjee, "Biomedical Instrumentation: Technology and Applications", 1st Edition, CRC Press, 2023.
2. John G. Webster, Amit J. Nimunkar, Medical Instrumentation: Application and Design, 5th Edition, Wiley, 2023.

REFERENCE BOOKS:

1. R.S. Khandpur, Biomedical Instrumentation: Technology and Applications, 3rd Edition, McGraw Hill, 2023.
2. C.R. Mahapatra, Biomedical Instrumentation and Measurements, 2nd Edition, PHI Learning, 2022..

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/112/105/112105249/
2. https://onlinecourses.nptel.ac.in/noc20_me03/preview
3. https://www.jove.com/librarians/resources

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	1	-	-	-	-	-	-	1	2	-
CO3	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO4	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO5	3	2	1	1	1	-	-	-	-	-	-	1	1	-
AVG	3	2	1	1	1	-	-	-	-	-	-	1	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BMO12	MEDICAL ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Get introduced to the fundamental of robotics and position analysis.
- To study the kinematics, dynamics, motion planning and control of robotics.
- To understand the concepts of robotics of surgery.
- To understand the concept of robotics for neurosurgery.
- To compare the various future technologies being proposed.

UNIT-I INTRODUCTION TO ROBOTICS AND AUTOMATION **9**

Introduction Automation and Robots, Classification, Specification, Notations, Direct Kinematics Dot and cross products, Coordinate frames, Rotations, Homogeneous coordinates Link coordination arm equation, Four-axis robot.

UNIT-II ROBOT KINEMATICS AND DYNAMICS **9**

Kinematics of manipulators - Rotational, Translation and transformation, Homogeneous transformations, Denavat – Hartenberg representation - Inverse kinematics - Linearization of Robot Dynamics – State variable continuous and discrete models.

UNIT-III ROBOT IN SURGERY **9**

Minimally invasive surgery and robotics integrations, Surgical robotic sub systems, synergistic control, Control modes, Orthopedic surgery.

UNIT-IV ROBOTICS FOR NEUROSURGERY **9**

Introduction to neurosurgical progression-Evolution of neurosurgical robots-Maintaining operator Control – Human machine interface-Future trends: informatics surgery.

UNIT-V ROBOTIC SYSTEMS FOR CARDIOVASCULAR INTERVENTIONS **9**

Introduction-Heart conditions and evolving role of cardiac surgeons and cardiologist- Surgical robot requirements and availability for cardiovascular interventions-Future trends.

TOTAL: 45 PERIODS

At the end of the course, the students will be able to

CO1: Have an understanding of the basics of robotics.

CO2: Understand the kinematics and dynamic involved in design of robotic systems.

CO3: Outline the concepts of robotics of surgery.

CO4: Identify the robotic system used for neurosurgery.

CO5: Compare robotic systems used for cardiovascular interventions.

TEXT BOOKS:

1. Douglas P. Murphy, Robotics in Physical Medicine and Rehabilitation, Elsevier - Health Sciences Division, 2023.
2. Guang-Zhong Yang (Editor), Medical Robotics: Fundamentals, Applications and Challenges, 1st Edition, Springer, 2022.
3. S. B. Niku, Introduction to Robotics, Analysis, Control, Applications, Pearson Education, 2020.

REFERENCE BOOKS:

1. Moustapha Hamdi, Surgical Robotics: Systems, Applications, and Visions, 2nd Edition, Springer, 2023.

Chairman
BoS/BME

2. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, Robotics: Modelling, Planning and Control, 2nd Edition, Springer, 2023.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/112/105/112105249/
2. https://onlinecourses.nptel.ac.in/noc20_me03/preview

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO3	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO4	3	2	1	1	1	-	-	-	-	-	-	1	1	1
CO5	3	2	1	1	1	-	-	-	-	-	-	1	1	1
AVG	3	2	1	1	1	-	-	-	-	-	-	1	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BM013	BIOMETRIC TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the technologies of fingerprint, iris, face.
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- To recognize personal privacy and security implications of biometrics based identification technology.
- To identify issues in the realistic evaluation of biometrics based systems.
- To interpret the technologies of face recognition.

UNIT-I INTRODUCTION TO BIOMETRICS 9

Biometric technologies – passive biometrics – active biometrics –Biometric systems – Enrollment – templates – algorithm – verification – Biometric applications –biometric characteristics– Protecting privacy and biometrics and policy-Biometric systems.

