

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)

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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)

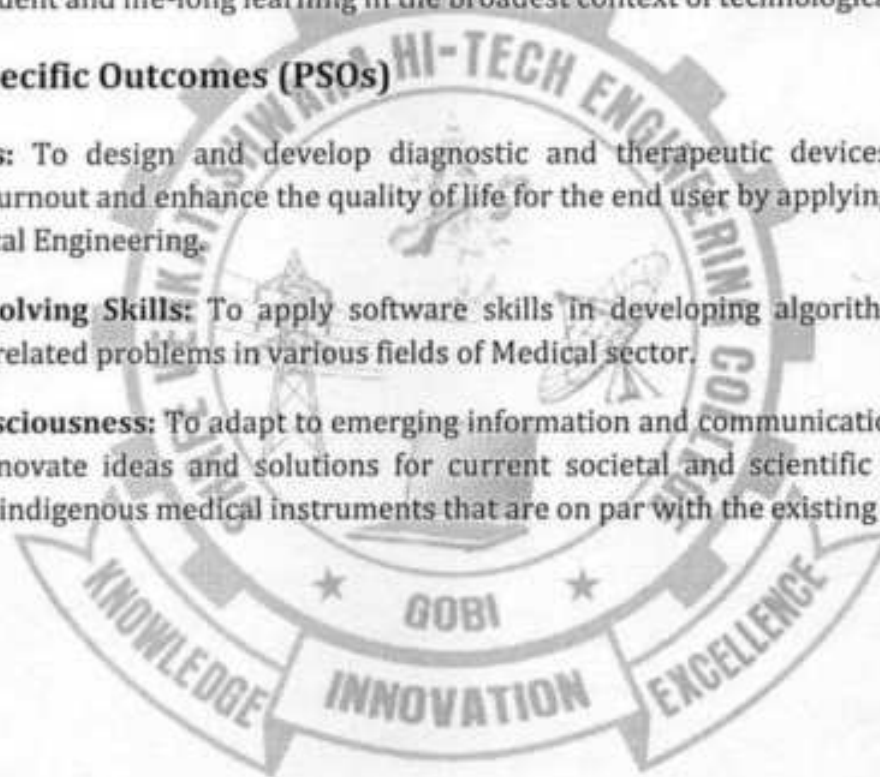
- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.


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8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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




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Mapping of Course Outcome and Programme Outcome

Year	Sem	Course name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	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	3	-	-	-	-	1	-	-	-
		Problem Solving and Python Programming	2	3	3	3	2	-	-	-	-	-	2	2	3	3	3
		தமிழர் மரபு /Heritage of Tamils	-	-	-	-	-	1	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	2	1	-	-	-	1	-	-	-
		English Laboratory	-	-	-	-	-	-	-	1	3	3	-	2	-	-	-
	II	Professional English - II	-	1	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	-	-	-	-	-	-	-	-	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	-	2			
		Engineering Practices Laboratory	3	-	-	3	-	-	-	-	-	-	-	-	2	1	1
		Biosciences Laboratory	3	3	2	1	1	2	-	-	-	-	-	2	1	-	-
		Communication Laboratory / Foreign Language ¹	-	-	2	-	-	-	-	1	3	3	-	3	-	-	-
III	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
		Anatomy and Human Physiology	3	3	2	-	-	-	-	-	-	-	-	1	1	-	-

II	III	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	2	1	1	-	-	-	-	1	2	1	-	2	-	-
		Object oriented Programming using Java Laboratory	3	3	1	1	1	-	-	-	-	1	1	-	-	1	1
	IV	Probability and Statistics	3	3	-	-	-	-	-	-	3	-	-	2	-	-	-
		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	2	2	1	-	-	-	1	1	1	-	2	1	-
		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
		Analog and Digital Integrated Circuits Laboratory	3	3	1	1	1	-	-	-	1	1	1	-	1	-	-
		Soft and Analytical Skills-I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Embedded Systems and IoMT	3	2	1	1	1	-	-	-	-	-	-	1	1	1	-
	V	Diagnostic and Therapeutic Equipment	3	2	1	-	1	-	-	-	-	-	-	1	2	-	1
		Embedded systems and IoMT Laboratory	2.6	2	3	2.4	1.5	-	-	-	1	2.2	2.2	2.4	2.2	1.6	2.6
		Diagnostic and Therapeutic Equipment Laboratory	3	3	1	1	1	-	-	-	1	1	1	-	1	-	-
	VI	Bio Mechanics	3	1	1	-	-	1	-	1	-	-	-	-	1	2	-
		Artificial Intelligence and Machine Learning	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2
		Medical Image Processing	3	3	2	2	2	-	-	-	-	-	-	1	2	1	1

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


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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					5		12	7.27	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				4	10	18	10.90	16
8	MC		√		√	√	√					
Total Credits / Semester		22	26	25.5	22	21.5	20	18	10	165		163

CATEGORIZATION OF COURSES

- Humanities and Social Sciences including Management Courses (HSS)
- Basic Science Courses (BS)
- Engineering Science Courses (ES)
- Professional Core Courses (PC)
- Professional Elective Courses (PE)
- Open Elective Courses (OE)
- Mandatory Courses (MC)
- Employability Enhancement Courses (EEC)
- 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,


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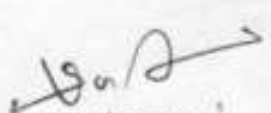


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Curriculum and Syllabus
BE- Biomedical Engineering

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			


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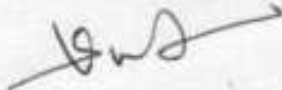
SEMESTER II

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 /Tamil 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			

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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.	23BML31	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			


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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	-	-	-
Total				18	1	8	27	22			


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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	-	-	-
10		Mandatory Course - IV*	MC	3	0	0	3	0	100	0	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)

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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.


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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	Human Values and Ethics	HSS	2	0	0	2	2	40	60	100
2.		Elective – Management*	HSS	3	0	0	3	3	40	60	100
3.		Professional Elective VI*	OE	-	-	-	-	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	4	4	2	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.

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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



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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

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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	Body Area Networks	Human Assist 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	Assistive Technology
Genetic Engineering	Rapid Prototyping	Forensic Science in Healthcare	Haptics	Biometrics	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 Equipments	Health policy and equipment management	Healthcare Information systems	Bio Inspired Computing	Biotelemetry and telemedicine	Home Medicare technology

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 area of 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 Equipments	PE	3	0	0	3	3	40	60	100

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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 management	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

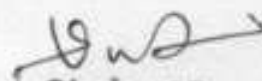

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VERTICAL 5: BIOSIGNAL AND IMAGE PROCESSING

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	Biometrics	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	Body Area Networks	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


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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 Assist 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	Assistive Technology	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


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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	23CE011	Civil and Infrastructure Engineering	OE	3	0	0	3	3	40	60	100
2	23CE012	Environmental Pollution and waste management	OE	3	0	0	3	3	40	60	100
3	23CE013	Environmental Impact Assessment	OE	3	0	0	3	3	40	60	100
4	23CE014	Building Services	OE	3	0	0	3	3	40	60	100
5	23CE015	Water, Sanitation and Health	OE	3	0	0	3	3	40	60	100
OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING											
1	23CS011	Foundation of AR/VR	OE	3	0	0	3	3	40	60	100
2	23CS012	Web Designing	OE	3	0	0	3	3	40	60	100
3	23CS013	Block Chain fundamentals	OE	3	0	0	3	3	40	60	100
4	23CS014	Knowledge Management	OE	3	0	0	3	3	40	60	100
5	23CS015	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.	23EE011	Renewable Energy Sources	OE	3	0	0	3	3	40	60	100
2.	23EE012	Electrical Vehicle	OE	3	0	0	3	3	40	60	100
3.	23EE013	Energy Auditing and Conservation	OE	3	0	0	3	3	40	60	100
4.	23EE014	Domestic and Industrial Electrical Installations	OE	3	0	0	3	3	40	60	100
5.	23EE015	Microcontroller Based System Design	OE	3	0	0	3	3	40	60	100

OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING

1	23ME011	Industrial Instrumentation	OE	3	0	0	3	3	40	60	100
2	23ME012	Energy Technology	OE	3	0	0	3	3	40	60	100
3	23ME013	Reverse Engineering	OE	3	0	0	3	3	40	60	100
4	23ME014	Fire Safety Engineering	OE	3	0	0	3	3	40	60	100
5	23ME015	Nano Technology	OE	3	0	0	3	3	40	60	100
6	23ME016	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 systems and their applications	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

23IPA11

INDUCTION PROGRAMME
(Common to B.E./B.Tech. all Branches)

L	T	P	C
-	-	-	0

This is a mandatory **2 week programme** to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by **AICTE** with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character."

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity:

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts:

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

(iii) Universal Human Values:

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don't's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

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Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity:

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules:

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People:

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area:

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations:

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities:

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop.

For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games, ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

REFERENCES:

1. Guide to Induction program from AICTE

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02/09/2023

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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, de initiions, essays and user manuals.

UNIT-I	INTRODUCTION TO EFFECTIVE COMMUNICATION AND FUNDAMENTALS OF COMMUNICATION	10
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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 Technical Contexts)

UNIT-II	NARRATION AND SUMMATION	9
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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 (Pre ixes& Suf ixes); Synonyms and Antonyms; Phrasal Verbs.

UNIT-III	DESCRIPTION OF A PROCESS / PRODUCT	9
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Reading - Reading Advertisements, Gadget Reviews; User Manuals.

Writing - Writing De initiions; 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)

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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

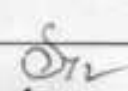
TEXT BOOKS:

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.

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- 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	PO12
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

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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.

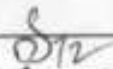
UNIT-IV

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.

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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 :

- 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]
- Grewal. B. S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018

REFERENCE BOOKS :

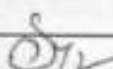
- Thomas. G. B., Hass. J., and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2022
- Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2021
- Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016
- Ramana. 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	PO12
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

SVHEC-R2023


Chairman
BoS / S&H

23PHT11

ENGINEERING PHYSICS
(Common to B.E./B. Tech. all branches)

L T P C
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 law – 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, CO₂ 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

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 (Indian Edition), 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	PO12
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

23CYT11

ENGINEERING CHEMISTRY
(Common to B.E./B. Tech. all branches)

L	T	P	C
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:** De inition, 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, de inition 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: De inition & Need for composites; **Constitution:** Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, lakes and whiskers). **Properties and applications of:** Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites.