UNIT-II FINGERPRINT TECHNOLOGY 9

Finger print feature processing techniques – fingerprint sensors using RF imaging techniques – fingerprint quality assessment – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching.

UNIT-III FACE RECOGNITION AND HAND GEOMETRY 9

Face recognition from correspondence maps – Hand geometry – scanning – Feature Extraction – Adaptive Classifiers -Visual- Based Feature Extraction and Pattern Classification – feature extraction – types of algorithm.

UNIT-IV MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION 9

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.

UNIT-V BIOMETRICS AND ITS APPLICATION 9

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.

TOTAL: 45 PERIODS

Chairman
BoS/BME

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Distinguish the authentication mechanism of the biometric systems

CO2: Illustrate the various methodologies involved in fingerprint technology

CO3: Develop techniques for face recognition and hand geometry biometrics

CO4: Demonstrate the multimodal biometrics and the methods for evaluating the performance

CO5: Implement the concept of Biometrics and its applications

TEXT BOOKS:

1. Raghavendra Ramachandra, Christoph Busch, Biometric Systems: Design, Performance, and Applications, 1st Edition, Elsevier, 2023.
2. Nalini K. Ratha, Ruud M. Bolle, Automatic Fingerprint Recognition Systems, 2nd Edition, Springer, 2022.
3. Marina Gavrilova, Maruf Monwar, Multimodal Biometrics and Intelligent Image Processing for Security Systems, 1st Edition, IGI Global, 2021.

REFERENCE BOOKS:

1. Karthik Nandakumar, Anil K. Jain, Biometric Systems: Technology, Design and Performance Evaluation, 1st Edition, Springer, 2023.
2. Arun A. Ross, Anil K. Jain, Karthik Nandakumar, Handbook of Multibiometrics, 2nd Edition, Springer, 2022.

E-RESOURCES:

1. https://nptel.ac.in/courses/106104119/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	3	2	1
CO2	3	2	2	1	-	-	-	-	-	-	-	3	2	1
CO3	3	2	2	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	1	1	-	-	-	-	-	-	3	2	1
CO5	3	2	2	1	1	-	-	-	-	-	-	-	2	1
AVG	3	2	2	1	1	-	-	-	-	-	-	3	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BM014 **HEALTHCARE MANAGEMENT SYSTEMS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To Provide foundational knowledge about various healthcare systems at national, state, and local levels.
2. To Introduce students to national health policies and their importance in public health.
3. To Develop skills in biomedical equipment maintenance and management.
4. To Foster understanding of sustainable human resource strategies in healthcare environments.
5. To Enable students to interpret healthcare data through relevant case studies and investigative methods.

UNIT-I INTRODUCTION HEALTH SYSTEM 9

Health Organization of the Country, the State and Cities, Health Financial System, Teaching cum Research Hospitals, General Hospital, PHC Reference System, Ambulatory Care.

UNIT-II NATIONAL HEALTH POLICY 9

Need for Evaluating a Health Policy, Need for providing Primary Health Care, Health Education, Health Insurance, Health Legislation, Inter Sectoral Co-operation.

UNIT-III EQUIPMENT MAINTENANCE MANAGEMENT 9

Organizing the Maintenance Operation, Biomedical Equipment Procurement Procedure, Proper Selection, Compatibility, Testing and Installation, Purchase and Contract Procedure, Trained Medical Staff, Proper use of Equipment and Operating Instructions. Maintenance Job Planning, Preventive Maintenance, Maintenance Budgeting, Contract Maintenance.

UNIT-IV PERSPECTIVES OF HUMAN RESOURCE MANAGEMENT 9

Clinical engineering: program services, Program database – Clinical Engineering Program management, Program indicator, Managing clinical engineering performance using program indicators – Indicator management process.

UNIT-V CASE STUDIES 9

Case Studies: Epidemical reading and interpreting of epidemical studies, application in community health, Case study on Medical Imaging like MRI, CT. Case study on respiratory data, Case study on ECG data.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the structure and functioning of healthcare systems and organizations.

CO2: Analyze the need for and components of national health policy, including insurance,

Chairman
BoS/BME

education, and legislation.

CO3: Demonstrate knowledge of biomedical equipment procurement, maintenance planning, and budgeting.

CO4: Analyze human resource strategies and performance indicators in clinical engineering management.

CO5: Interpret case studies involving epidemiological data, imaging systems, and diagnostic tools like ECG and respiratory data.