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. CO₂ emission and carbon footprint.**

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:** H₂-O₂ 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

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

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

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	PO12
CO1	3	3	3	1	1	3	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	2	-	-	-	-	-
AVG	3	2	2	1	1	2	3	-	-	-	-	1

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

23CST11	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
	(Common to: B.E. / B.Tech. all Branches)	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
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Introduction - Problem solving and Decomposition - Abstraction - Notations Pseudo code - Flow chart - Programming language

UNIT-II	ALGORITHMIC PROBLEM SOLVING	8
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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
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Variables - Immutable variables - Data types - Operators - Python Reserved Words - Understanding error messages

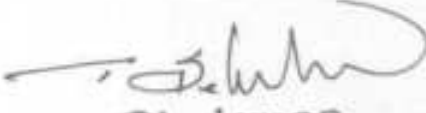
UNIT-IV	CONTROL STATEMENTS AND STRUCTURED TYPES	10
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Control Flow - Indenting - if Statement - while Loop - break and continue - for Loop - String - Lists - Tuples - Sets - Dictionaries

UNIT-V	FUNCTIONS, MODULES AND FILES	10
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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	PO12	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	2	3	3	3	2	-	-	-	-	-	2	2	3	3	3

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

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23TAT11

HERITAGE OF TAMILS
(Common to B.E./B. Tech. 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 Thinaï 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 Modern literature 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, Yath 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

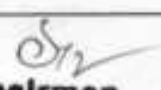
**CONTRIBUTION OF TAMILS TO INDIAN
NATIONAL MOVEMENT AND INDIAN CULTURE**

3

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

TOTAL: 15 PERIODS

SVHEC-R0023


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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 Thinaï 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	PO12
CO1	-	-	-	-	-	1	1	1	-	1	-	-
CO2	-	-	-	-	-	1	1	1	-	1	-	-
CO3	-	-	-	-	-	1	1	1	-	1	-	-
CO4	-	-	-	-	-	1	1	1	-	1	-	-
CO5	-	-	-	-	-	1	1	1	-	1	-	-
AVG	-	-	-	-	-	1	1	1	-	1	-	-

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

23TAT11

தமிழர் மரபு

L T P C
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(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 - பாரை ஒவியங்கள் முதல் நவீன ஒவியங்கள் 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

நாட்டப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகள்

3

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

அலகு - IV

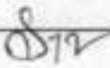
தமிழர்களின் திணைக் கோட்பாடுகள்

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

SVHEC-R2023

சுயநிர்வாகம்
11/06/2023


Chairman
BoS / S&M

அலகு - V

இந்திய தேசிய இயக்கம் மற்றும்

3

இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு

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

மொத்தம்: 15 பாடவேளைகள்

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	PO12
CO1	-	-	-	-	-	1	1	1	-	1	-	-
CO2	-	-	-	-	-	1	1	1	-	1	-	-
CO3	-	-	-	-	-	1	1	1	-	1	-	-
CO4	-	-	-	-	-	1	1	1	-	1	-	-
CO5	-	-	-	-	-	1	1	1	-	1	-	-
AVG	-	-	-	-	-	1	1	1	-	1	-	-

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

SVHEC-R2023

நவம்பர் 15
2023


Chairman
BoS / S&H

**PROBLEM SOLVING AND PYTHON PROGRAMMING
LABORATORY**

L T P C

23CSL11

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	PO12	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	3	3	3	2	-	-	-	-	-	2	2	3	3	3

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

23PCL11

PHYSICS AND CHEMISTRY LABORATORY
(Common to B.E./B. Tech. all branches)

L	T	P	C
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 a 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 a 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 a 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

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	PO12
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

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	PO12
CO1	3	2	1	-	-	3	3	1	-	-	-	1
CO2	3	2	2	-	-	3	3	1	-	-	-	1
CO3	3	2	1	-	-	3	3	1	-	-	-	1
CO4	3	2	2	-	1	2	1	-	-	-	-	-
CO5	3	2	1	-	1	2	1	-	-	-	-	-
Avg.	3	2	1	-	1	3	2	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 Textbook of Quantitative Chemical Analysis", (2009)

23ENL11

ENGLISH LABORATORY
(Common to B.E./B.Tech. all Branches)

L	T	P	C
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 audio materials 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 and Offers- 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 and Interviews with Celebrities.

Speaking - Narrating Personal Experiences / Events-Talking about Current and Temporary Situations & 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.

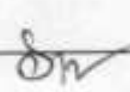
Speaking - Picture Description- Describing Locations in Workplaces- Giving Instruction to Use the Product- Explaining Uses and Purposes- Presenting a Product- Describing Shapes and Sizes and Weights- Talking about Quantities (Large & Small)- Talking about Precautions.

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.

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UNIT-V

EXPRESSION

6

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

Speaking - Making Predictions- Talking about a Given Topic-Giving Opinions- Understanding a 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

E. RESOURCES:

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

CO's & PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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

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23ENT21

PROFESSIONAL ENGLISH - II
(Common to B.E./B.Tech. all Branches)

L	T	P	C
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 and placements.

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 / Emails of Complaint.

Writing - Writing Responses to Complaints.

Grammar - Active Passive Voice Transformations, In 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

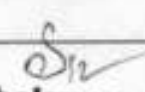
Reading - Newspaper Articles.

Writing - Recommendations, Transcoding, Accident Report, Survey Report

Grammar - Reported Speech, Modals.

Vocabulary - Conjunctions- Use of Prepositions.

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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, New Delhi, 2001.

E. RESOURCES:


- <https://learnenglish.britishcouncil.org/>

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CO'S-PO'S MAPPING :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	1	-	-	-	-	-	1	2	3	-	2
C02	-	-	-	-	-	-	1	-	3	3	-	3
C03	-	1	1	-	-	-	-	-	3	3	-	3
C04	-	-	-	-	-	-	-	-	2	3	-	2
C05	-	-	-	-	-	-	-	-	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
(Common to B.E./B.Tech. all Branches)**

**L T P C
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 9+3
NUMERICAL INTEGRATION**

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

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

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 and small samples) - Tests for single variance and equality of variances - Chi square test for goodness of fit - Independence of attributes

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

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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:

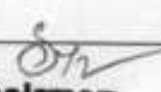
1. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020
2. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016
3. Devore, J.L., "Probability and Statistics for Engineering and the Sciences", Cengage 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	PO12
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

SVHEC- R2023


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

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. Tampo 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	PO12	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

23EET22	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (For B.E./B.Tech- CIVIL, CSE, MECH, AI&DS, BME, IT, Pharm.Tech branches)	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	ELECTRIC CIRCUITS	10
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Basic components of electric circuits, Charge, Current, Voltage and Power, Voltage and current sources, Ohm's 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-DC Circuits.

UNIT-II	MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS	10
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Magnetic circuits-definitions-MMF, flux, reluctance, Magnetic field intensity, Flux density, Fringing, Self and Mutual inductances-simple problems. Domestic wiring, Wires and Cables - types, Earthing, Protective devices, Switch fuse unit, Safety precautions and First Aid.

UNIT-III	ELECTRICAL MACHINES	10
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Construction and working principle- DC generators, EMF equation, Types and applications. Working principle of DC motors, Types and applications. Construction, Working principle and applications of 1 ϕ Transformer, Three phase alternator, Three phase induction motor and Synchronous motor.

UNIT-IV	ANALOG ELECTRONICS	8
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Resistor, Inductor and Capacitor in electronic circuits, PN Junction diodes, Rectifier, Zener diode-Characteristics-Applications, Construction and characteristics of bipolar junction transistor-Biasing, JFET, MOSFET, IGBT, SCR, Amplifier -Applications.

UNIT-V	DIGITAL ELECTRONICS	7
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Review of number systems, Binary codes, Error detection and correction codes, Combinational logic Circuits, Representation of logic functions-SOP and POS forms, K-map representations, Minimization using K maps - Simple Problems.

TOTAL: 45 PERIODS


Chairman
BoS / EEE

COURSE OUTCOME

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

- CO1** Explain circuit's behavior using circuit laws and analyze the mesh analysis and nodal analysis.
- CO2** Analyze the Magnetic circuits, earthing and wiring.
- CO3** Understand the working principle and applications of electrical machines.
- CO4** Aanalyze the characteristics of analog electronic devices.
- CO5** Explain the basic concepts of digital electronics.

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. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019.
3. James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley, 2018.
4. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

REFERENCE BOOKS:

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

E-RESOURCES:

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

CO's - PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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
AVG	3	3	2	2	-	-	-	-	-	1	-	-	3	3	2

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

23PHT24

MEDICAL PHYSICS
(for B.E. BME)

L	T	P	C
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 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.

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

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

CO's – PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	1	1	1	-	-	-	-	-	-	-
C02	3	3	1	1	1	1	-	-	-	-	-	-
C03	3	3	1	1	1	-	-	-	-	-	-	-
C04	3	3	-	1	1	-	-	-	-	-	-	-
C05	3	3	-	1	1	1	-	-	-	-	-	-
AVG	3	3	1	1	1	1	-	-	-	-	-	-

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

23MET21

ENGINEERING GRAPHICS
(Common to: B.E./B.Tech. 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.
- Drawing projection 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

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 Edition, 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	PO12	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

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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 beads - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT-IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3


Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoombu 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

SVHEC-R2023


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 isherly knowledge of Tamils
- CO5:** Apply scienti ic 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	PO12
C01	1	-	-	-	-	1	1	1	1	1	-	1
C02	2	-	-	-	-	2	2	2	2	2	-	2
C03	2	-	-	-	-	2	2	2	2	2	-	2
C04	1	-	-	-	-	1	1	1	1	1	-	1
C05	2	-	-	-	-	2	2	2	2	2	-	2
AVG	2	-	-	-	-	2	2	2	2	2	-	2

23TAT21

தமிழரும் தொழில்நுட்பமும்

L T P C
1 0 0 1

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

பாடநெறி நோக்கங்கள்:

- நெசவு மற்றும் பாணைத்தொழில்நுட்பத்தைப் 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 கட்டிடத் தொழில்நுட்பம்

3

சங்க காலத்தில் நெசவுத்தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்சங்க காலத்தில் நெசவுத்தொழில் - பாணைத் 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 - மாமல்லபுரம் 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 காட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சுத்தல் - 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 குழுமித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் 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

- C01: நெசவு மற்றும் பானைத்தொழில்நுட்பத்தை பற்றிப் புரிந்துகொள்வார்கள்
- C02: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பத்தில் தமிழர்களின் அறிவைப் பெறுவார்கள்
- C03: தமிழர்களின் உற்பத்தி தொழில்நுட்பத்தை கண்டறிவார்கள்
- C04: தமிழர்களின் வேளாண்மை மற்றும் கடல்சார் அறிவைக் குறித்து விவாதிப்பார்கள்.
- C05: 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	PO12
C01	1	-	-	-	-	1	1	1	1	1	-	1
C02	2	-	-	-	-	2	2	2	2	2	-	2
C03	2	-	-	-	-	2	2	2	2	2	-	2
C04	1	-	-	-	-	1	1	1	1	1	-	1
C05	2	-	-	-	-	2	2	2	2	2	-	2
AVG	2	-	-	-	-	2	2	2	2	2	-	2

SVHEC-R2023


Chairman
BoS / S&H

23MEL21

ENGINEERING PRACTICES LABORATORY
(Common to: B.E./B.Tech. 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

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:

- Study elements of smart phone
- Assembly and dismantle of LED TV
- 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:

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

E-RESOURCES:

- <https://www.youtube.com/watch?v=GPnQjCrb83Y>
- <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	PO12	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

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 (λ_{max}) 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.

TEXT BOOKS:

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

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BoS/BME

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	PO12	PSO1	PSO2	PSO3
C01	3	2	1	1	1	1	-	-	-	-	-	1	1	-	-
C02	3	3	1	1	2	2	-	-	-	-	-	2	1	-	-
C03	3	3	2	1	2	2	-	-	-	-	-	2	1	-	-
C04	3	3	2	1	1	2	-	-	-	-	-	2	1	-	-
C05	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

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.

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

E-RESOURCES:

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

CO's-PO's MAPPING :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

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
Agha. Santhi : Clearance. 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
Surya 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.


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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

COURSE OUTCOMES:

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

- C01:** Understand how to solve the given standard partial differential equations.
- C02:** Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- C03:** Appreciate the physical significance of Fourier series techniques in solving one dimensional heat flow problems and one-dimensional wave equations
- C04:** Understand Fourier transform and its properties and to handle various types of problems using different kind of integral Transforms.
- C05:** 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", 44th Edition, 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", 5th Edition, 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	PO12
C01	3	3	1	1	-	-	-	-	2	-	-	3
C02	3	3	1	1	-	-	-	-	2	-	-	3
C03	3	3	1	1	-	-	-	-	2	-	-	3
C04	3	3	1	1	-	-	-	-	2	-	-	3
C05	3	3	1	1	-	-	-	-	2	-	-	3
Avg	3	3	1	1	-	-	-	-	2	-	-	3

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

23ECT31

ELECTRONIC DEVICES AND CIRCUITS
(For-B.E - 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 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

- C01:** Explain the structure and working operation of basic electronic devices
- C02:** Design and analyze amplifiers.
- C03:** Analyze frequency response of BJT and MOSFET amplifiers
- C04:** Design and analyze feedback amplifiers and oscillator principles.
- C05:** Design and analyze power amplifiers and supply circuits

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	PO12	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

23BMT31

BIOSENSORS 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-PMDC-MI- CRO – block diagram, CRT – vertical & horizontal deflection system – DSO - LCD monitor-PMDC writing systems-servo recorders-photographic recorder-Magnetic tape recorder-Inkjet recorder-thermal recorder.

UNIT-V

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.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

- C01:** Measure various electrical parameters with accuracy, precision, resolution.
- C02:** Select appropriate passive or active transducers for measurement of physical phenomenon.

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- C03:** Select appropriate light sensors for measurement of physical phenomenon.
C04: Use Recording devices and bridge circuits for relevant parameter measurement.
C05: Select appropriate Biosensors for measurement of physical phenomenon.

TEXT BOOKS:

1. A.K.Sawhney, "Electrical & Electronics Measurement and Instrumentation", 10th edition, Dhanpat Rai & 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, Toshiyo Tamma and P. Ake Å-berg, "Biomedical Transducers and Instruments", CRC Press, 2018.

E-RESOURCES:

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

CO's - PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
C02	3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
C03	3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
C04	3	3	3	2	-	-	-	-	-	-	-	-	1	-	-
C05	3	3	3	2	-	-	-	-	-	-	-	-	1	-	-
AVG	3	3	2	1	-	-	-	-	-	-	-	-	1	-	-

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

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.

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 Mahmood Nahvi, "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.

E-RESOURCES:

<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	PO12	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	-	-

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

23CST33

OBJECT ORIENTED PROGRAMMING

(for B.E./B.Tech. –CSE, IT and BME)

L	T	P	C
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 JAVA FX

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–UserdefinedException.MultithreadedProgramming:javaThreadModel–Creatinga 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.

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

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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 BOOKS:

1. CayS.Horstmann, "CoreJavaFundamentals", Volume1, 11th Edition, Prentice Hall, 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	PO12	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	2	2	2	-	-	-	2	2	1	2	3	2	2

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


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 BoS/CSE&IT

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.

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

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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)
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	PO12	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

23EST31	ENTREPRENEURSHIP AND STARTUP	L	T	P	C
	(Common to: B.E / B.Tech. all Branches)	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 edition.
2. Khanka S.S.-Entrepreneurial Development-S.Chand& Co, RamNagar, New Delhi, Latest edition.

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 edition.
4. Donald F.Kuratko- Entrepreneurship theory, process & practice-9th Edition-Cengage Learning,2022.

E-RESOURCES:

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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-low, 2-medium, 3- high, '-'-no correction

23ECL31 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L T P C
0 0 3 1.5

(For-B.E - 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 Characteristic and 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

- C01:** Characteristics of PN Junction Diode and Zener diode.
- C02:** 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.
- C03:** Design and Testing of BJT and MOSFET amplifiers
- C04:** Analyze the characteristics of FET based differential amplifier experimentally.
- C05:** Operation of power amplifiers.

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	PO12	PSO1	PSO2	PSO3
C01	3	2	1	3	2	1	-	-	-	-	-	1	2	1	1
C02	3	2	1	3	2	1	-	-	-	-	-	1	2	1	1
C03	3	2	1	1	1	1	-	-	-	-	-	1	2	1	1
C04	3	2	1	-	3	1	-	-	-	-	-	1	2	1	1
C05	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

23BML31

**BIOSENSORS AND MEASUREMENTS
LABORATORY**

L	T	P	C
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".

REFERENCE BOOKS:

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

C01: Design and understand characteristics and calibration of various transducers.

C02: Design and develop bridge circuits to find unknown variables.

C03: Select proper transducer for various applications.

C04: Understand various read out and display devices.

C05: 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	PO12	PSO1	PSO2	PSO3
C01	3	2	1	2	-	-	-	-	1	2	-	-	2	-	-
C02	3	2	1	1	-	-	-	-	1	2	-	-	2	-	-
C03	3	2	1	1	-	-	-	-	1	2	-	-	2	-	-
C04	3	2	1	2	-	-	-	-	1	2	1	-	2	-	-
C05	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

23CSL35

OBJECT ORIENTED PROGRAMMING USING JAVA**LABORATORY**

(for B.E. - BME)

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To build software development skills using java programming for real- world applications.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, exception handling and file processing.
- To develop applications using generic programming and event handling

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
4. Solve the above problem using an interface Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
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 Java FX controls, layouts and menus.

Lab Requirements: for a batch of 30 students

Operating Systems: Linux / Windows

Front End Tools: Eclipse IDE/ Net beans IDE

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

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

- C01:** Design and develop java programs using object oriented programming concepts
- C02:** Develop simple applications using object oriented concepts such as package, exceptions
- C03:** Implement multithreading, and generics concepts
- C04:** Create GUIs and event driven programming applications for real world problems.
- C05:** Implement and deploy web applications using Java


Chairman
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CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	-	-	-	-	1	2	2	2	1	2	3
CO2	2	1	3	1	-	-	-	-	2	3	3	2	1	3	1
CO3	2	2	1	2	1	-	-	-	1	2	1	3	2	3	2
CO4	2	2	1	3	-	-	-	-	3	1	1	1	2	1	2
CO5	1	3	3	1	3	-	-	-	1	1	1	1	2	1	2
AVG	2	2	2	2	2	-	-	-	2	2	2	2	2	2	2

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


Chairman
 B&S/CSEA/IT

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

		3	1	0	4
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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
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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
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Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression

UNIT-III	ESTIMATION THEORY			9+3
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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
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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
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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 for Engineers", Pearson Education, Asia, 9th Edition, 2016.

Shree Venkateshwara Hi-Tech Engineering College (Autonomous)

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 Stochastic Processes", 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 of Probability 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	PO12
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

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, direct methods: electronic manometer, Pressure amplifiers - systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultra sound blood flow measurements .

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.

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R. S. Kumar
Chairman
BoS/BME

- C04:** Explain the different measurement techniques for non-electrical bio-parameters
C05: 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/>

CO's-PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	2	1	1	-	-	-	-	-	-	-	-	2	1	-
C02	3	2	1	1	-	-	-	-	-	-	-	-	2	1	-
C03	3	2	1	1	-	-	-	-	-	-	-	-	2	1	-
C04	3	2	1	2	-	-	-	-	-	-	1	-	2	1	-
C05	3	2	1	1	-	-	-	-	-	-	1	-	2	1	-
AVG	3	2	1	1	-	-	-	-	-	-	1	-	2	1	-

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

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.

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.
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.

E-RESOURCES:

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	PO12	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

23BMT43

BIOCONTROL 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

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.

E-RESOURCES:

<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>

CO & PO MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

23CYT41	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	L T P C
	(Common to B.E./B.Tech. all Branches)	
		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
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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
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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 (OHSMS). Environmental protection, Environmental protection acts.

Activity: Documentation of pollution issues in Erode district.