TEXT BOOKS:

1. Bodenheimer, Understanding Health Policy: A Clinical Approach, 9th Edition, McGraw Hill, 2023.
2. Ryan J, Biomedical Equipment Maintenance and Safety, 1st Edition, 2023.
3. Susan E. Skochelak, Health Systems Science, 2nd Edition, Elsevier, 2020.

REFERENCE BOOKS:

1. Elisabeth Thames Askin, Nathan Moore, "The Health Care Handbook, Third Edition, LWW, 2023.
2. Paul Cerrato, John Halamka, Digital Reconstruction of Healthcare: Patient Safety, Risk Management, and Human Factors Engineering, 1st Edition, Academic Press, 2023.

E-RESOURCES:

1. 1.https://www.eresourcescheduler.com/blog/top-9-resource-management-software-in healthcare
2. https://multiviewcorp.com/blog/different-types-healthcare-software
3. https://www.avanttec.net/hospital-management-system/

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3	1	3	2	1	-	-	-	2	3	1	3	3	2
CO 2	3	2	3	2	1	-	-	-	2	2	1	3	2	1
CO 3	3	1	1	1	2	-	-	-	2	1	1	2	2	1
CO 4	3	1	1	1	1	-	-	-	2	3	2	2	1	1
CO 5	3	2	3	2	1	-	-	-	1	2	1	1	1	1
AVG	3	1	2	2	1	-	-	-	2	2	1	2	2	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

Chairman
BoS/BME

23BMO15	IoT IN HEALTHCARE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide foundational knowledge of the Internet of Things (IoT) with a focus on physical and logical design principles.
- To enable students to analyse communication models and protocols for developing cost-effective IoT applications.
- To introduce core technologies and architectures that drive IoT systems.
- To teach programming skills for IoT using open platforms such as Arduino and Raspberry Pi.
- To explore real-world case studies highlighting the role of IoT in healthcare applications.

UNIT-I INTRODUCTION TO INTERNET OF THINGS **9**

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT.

UNIT-II COMPONENTS IN INTERNET OF THINGS **9**

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee, Wifi, GPS, GSM Modules)

UNIT-III PROTOCOLS AND TECHNOLOGIES BEHIND IoT **9**

IoT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, Big Data Analytics, Cloud Computing, Embedded Systems.

UNIT-IV OPEN PLATFORMS AND PROGRAMMING **9**

IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT-V CASE STUDY/HEALTHCARE **9**

IOT in Emergency and Healthcare services, Components of IoT healthcare, Remote health care, Real time monitoring, Preventive care, Preventive Cardiological Monitoring, Health care systems- Activity Monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Explain the evolution, architecture, and enabling technologies of IoT.

CO2: Identify the key components of IoT ecosystems including sensors, actuators, and communication modules.

CO3: Evaluate the protocols and technologies behind IoT systems such as MQTT, CoAP, and 6LoWPAN.

CO4: Develop and implement basic IoT applications using Arduino/Raspberry Pi platforms and integrate with cloud services.

CO5: Apply IoT solutions to healthcare scenarios involving real-time monitoring, preventive care, and remote diagnostics.

Chairman
BoS/BME

TEXT BOOKS:

1. Alex Khang,AI and IoT Technology and Applications for Smart Healthcare Systems",1st Edition, 2024.
2. IoT in Healthcare Systems: Applications, Benefits, Challenges, and Case Studies," 1st Edition,CRC Press, 2023.
3. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, 2nd Edition, VPT, 2023.

REFERENCE BOOKS:

1. Ovidiu Vermesan, Peter Friess (Editors), Internet of Things – The Call of Edge: Everything Intelligent Everywhere, 1st Edition, River Publishers, 2022.
2. D Jeya Mala ,"Integrating AI in IoT Analytics on the Cloud for Healthcare Applications ", 1st Edition, Engineering Science Reference, 2021.
3. Rajkumar Buyya, Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, 1st Edition, Elsevier/Morgan Kaufmann, 2021.

E-RESOURCES:

1. https://archive.nptel.ac.in.
2. https://www.jove.com/

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	1	1	1	-
CO2	3	2	2	1	1	-	-	-	-	-	1	1	1	-
CO3	3	2	2	1	1	-	-	-	-	-	1	1	1	-
CO4	3	2	2	1	1	-	-	-	-	-	1	1	1	-
CO5	3	2	1	1	1	-	-	-	-	-	1	1	1	-
AVG	3	2	1	1	1	-	-	-	-	-	1	1	1	-

1 -low,2-medium,3-high,'-'-no correlation

Chairman
BoS/BME