UNIT-III	RENEWABLE SOURCES OF ENERGY	6
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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
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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
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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

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=17Z34WU257U> (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)

CO's & PO's MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	1	-	-	-	2	3	-	-	-	-	2
C02	3	2	-	-	-	3	3	-	-	-	-	2
C03	3	-	1	-	-	2	2	-	-	-	-	2
C04	3	2	1	1	-	2	2	-	-	-	-	2
C05	3	2	1	-	-	2	2	-	-	-	-	1

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 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

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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. Willsky 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. Van Veen, "Signals and Systems", Wiley, 2nd Edition, 2017
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.

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	PO12	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

23BML41

BIOMEDICAL 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.

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	PO12	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

		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

- C01** Design Combinational Circuits using logic gates.
- C02** Design and implement arithmetic circuits for different applications using op amp.
- C03** Design Sequential Circuits using logic gates.
- C04** Design Sequential Circuits using logic gates.
- C05** Simulate and analyse circuits using ICs.

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	PO12	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

23MDC41

SOFT 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).


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23BMT51

EMBEDDED SYSTEMS AND IoT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge and understand fundamental embedded systems design paradigms, architectures, possibilities, and challenges, both with respect to software and hardware.
- To understand the hardware architecture and features of embedded microcontrollers and peripherals.
- To understand programming aspects of embedded system design.
- To understand IoT architecture and Build simple IoT Systems using embedded target boards.
- To understand IoT infrastructure for healthcare applications.

UNIT-I EMBEDDED SYSTEM DESIGN

9

Introduction to embedded processors- Categories of embedded processors- Challenges in Embedded System Design, Design process- Requirements-specifications-Hardware architecture- Software architecture-Introduction to Harvard & Von Neuman architectures- CISC & RISC Architectures.

UNIT-II PERIPHERAL INTERFACING

9

I/O Devices-Timers and Counters- Watchdog Timers, Interrupt Controllers- A/D and D/A, Interfacing- Memory interfacing with a case study- I/O Device Interfacing with case Study- Programmed IO-Memory Mapped IO, Interfacing Protocols-SPI, I2C, USB, CAN, Ethernet/WiFi, Bluetooth.

UNIT-III EMBEDDED SYSTEM SOFTWARE DESIGN

9

Application Software, System Software, Design techniques, Model-based system engineering (MBSE), Use of High-Level Languages-embedded C / C++ Programming, Integrated Development Environment tools.

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 and interfacing using any Embedded target boards, Benefits and impact of IoT-Medical Big Data Analytics

UNIT-V INTERNET OF MEDICAL THINGS

9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain fundamental embedded systems design paradigms, architectures, possibilities, and challenges, both with respect to software and hardware.
- CO2:** Describe the hardware architecture and features of embedded microcontrollers and peripherals.
- CO3:** Explain software design tools and embedded system design programming phases.
- CO4:** Describe IoT Architectures and Build simple IoT Systems using embedded target boards.
- CO5:** Exhibit understanding of IoMT infrastructure for healthcare applications.

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. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.

E-RESOURCES:

1. <https://archive.nptel.ac.in>.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	1	1	1	-
CO2	3	2	1	1	1	-	-	-	-	-	-	1	1	1	-
CO3	3	2	1	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,'-'-nocorrelation

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 CARDIOLAICAL EQUIPMENT

9

Monitoring and recording of 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 Encephalo Graph). 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 - Spirometer -Lung Volume and vital capacity, measurements of residual volume, Whole body Plethysmograph, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor-Ventilators.

UNIT-V THERAPEUTIC EQUIPMENT

11

Cardiac Defibrillators, Pacemakers, blood warmers, Intravenous blood administration pumps, Haemodialysis, electro surgery machine, Humidifiers, oxygen concentrators, CPAP, BiPAP, Anaesthesia equipment, Lithotriptors, hearing aids.

TOTAL: 45 PERIODS

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

- C01** Describe the working and recording setup of all basic cardiac equipment.
- C02** Understand the working and recording of all basic neurological equipment's.
- C03** Discuss the recording of diagnostic and therapeutic equipment's related to EMG.
- C04** Explain about measurements of parameters related to respiratory system.
- C05** Understand the therapeutic procedures in assisting ventilation, hearing.

TEXT BOOKS:

1. Steven C. Schachter, Wade E. Bolton, Accelerating Diagnostics in a Time of Crisis: The Response to COVID-19 and a Roadmap for Future Pandemics, 1st Edition, Cambridge University Press, 2024.
2. American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, 5th Edition, Amer Psychiatric Pub Inc, 2022.
3. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.

REFERENCE BOOKS:

1. LA Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008.
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007.
3. Khandpur, R. S. (2020). Compendium of Biomedical Instrumentation, 3 Volume Set. United Kingdom: Wiley.
4. Medical Instrumentation: Application and Design. (2020). United Kingdom: Wiley.

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	PO12	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

23BML51

EMBEDDED SYSTEMS AND IoT LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open Platform.
- To apply the concept of Internet of Things in real world scenario.

LIST OF EXPERIMENTS

1. Programming Arithmetic and Logical Operations in 8051.
2. Generation of Square waveform using 8051.
3. Programming using On – Chip ports in 8051.
4. Programming using Serial Ports in 8051.
5. Design of a Digital Clock using Timers/Counters in 8051.
6. Write Basic and arithmetic Programs Using Embedded C
7. Blinking of LEDs and LCD
8. Interfacing ADC and DAC
9. Interfacing keyboard and Stepper Motor.
10. Introduction to Arduino platform and programming.
11. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth).
12. Introduction to Raspberry PI platform and python programming.
13. Interfacing sensors with Raspberry PI.
14. Communicate between Arduino and Raspberry PI using any wireless medium.
15. Log Data using Raspberry PI and upload to the cloud platform.

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. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
3. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014.

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

- C01:** Explain the architecture of embedded processors.
- C02:** Write embedded C programs.
- C03:** Design simple embedded applications.
- C04:** Compare the communication models in IOT.
- C05:** Design IoT applications using Arduino/Raspberry Pi /open platform.

CO's - PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	3	3	3	-	-	-	-	1	2	3	3	2	1	3
C02	2	1	3	2	2	-	-	-	1	2	2	3	3	1	3
C03	3	1	3	3	1	-	-	-	1	2	1	1	1	3	3
C04	3	2	3	2	1	-	-	-	1	2	2	3	2	2	1
C05	2	3	3	2	2	-	-	-	1	3	3	2	3	1	3
Avg	2.6	2	3	2.4	1.5	-	-	-	1	2.2	2.2	2.4	2.2	1.6	2.6

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

23BML52

**DIAGNOSTIC AND THERAPEUTIC EQUIPMENT
LABORATORY**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To demonstrate recording and analysis of different Bio potentials
- To examine different therapeutic modalities.
- To measure the different bioelectrical signals.
- To analyze the various physiological signal using telemetry.
- To understand the concept of different bio signals using suitable tools.

LIST OF EXPERIMENTS

1. Measurement of visually and auditory evoked potential.
2. Galvanic skin resistance (GSR) measurement.
3. Measurement of output intensity from shortwave and ultrasonic diathermy.
4. Measurement of various physiological signals using biotelemetry.
5. Measurement of various physiological signals using biotelemetry.
6. Measurement of stimulation current waveforms used in medical stimulator.
7. Analyze the working of ESU-cutting and coagulation modes.
8. Recording of Audiogram.
9. Study the working of Defibrillator and pacemakers.
10. Study of ventilators and Ultrasound Scanners.
11. Study of speech signals using speech signal trainer kit.
12. Study of heart lung machine model.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

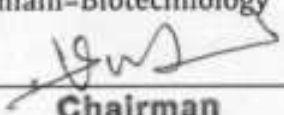
- C01:** Measure the different bioelectrical signals.
- C02:** Record the various physiological signals using telemetry.
- C03:** Demonstrate various diagnostic and therapeutic techniques.
- C04:** Examine the electrical safety measurements.
- C05:** Analyse the different bio signals using suitable tools.

REFERENCE BOOKS:

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

E-RESOURCES:

1. <http://bmshp-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Biotechnology>
SVHEC-R2023


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CO's - PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

23MDC51

SOFT 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: Interpret the data.


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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


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SUB. CODE	INTRODUCTION TO WOMEN AND GENDER STUDIES	L	T	P	C
23MDC52	(Common to: B.E / B.Tech. all Branches)	3	0	0	0

Course Objectives:

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

- To explore the concepts of sex and gender, understanding how they influence social constructs.
- To educate the key feminist theories and perspectives.
- To provide an overview of global and national women's movements with a focus on historical contexts and impacts.
- To understand how language shapes the ideas about gender, and how it can either reinforce or question traditional gender roles.
- To know how language influence the understanding of gender and how can it support or challenge traditional gender roles. is this correct.

UNIT-I	CONCEPTS	9
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Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT-II	FEMINIST THEORY	9
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Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT-III	WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL	9
-----------------	------------------------------------------------------	----------

Rise of Feminism in Europe and America. Women's Movement in India.

UNIT-IV	GENDER AND LANGUAGE	9
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Linguistic Forms and Gender. Gender and narratives.

UNIT-V	GENDER AND REPRESENTATION	9
---------------	----------------------------------	----------

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

Total Hours 45

COURSE OUTCOMES:

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

- CO1:** Differentiate between sex and gender, identifying the roles of socialization, patriarchy, and power structures in shaping gender norms and relations.
- CO2:** Critically evaluate feminist theories and apply them to analyze gender dynamics in various societal contexts.
- CO3:** Assess the historical and contemporary significance of women's movements globally and in India, recognizing their contributions to gender equality.
- CO4:** Understand and analyze the intersection of language, narratives, and gender, identifying how linguistic constructs influence societal perceptions of gender.
- CO5:** Examine the representation of gender in mainstream and alternative media, identifying stereotypes and advocating for more inclusive narratives.


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TEXT BOOKS:

1. Melissa J. Gillis and Srinivasan - Introduction to Women's and Gender Studies: An Interdisciplinary Approach 2nd edition.
2. Chris Beasley, Feminist Theory Today: An Introduction to Second-Wave Feminism, SAGE Publications.

REFERENCE BOOKS:

1. Dr.Girish Pachauri, Dr.Premalata Maisnam, Dr.Vandana Goswami.- 2023
2. Shagufta Siddiqui, Women and Gender Study: A Critical Exploration - 2024

E-RESOURCES:

- <https://plato.stanford.edu/entries/feminism-philosophy>
- <https://www.unwomen.org/en/digital-library>

CO, PO & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	1	1	1	-	-	-	-	-	-	3	3	2
CO2	2	3	3	-	-	2	-	-	-	-	-	-	2	-	-
CO3	1	-	2	2	2	1	-	-	-	-	-	-	1	3	2
CO4	-	2	3	2	1	-	-	-	-	-	-	-	1	2	1
CO5	2	2	1	3	1	1	-	-	-	-	-	-	1	1	-
Avg	1.6	2	1.8	1.6	1	1	-	-	-	-	-	-	1.6	1.8	1

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

23MDC53

ELEMENTS OF LITERATURE

L	T	P	C
3	0	0	0

COURSE OBJECTIVES:

- To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

UNIT-I	INTRODUCTION TO ELEMENTS OF LITERATURE	9
---------------	-----------------------------------------------	----------

- a) Nature of Literature: Meaning, Characteristics, literature as an art form.
- b) Functions of Literature: The aesthetic, moral, and cultural functions of literature.
- c) Types of Literature: Introduction to the three main genres: Prose, Poetry, and Drama.

UNIT-II	RELEVANCE OF LITERATURE	9
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- a) Enhances Reading, thinking, discussing and writing skills.
- b) Develops finer sensibility for better human relationship.
- c) Increases understanding of the problem of humanity without bias.

UNIT-III	ELEMENTS OF FICTION	9
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- a) Fiction, fact and literary truth.
- b) Fictional modes and patterns.
- c) Plot character and perspective.

UNIT-IV	ELEMENTS OF POETRY	9
----------------	---------------------------	----------

- a) Emotions and imaginations.
- b) Figurative language.
- c) Figures of Speech: Simile, metaphor, conceit, symbol, pun, personification irony and trend.

UNIT-V	ELEMENTS OF DRAMA	9
---------------	--------------------------	----------

- a) Drama as representational art.
- b) Drama as narration, mediation and persuasion.
- c) Features of tragedy, comedy and satire.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- Students will be able to understand the relevance of literature in human life and appreciate its aspects in developing finer sensibilities.

TEXT BOOKS:

- 1) An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
- 2) The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2014.
- 3) The Elements of Drama, J.L. Styan, Literary Licensing, 2011.
- 4) An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
- 5) The Experience of Poetry, Graham Mode, Open college of Arts with Open Univ Press, 1991.

REFERENCE BOOKS:

- 1) To be decided by the teacher and student, on the basis of individual student so as to enable him or her to write the term paper.

	FILM APPRECIATION	L	T	P	C
23MDC54	(BE/B.Tech- Common to all Branches)	3	0	0	0

In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved overall century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.

Theme - A: The Component of Films

- A-1: The material and equipment
- A-2: The story, screenplay and script
- A-3: The actors, crew members, and the director
- A-4: The process of film making... structure of a film

Theme- B: Evolution of Film Language

- B-1: Film language, form, movement etc.
- B-2: Early cinema... silent film (Particularly French)
- B-3: The emergence of feature films: Birth of a Nation
- B-4: Talkies

Theme-C: Film Theories and Criticism/ Appreciation

- C-1: Realist theory; Auteurists
- C-2: Psychoanalytic, Ideological, Feminists
- C-3: How to read films?
- C-4: Film Criticism/Appreciation

Theme-D: Development of Films

- D-1: Representative Soviet films
- D-2: Representative Japanese films
- D-3: Representative Italian films
- D-4: Representative Hollywood film and the studio system

Theme-E: Indian Films

- E-1: The early era
- E-2: The important films made by the directors
- E-3: The regional films
- E-4: The documentaries in India

READING:

A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.


Chairman
 BoS/CSE&IT

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]


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SVHEC - R2023

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	PO 12	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

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


Chairman
BoS / Civil

SVHEC - R2023

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

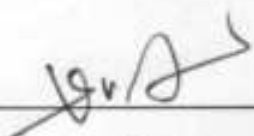
Small intestinal submucosa and other decellularized matrix biomaterials for tissue repair. Soft tissue replacements, types of transplant by stem cell, sutures, surgical tapes, Tissue adhesive/glue. Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, 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

SVHEC-R2023


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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:

- 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.
- Richard J. Miron (Editor), M.D. Zhang, Yufeng, Next-Generation Biomaterials for Bone & Periodontal Regeneration, 1st Edition, Quintessence Pub Co, 2019.
- 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:

- Paul Ducheyne (Editor), Kevin Healy (Editor), Dietmar W. Hutmacher, Comprehensive Biomaterials II, 2nd Edition, Elsevier, 2017.

E-RESOURCES:

- <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	PO12	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

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

- C01:** Gain adequate knowledge about artificial organs & transplants.
- C02:** Get clear idea about implant design and its parameters and solution.
- C03:** Explain different types of hard tissue replacement and soft tissue replacement.
- C04:** Have in-depth knowledge about blood interfacing implants.
- C05:** Adequate knowledge about Implantable medical devices and organs.

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.
- 4.

REFERENCE BOOKS:

1. Prof Philip M. Parker Ph.D, The 2023 Report on Artificial Organs and Bionic Implants: World Market Segmentation by City , First Edition, ICON Group International, Inc, 2022.

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	PO12	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

23BME13

REHABILITATION ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To explain the need for medical aids.
- To understand the sensory rehabilitation systems.
- To learn the use of orthopedic prosthetics and orthotics in rehabilitation.
- To understand virtual reality in rehabilitation
- To have an understanding of rehabilitation medicine and advocacy.

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

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

CO1: Summarize the key terminologies used by the rehabilitation team.

CO2: Illustrate Engineering Concepts in Sensory & Motor rehabilitation.

CO3: Design different orthotics and prosthetics for rehabilitation applications.

CO4: Summarize the need of virtual reality tools for different aids.

CO5: Appraise the legal aspects for building rehabilitation aids for the needed people.

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	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1	-	1	-	-	-	-	1	-	-
CO2	3	1	1	-	-	1	-	1	-	-	-	-	1	-	-
CO3	3	1	1	-	-	1	-	1	-	-	-	-	1	-	-
CO4	3	1	1	-	-	1	-	1	-	-	-	-	1	-	-
CO5	3	1	1	-	-	1	-	1	-	-	-	-	1	-	-
AVG	3	1	1	-	-	1	-	1	-	-	-	-	1	-	-

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

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 acquire 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

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	PO12	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

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 acquire 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

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	PO12	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

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

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	PO12	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

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 Decay, 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 - ^{32}P and ^{89}Sr Dosage.

UNIT-IV THERAPEUTIC APPLICATIONS OF RADIONUCLIDE 9

Intravascular Particulate Radio Nuclide Therapy, Receptor Targeted Therapy, ^{131}I - 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

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:

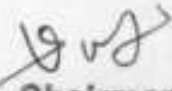
1. Max. H. Lombardi, "Radiation Safety in Nuclear Medicine", 2nd Edition, CRC Press, Florida, USA, 2006.
2. Harvey Ziessman, Janis O Malley and James Thrall, "Nuclear Medicine", 4th Edition, Elsevier, 2013.
3. Pete Shackett, "Nuclear Medicine Technology", 2nd Edition, Lipkott William Wilkkins, USA, 2009.
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/P SO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	2	2	-	-	-	-	-	-	-	-	2	-	-
CO4	-	2	-	-	2	-	-	3	-	-	-	-	-	-	2
CO5	-	-	-	-	-	3	2	-	-	2	-	-	-	-	-
AVG	3	2	2	2	2	3	2	3	-	2	-	-	2	1	2

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

SVHEC-R2023


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

SVHEC-R2023


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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. Anselm 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	PO12	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

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

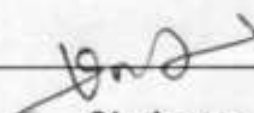
Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation- Sustenance.

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

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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, 2011.
2. Wes Bush, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

REFERENCE BOOKS:

1. Hiriappa 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 Development".

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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-Labeling 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.

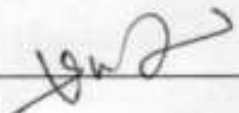
TOTAL : 45 PERIODS

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.

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TEXT BOOKS:

1. Peter J.Ogrodnik , "Medical Device Design", Academic press, Elsevier, 2nd Edition, 2020.
2. DeMarco, Carl T., "Medical Device Design and Regulation ", American Society for Quality ASQ 1st 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	PO12	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

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

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", 4th edition, Wiley India PvtLtd, New Delhi, 2015.
2. Liam Donaldson, Walter Ricciardi, "Textbook of patient safety and clinical Risk management", Springer.

REFERENCE BOOKS:

1. 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	PO12	PSO1	PSO2	PSO3
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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

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 DGCI, 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

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	PO12	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

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

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:

- 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.
- Robert D. Hisrich (Author), Claudine Kearney, Managing Innovation and Entrepreneurship, 1st Edition, SAGE Publications, Inc, 2013.
- Jen-Shih Lee "Biomedical Engineering Entrepreneurship", World Scientific Publishing, USA 2010.
- Vasant Desai, –The Dynamics of Entrepreneurial Development and Management||, Himalaya Publishing House, 2010.

REFERENCE BOOKS:

- Brant Cooper, Patrick Vlaskovits, "The Lean Entrepreneur", Wiley, 2nd edition, New Jersey, 2016.
- Nathan Furr, Jeff Dyer, "The Innovator's Method: Bringing the Lean Start-up into Your Organization", Harvard Business Press, Boston, 2014.
- Gupta S.L., Arun Mittal, "Entrepreneurship Development", International Book House, 2012.
- Prasanna Chandra, "Projects- Planning, Analysis, Financing, Implementation and reviews, TATA McGraw Hill, 2012.

E-RESOURCES:

- <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	PO12	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

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

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:

- Matthew Smith, Andrew Peterson, The Rapid Prototyping Game ,1st Edition, CRC Press,2021.
- Fuwen Frank Liou, Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Second Edition, CRC Press,2019.
- Ramesh S, Textbook of Rapid Prototyping, Ane Books Pvt. Ltd,2016.
- Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, World Scientific Publishers, Third edition, 2010.

REFERENCE BOOKS:

- Kalpesh Kamble, A Textbook of Rapid Prototyping Technology, Kalpesh Sunil Kamble,2023.
- M. Adithan, Rapid Prototyping 1st Edition, Atlantic Publishers and Distributors Pvt Ltd,2015.
- Tom Page Design for Additive Manufacturing, LAP Lambert Academic Publishing, 2012.

E-RESOURCES:

- <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	PO12	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

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.

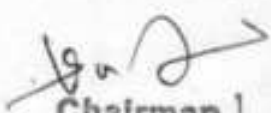
TOTAL : 45 PERIODS

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:** Understand the processes to ensure quality, testing, and approval of biomedical products

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- CO3:** Implement signal processing techniques required for product development.
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. 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	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	-	-	2	2	2	3	2	3
CO2	3	3	2	2	2	1	1	-	-	2	2	2	3	3	2
CO3	3	3	2	2	2	3	3	-	-	2	3	2	2	2	2
CO4	3	3	2	2	2	3	3	-	-	2	2	2	1	2	1
CO5	3	3	2	2	3	3	2	-	-	2	2	2	1	2	1
AVG	3	3	2	2	2.2	2.4	2	-	-	2	2	2	2	2	2

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

23BME28 OPTHALMOLOGY AND DENTISTRY EQUIPMENTS

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 OPTHALMIC 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 OPTHALMIC TECHNIQUE

9

Head posture and its significance - Specular Microscopy- Squint - Katerometer - Retinoscope
 Exophthalmometer - Dark adaptometer - Paediatric Refraction - eye bank specular - Rehabilitation
 of the visually handicapped.

UNIT-III CLINICAL OPTHALMOLOGY

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

COURSE OUTCOMES:

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

- CO1:** Explain 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 Ophthalmic 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-IVXudr27-N1oE5OZxD1R2BqynT /view](https://drive.google.com/file/d/1ZfnUB-IVXudr27-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	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	-	-	1	1	1	3	2	3
CO2	3	3	2	2	2	1	1	-	-	1	1	1	3	3	2
CO3	3	3	2	2	2	3	3	-	-	1	1	1	2	2	2
CO4	3	3	2	2	2	3	3	-	-	1	1	1	1	2	1
CO5	3	3	2	2	3	3	2	-	-	1	1	1	1	2	1
AVG	3	3	2	2	2.2	2.4	2	-	-	1	1	1	2	2	2

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

23BME31

CLINICAL ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide a basic understanding of the clinical engineering profession, Qualifications, roles, activities, and expectations.
- To enhance students to practice medical equipment and analyze challenges with their healthcare technology.
- To engage the students to work as a team to address problems and errors in medical devices.
- To help students to design better medical devices with computerized Approaches.
- To expose students to explore the Health Technology Management systems with medical devices and supportive services with advanced application.

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, Prerequisite 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: Health 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

COURSE OUTCOMES:

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

- CO1:** State the role of clinical engineers and discuss the basic concepts of medical and healthcare technology
- CO2:** Give the program and framework to recognize the errors of medical equipment
- CO3:** State the issues or errors in patient safety and formulate patient safety package system
- CO4:** Define the problem precisely and examine the possible issues using program indicators.
- CO5:** Demonstrate computer based equipment with automated system by using CPOE method.

TEXT BOOKS:

1. Samantha Jacques PhD FACHE, Barbara Christe, " Introduction to Clinical Engineering Academic Press, 2020.
2. Azzam Taktak , Paul Ganney , David Long , Richard Axell, Clinical Engineering: A Handbook for Clinical and Biomedical Engineers, 2nd Edition, Academic Press, 2019.
3. Ernesto Iadanza, Clinical Engineering Handbook, 2nd Edition, Academic Press, 2019.

REFERENCE BOOKS:

1. Robin Southwood, Virginia H. Fleming , Gary Huckaby, Concepts in Clinical Pharmacokinetics, 7th Edition, American Society of Health-System Pharmacists, 2018.
2. Robert Miniati, "Clinical Engineering from Devices to Systems", Academic Press, 23-Dec-2015 - Technology & Engineering.

E-RESOURCES:

1. https://nu.kz.libguides.com/biomedical_engineering/
2. <https://crridom.gov.in/open-access-e-resources>
3. <https://library.saskhealthauthority.ca/home/clinicaleng>

CO's - PO's & PSO's MAPPING

CO/PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	1	-	-	1	-	1	-	-	-	-	2	3	-
CO 2	3	2	1	-	-	1	-	1	-	-	-	-	2	2	-
CO 3	3	2	1	-	-	1	-	1	-	-	-	-	2	1	1
CO 4	3	2	1	-	-	1	-	1	-	-	-	-	1	1	1
CO 5	3	2	1	-	-	1	-	1	-	-	-	-	1	1	1
AVG	3	2	1	-	-	1	-	1	-	-	-	-	1.6	1.6	1

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

23BME32

HOSPITAL PLANNING AND MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the relevance of this course to the existing technology
- To demonstrations, case studies, simulations, contributions of scientist, national/international policies.
- To a futuristic vision along with socio-economic impact and issues.
- To the student should be made to understand the principles.
- To practices and areas of application in Hospital management.

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 & CONSUMER BEHAVIOUR

9

Marketing information systems , assessing information needs, developing & disseminating information - Market Research process , Other market research considerations , Consumer Markets & Consumer Buyer behaviour - Model of consumer behaviour , Types of buying decision behaviour , The buyer decision process , Model of business buyer behaviour , Major types of buying situations , global marketing in the medical sector , WTO and its implications.

UNIT-IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

9

Management Decisions and Related Information Requirement , Clinical Information Systems , Administrative Information Systems , Support Service Technical Information Systems, Medical Transcription, Medical Records Department, Central Sterilization and Supply Department , 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, Environment Management Systems. 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

COURSE OUTCOMES:

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

- CO1:** Explain the principles, practices and areas of application in Hospital Management.
- CO2:** Understand the concept of human resource management in hospital.
- CO3:** Explain the importance of supportive services.
- CO4:** Comprehend the quality aspect specified by the international standards.
- CO5:** Knowledge on Hospital safety.

TEXT BOOKS:

1. R.C. Goyal, D.K. Sharma, Hospital Administration and Human Resource Management, 7th Edition, Prentice Hall, 2017.
2. John I. Gallin MD, Frederick P Ognibene, Laura Lee Johnson PhD, Principles and Practice of Clinical Research, 4th Edition, Academic Press, 2017.
3. Cynthia Hayward, Healthcare Facility Planning: Thinking Strategically, 2nd Edition, Health Administration Press, 2016.

REFERENCE BOOKS:

1. Nancy J. Niles, Basic Concepts of Health Care Human Resource Management, 2nd Edition, Jones & Bartlett Learning, 2019.
2. Sharon B. Buchbinder, Nancy H. Shanks, Bobbie J Kite, Introduction to Health Care Management, 4th Edition, Jones & Bartlett Learning, 2019.
3. Dr Ali Nadeem, "New Public Management in Developing Countries. The Case of Health Sector Reform, 1st Edition, Grin Verlag, 2016.

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	PO12	PSO1	PSO2	PSO3
CO 1	3	2	1	-	-	1	-	1	-	1	-	-	-	-	-
CO 2	3	2	1	-	-	1	-	1	-	1	-	-	-	-	-
CO 3	3	2	1	-	-	1	-	1	-	1	-	-	-	-	-
CO 4	3	2	1	-	-	1	-	1	-	1	1	-	-	-	-
CO 5	3	2	1	-	-	1	-	1	-	1	1	-	-	-	-
AVG	3	2	1	-	-	1	-	1	-	1	1	-	-	-	-

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

23BME33

MEDICAL WASTE MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the hazardous materials used in hospital and its impact on health
- To understand various waste disposal procedures and management.
- To collect & receive the Biomedical Waste from health care facilities.
- To optimize the treatment and disposal cost by management practices and provide the very economical services to the hospitals.
- To conduct the public awareness program.

UNIT-I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS 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. Understanding Accidents: Accident Causation Theories, Human Factors, Accident Deviation Models, Accident Reporting, Accident Investigations, Accident Analysis, Organizational Functions That Support Accident Prevention, Workers' Compensation, Orientation, Education, and Training.

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, Control of Hazardous Energy, Permit Confined Spaces, OSHA Hearing Conservation Standard, Heating, Ventilating, and Air-Conditioning Systems, Assessing IAQ, Landscape and Grounds Maintenance, Fleet and Vehicle 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

COURSE OUTCOMES:

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

- CO1:** Analyse various hazards, accidents and its control.
- CO2:** Design waste disposal procedures for different biowastes.
- CO3:** Categorise different biowastes based on its properties.
- CO4:** Design different safety facility in hospitals.
- CO5:** Propose various regulations and safety norms.

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
3. William C. Blackman Jr, Basic Hazardous Waste Management ,3rd Edition, CRC Press,2016.
4. Anantpreet Singh, Sukhjit Kaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd, 2012.

REFERENCE BOOKS:

1. Yang Chen , Qinzhong Feng , Zhongkui ZhangInnovative," Disposal Technology and Management Practice for Medical Waste",1st Edition, Springer Verlag,2023.
2. D. K. Sharma , R. C. Goyal , Hospital Administration and Human Resource Management, 7th Edition, PHI Learning,2017.
3. Dr Ali Nadeem, " New Public Management in Developing Countries. The Case of Health Sector Reform, 1st Edition, Grin Verlag, 2016.

E-RESOURCES:

1. http://tnenviis.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	PO12	PSO1	PSO2	PSO3
CO 1	3	2	1	-	-	2	2	1	-	-	-	1	1	2	-
CO 2	3	2	1	-	-	2	2	1	-	-	-	1	1	2	-
CO 3	3	2	1	-	-	1	2	1	-	-	-	1	1	1	-
CO 4	3	2	1	-	-	1	2	2	-	-	-	1	1	1	1
CO 5	3	2	1	-	-	1	2	2	-	-	-	1	1	1	1
AVG	3	2	1	-	-	1.4	2	1.4	-	-	-	1	1	1.4	1

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

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.

TEXT BOOKS:

1. J.R. Monga , Raj Bahadur , Financial Accounting, 1st Edition, scholar tech press 2024.
2. New Age International Pvt. Ltd, Managerial Economics and Financial Analysis, 2nd Edition, New Age International Pvt. Ltd, 2019.
3. Banga & Sharma, Industrial Organization & Engineering Economics, 2nd Edition, Khanna Publishers, 2018.

REFERENCE BOOKS:

1. Lila J. Truett, Dale B. Truett , Name Leela Rani, " Managerial Economics, Wiley, 2022.
2. D.R.Patel, Principle of Economics and Management, 1st Edition, Atul Prakashan, 2020.

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	PO12	PSO1	PSO2	PSO3
CO 1	3	-	2	-	-	-	1	-	-	-	1	1	1	-	-
CO 2	3	-	2	-	-	-	1	-	-	-	1	1	1	-	-
CO 3	3	-	2	-	-	-	1	-	-	-	1	1	1	1	-
CO 4	3	-	2	-	-	-	1	-	-	-	1	1	1	1	1
CO 5	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

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
8. Calculate the regression equation
9. Calculate correlation coefficient
10. Interpreting life tables clinical trials

PRACTICAL: 30 PERIODS

TOTAL (30+30) =60 PERIODS**COURSE OUTCOMES:**

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

- CO1:** Define the new and existing statistical methodology for their research problem.
- CO2:** Explain p- values for different statistical tests.
- CO3:** Analyze the biomedical research data and be able to report the study results.
- CO4:** Describe the various sources of medical data
- CO5:** Demonstrate the visual analytical procedure of Medical Data.

TEXT BOOKS:

1. Chandan K. Reddy , Charu C. Aggarwal, Healthcare Data Analytics, 1st Edition, Chapman and Hall/CRC,2020.
2. Charan Singh Rayat, Statistical Methods in Medical Research, Soft cover reprint of the original 1st Edition, Springer Verlag, 2019.
3. K. Janardhan P. Hanmanth Rao, Fundamentals of Biostatistics, 2nd Edition, Dream tech Press2019.
4. M. Ataharul Islam , Abdullah Al-Shiha, Foundations of Biostatistics, Soft cover reprint of the original 1st Edition, Springer Verlag, Singapore, 2018.

REFERENCE 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. Dong-Qing Wei , Yilong Ma, William C.S. Cho , Qin Xu & Fengfeng Zhou, Translational Bioinformatics and Its Application, 1st Edition, Springer,2018.

E-RESOURCES:

1. <https://nptel.ac.in/courses/106/107/106107220/>
2. https://onlinecourses.nptel.ac.in/noc21_cs45/preview

CO's – PO's & PSO's MAPPING

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

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

23BME36

FORENSIC SCIENCE IN HEALTHCARE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To the history of the forensic sciences and its place in popular culture.
- To the roles of different types of professionals involved in evaluating a crime scene and the collected evidence.
- To forensic microscope and Anthropology
- To the Blood stain identification
- To the methodology of collecting & interpreting data for fingerprint application

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: Define the significance of forensic sciences
- CO2: Observe and document crime scenes
- CO3: Determine Trauma and Diseases.
- CO4: Describe the various sources of medical data related to forensic science.
- CO5: Demonstrate the visual analytical procedure of finger print application.

TEXT BOOKS:

1. Suzanne Bell, Forensic Science an Introduction to Scientific and Investigative Techniques with access Code, 5th Edition, CRC Press, 2019.
2. Connie Darnell, Forensic Science in Healthcare: Caring for Patients, Preserving the Evidence, 1st Edition, CRC Press, 2018.
3. B.B. Nanda, Forensic science in India: A vision for the twenty-first century, 1st Edition, 2014.

REFERENCE BOOKS:

1. B R Sharma, Forensic Science in Criminal Investigation and Trials, Sixth Edition, Lexis Nexis, 2019.
2. Richard Saferstein, Criminalistics: An Introduction to Forensic Science, 12th Edition, Pearson, 2017.

E-RESOURCES:

1. <https://ser-infotech.com/category/index/506>
2. <https://www.hsls.pitt.edu/e-journals/Forensic%20Sciences>

CO's - PO's & PSO's MAPPING

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

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

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 about health care analytics and benefits of Electronic health records.
- CO2:** Understand about Bio medical image analysis.
- CO3:** Understand about Natural language processing and biomedical mining.
- CO4:** Understand about information retrieval for health care.
- CO5:** Demonstrate about applications and practical systems for health care.

TEXT BOOKS:

1. Leyla Özgür Polat and Olcay Polat, AI-Driven Innovation in Healthcare Data Analytics, First Edition, IGI Global, 2024.
2. Tiko Iyamu, Advancing Big Data Analytics for Healthcare Service Delivery, 1st Edition, Taylor & Francis Ltd, 2022.

REFERENCE BOOKS:

1. Chandan K. Reddy, Charu C. Aggarwal, Healthcare Data Analytics, First Edition, Chapman & Hall, 2015.

E-RESOURCES:

1. <https://www.coursera.org/courses?query=understanding%20iot%20technologies>.

CO's - PO's & PSO's MAPPING

CO/PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	2	-	-	-	-	2	3	3	3	3
CO 2	2	1	2	2	2	1	-	-	-	-	1	3	2	3	3
CO 3	2	1	2	3	1	2	-	-	-	-	3	2	2	2	3
CO 4	2	1	2	2	1	1	-	-	-	-	-	2	2	3	2
CO 5	-	1	-	1	3	2	-	-	-	-	2	2	2	2	2
AVG	2	1	2	2	1.6	1.6	-	-	-	-	2	2.4	2.2	2.6	2.6

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

23BME38	HEALTH POLICY AND EQUIPMENT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To give an introduction of how health systems function and how health policy is shaped and implemented.
- To provide superior healthcare services to all age groups and genders.
- To involves prioritizing maintenance work as a means for improving site performance.
- To Provide a holistic approach to reliability, maintainability, maintenance, and logistic support analysis.
- To provide the knowledge and expertise of Systematic.

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:** Discuss the basics of health organization.
- CO2:** Explain the various national health policies.
- CO3:** Perform equipment installation, service & calibration needs and Planning activities at health care centres.
- CO4:** Repair methods for Material handling equipment.
- CO5:** Minimizing equipment failures and to increase patient safety.

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 Amooore, 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.asianhbm.com/technology-equipment/medical-equipment-management>.

CO's - PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	2	1	-	-	-	-	2	3	3	2	3
CO 2	3	2	3	-	2	1	-	-	-	-	1	2	2	3	2
CO 3	2	2	1	2	3	3	-	-	-	-	1	2	1	2	2
CO 4	2	3	1	1	3	3	-	-	-	-	1	2	1	1	2
CO 5	2	-	3	1	3	3	-	-	-	-	1	2	1	1	1
AVG	2.2	2.6	2	1.8	2.6	2.2	-	-	-	-	1.2	2.2	1.6	1.8	2

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

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

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:** Propose technical documents and give technical oral presentations related to design VR mini project results.
- CO5:** Develop simple and portable VR applications using appropriate software

TEXT BOOKS:

- Rajendra Kumar, Vishal Jain, Garry Tan Wei Han, Adberezak Touzene, Immersive Virtual and Augmented Reality in Healthcare: An IoT and Blockchain Perspective, 1st Edition, Hardcover – Import, 2023.
- C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc., 2008
- 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:

- 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
- 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:

- <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	PO12	PSO1	PSO2	PSO3
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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

23BME42

BIOMEDICAL OPTICS AND PHOTONICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge about 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 understand the engineering and practical applications of optics related to diagnostic and surgical applications.
- To understand 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 (LLL) - Biostimulation applications.

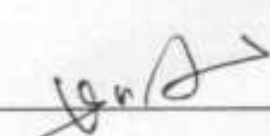
TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1: Explain the various physical properties of light and optical properties of tissues.
- CO2: Consolidate the working principles of optical components.
- CO3: Discuss the various Surgical laser applications of biosensors in medicine.
- CO4: Summarize the Non thermal diagnostic applications medicine.
- CO5: Explain the laser tissue interaction and various therapeutic applications of lasers.

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Chairman
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, Boca Raton, 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://archive.nptel.ac.in/courses/127/105/127105225/>
2. <https://www.youtube.com/watch?v=9Fxo5w1jsjs>

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	2	3	1	-	-	-	-	-	-	-	1	-	-	-
C02	3	2	3	1	-	-	-	-	-	-	-	1	2	-	1
C03	3	2	3	1	-	-	-	1	1	-	-	1	2	-	-
C04	3	2	3	1	-	-	-	1	1	-	-	1	2	-	1
C05	3	2	3	1	-	-	-	-	-	-	-	1	2	-	-
AVG	3	2	3	1	-	-	-	-	1	-	-	1	2	-	1

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

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

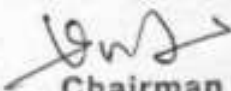
Modeling the body as compartments, behaviour in simple compartmental system, pharmacokinetic model, and multi compartmental system. Physiological modelling: Electrical analogy of blood vessels, model of systematic blood flow and model of coronary circulation. Mathematical modelling of the system: Thermo regulation, Thermoregulation of cold bloodedness& warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples.

UNIT-V SIMULATION OF PHYSIOLOGICALSYSTEMS 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

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

- CO1:** Explain the application of Physiological models
CO2: Describe the methods for analysis and synthesis of Linear system
CO3: Describe Nonlinear models of physiological systems
CO4: Describe the compartmental physiological model
CO5: Illustrate the Simulation of physiological systems

TEXT BOOKS:

1. Michel C Khoo, "Physiological Control Systems -Analysis, simulation and estimation", Prentice Hall of India, 2001.
2. Marmarelis, "Nonlinear Dynamic Modeling of Physiological Systems", Wiley-IEEE Press, 2004.

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	PO12	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

23BME44

ROBOTICS IN MEDICINE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To get introduced 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 be 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

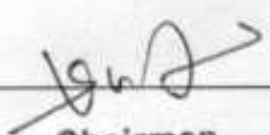
At the end of the course, the students will be able to

- C01:** Infer with the basics of robotics system
- C02:** Elucidate the kinematics, motion planning and control involved in design of robotics system
- C03:** Outline the concepts of robotics of surgery
- C04:** Analyze the technical aspects of robotic technology in image guided interventions
- C05:** Illustrate the role of robotics in assistive technology

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

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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	PO12	PSO1	PSO2	PSO3
C01	3	2	1	1	1	-	-	-	-	-	-	-	1	-	-
C02	3	2	1	1	1	-	-	-	-	-	-	-	1	-	-
C03	3	2	1	1	1	-	-	-	-	-	-	-	1	-	-
C04	3	2	1	1	1	-	-	-	-	-	-	-	1	-	-
C05	3	2	1	1	1	-	-	-	-	-	-	-	1	-	-
AVG	3	2	1	1	1	-	-	-	-	-	-	-	1	-	-

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

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 be 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.

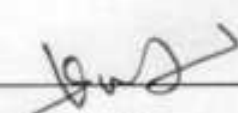
UNIT-V CASE STUDIES 9

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

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

- CO1:** Understand principles of ergonomics.
CO2: Understand the significance of posture
CO3: Learn about tracking tasks.
CO4: Learn about 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 Press 2007.
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	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-
CO2	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-
CO3	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-
CO4	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-
CO5	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-
AVG	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-

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

23BME46

HAPTICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To expose to basic principles of Haptics and their property.
- To give knowledge on machines in haptics.
- To learn types of sensors and actuators.
- To understand 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

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

- C01:** Explain the laws of principles of haptics for human
- C02:** Discuss the behavior of machines in haptics
- C03:** Analyze the suitable sensor and actuator for haptics.
- C04:** Identify suitable computation for haptics
- C05:** Describe the finite element analysis, design the work station depending upon the haptics

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. Kay M. Stanney, Handbook of Virtual Environments: Design, Implementation, and Applications, Lawrence Erlbaum Associates, Publications. N. I. Durlach and A. S. Mavor, eds., Virtual Reality: Scientific and Technological Challenges, National Academy Press, Washington, D.C., 1994.

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	PO12	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

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 understand 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

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:** Apply Artificial Intelligence for medical imaging applications.
- CO4:** Understand the concepts of Artificial Intelligence assisted surgery.
- CO5:** Develop Artificial Intelligence algorithms for remote patient monitoring.

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://www.youtube.com/watch?v=YX-23mwk05E>

CO's - PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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 explain, how the healthcare improved diversity issues in health informatics and consumer informatics.
- To understand 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

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

- C01:** Develop knowledge about problems and challenges that health informatics with its sub clauses addresses
- C02:** Demonstrate Basic Skills and knowledge in health informatics for application future health-related careers and nano technologies.
- C03:** Demonstrate ability to identify and understand imaging informatics technologies and their applications
- C04:** Analyze the key technologies that improved healthcare delivery and diversity issues in health informatics
- C05:** Understand 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, RE and Yoshihashi, A, Eds., Health Informatics: Practical Guide for Healthcare 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. Mohan Bansal MS, Medical Informatics, Tata McGraw Hill Publishing Company, New Delhi, 2005.
3. Yi-Ping Phoebe, Bioinformatics Technologies, Springer International, New Delhi, 2007.

E-RESOURCES:

1. <https://dth.ac.in/medical/course-inner.php?id=1>

CO's - PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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C04	3	3	3	-	1	2	-	-	-	2	-	1	3	1	-
C05	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

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 Markov 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.

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>.

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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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

23BME52

COMPUTER VISION

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To review image processing techniques for computer vision.
- To understand various features and recognition techniques.
- To learn about histogram and binary vision.
- To apply three-dimensional image analysis techniques.
- To 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

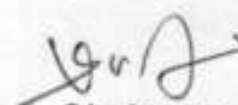
Introduction to motion – – Motion Editing – Facial Motion Capture – Markless Motion Capture, triangulation – bundle adjustment – translational alignment – parametric motion-spline-based motion-optical flow-layered motion.

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

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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>

CO's – PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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

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 Zolzer, 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://ocw.mit.edu/courses/6-345-automatic-speech-recognition-spring-2003/>
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	PO12	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

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 know the techniques used for visualizing various sections of the body.
- To understand the basic principles of ultrasound imaging techniques.
- 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.

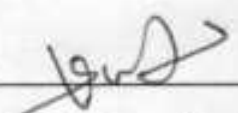
TOTAL : 45 PERIODS

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:** Know the concept of nuclear imaging techniques and radiation detectors

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- 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:** Discuss 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. 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. 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/>

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	-	-	-	-	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

23BME55	BRAIN COMPUTER INTERFACE AND APPLICATIONS	L	T	P	C
	(For B.E- ECE and BME)	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.

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/>

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	-	1	2	-
CO2	3	2	1	1	2	-	-	-	-	-	-	-	1	2	-
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	2	-

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

23BME56

BIOMETRICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the different principles of biometric systems.
- 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 understand the technologies of IRIS recognition.
- To understand 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.

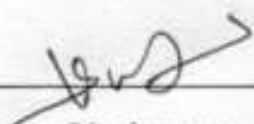
TOTAL : 45 PERIODS

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 recognition system.
- CO5: Classify the different voice scan techniques.

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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.nptelvideos.com/lecture.php?id=5439>
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	PO12	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

23BME57	DEEP LEARNING 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.

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://onlinecourses.nptel.ac.in/noc23_ee87/preview

CO's - PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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 know the steps involve in Ant Colony optimization
- To acquire sound knowledge on particle swarm optimization algorithm
- To be well versed with the concepts of multi-objective optimization method.
- To enlighten about hybrid optimization in the Neural Network Models.

UNIT-I EVOLUTIONARY COMPUTATION & 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.

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. Engelbrecht, 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>

CO's - PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	-	-	1	-	1	-	-	1	2	-
CO2	3	3	2	3	1	-	-	1	-	1	-	-	1	2	-
CO3	3	3	2	3	1	-	-	1	-	1	-	-	1	-	-
CO4	3	3	2	3	1	-	-	1	-	1	-	-	1	-	-
CO5	3	3	2	3	1	-	-	1	-	1	-	-	1	-	-
AVG	3	2.8	3	3	1	-	-	1	-	1	-	-	1	2	-

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

23BME61

COMMUNICATION SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the various analog modulation techniques
- To study the various digital communication techniques
- To study various Pulse Modulation techniques
- To impart knowledge in demodulation techniques
- To learn about noise 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.

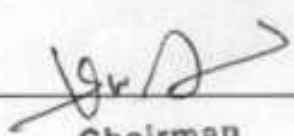
TOTAL HOURS: 45 PERIODS

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
- CO3:** Gain knowledge in Pulse Modulation techniques
- CO4:** Understand the importance of demodulation techniques
- CO5:** Knowledge on various types of noises during transmission

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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

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

23BME62

WEARABLE DEVICES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the hardware requirement of wearable systems
- To understand the communication and security aspects in the wearable devices
- To know the concept of signal processing to wearable devices
- To learn about application of wearable device in textile industry
- To know 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

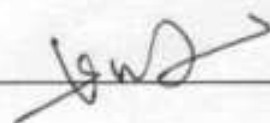
Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks. Case study-smart fabric for monitoring biological parameters - ECG, respiration.

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

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COURSE OUTCOMES:

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

- CO1:** Describe the concepts of wearable system.
- CO2:** Explain the energy harvestings in wearable device.
- CO3:** Use the concepts of BAN in health care.
- CO4:** Illustrate the concept of smart textile
- CO5:** Compare the various wearable devices in healthcare system

TEXT BOOKS:

1. Ram K. Gupta, Flexible and Wearable Sensors, 1st 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 Jamil Y. 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

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

23BME63

**BODY AREA NETWORKS
(For B.E- ECE and BME)**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know about concepts of body area network
- To know the hardware requirement of BAN
- To understand the communication and security aspects in the BAN
- To learn about Medical Device Regulations
- To know the applications of BAN in the field of medicine

UNIT I BODY AREA NETWORKS

9

BAN and healthcare, Technical challenges, sensor design, Biocompatibility, energy supply, energy scavenging methods, optimal node placement, number of nodes, networks for BAN, System security and reliability, standards. BAN Architecture

UNIT II HARDWARE FOR BAN

9

Processor, Low Power MCUs, mobile computing MCUs, Integrated processor with radio transceiver, memory types and ranges, Antenna types, PCB antenna, wire antenna, ceramic antenna, external antenna, Sensor interface, power sources, batteries and fuel cells for sensor nodes

UNIT III WIRELESS COMMUNICATION AND NETWORK

9

RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology-Stand -Alone BAN, Wireless personal Area Network Technologies-IEEE 802.15.1,IEEE P802.15.13, IEEE 802.15.14, Zigbee.

UNIT IV COEXISTENCE ISSUES WITH BAN

9

Interferences – Intrinsic - Extrinsic, Effect on transmission, Counter measures- on physical layer and data link layer, Regulatory issues-Medical Device regulation in USA and Asia, Security and Self-protection-Bacterial attacks, Virus infection, Secured protocols, Self-protection.

UNIT V APPLICATIONS OF BAN

9

Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhythmias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Comprehend and appreciate the significance and role of this course in the present Contemporary world.
- CO2:** Design a BAN for appropriate application in medicine.
- CO3:** Assess the efficiency of communication and the security parameters.
- CO4:** Understand the need for medical device regulation and regulations followed in various regions.
- CO5:** Extend the concepts of BAN for medical applications

TEXT BOOKS:

1. Dr. Kumar Keshamoni, Wireless Body Area Networks for Health Care Supervision, String Production, 2024.
2. Sandeep K.S. Gupta, Tridib Mukherjee, Krishna Kumar Venkata Subramanian, "Body Area Networks Safety, Security, and Sustainability", Cambridge University Press, 2013
3. Mehmet R. Yuce, Jamil Y.Khan, "Wireless Body Area Networks Technology, Implementation, and Applications", Pan Stanford Publishing Pte. Ltd., Singapore, 2012

REFERENCE BOOKS:

1. Dr. Salma Fauzia, Wireless Body Area Networks and IoT A Design Approach, Weser Books, 2021.
2. Zhang, Yuan-Ting, "Wearable Medical Sensors and Systems", Springer, 2013.
3. Guang-Zhong Yang(Ed.), "Body Sensor Networks", Springer, 2006.
4. Annalisa Bonfiglio, Danilo De Rossi, "Wearable Monitoring Systems", Springer, 2011.

E-RESOURCES:

1. <https://www.tonex.com/training-courses/wireless-body-area-network-training-wban/>

CO's – PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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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 comprehend 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. Case study on respiratory data, Case study on ECG data.

TOTAL: 45 PERIODS

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

CO1: Define the new and existing statistical methodology for their research problem.

CO2: Explain 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 Arnotage, 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, 2nd Edition, 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/

CO's - PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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 its 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 & 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

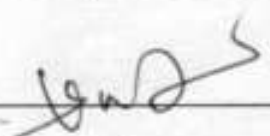
PRACTICALS:

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

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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:

- Mamta Mittal, Gopi Battineni, Information and Communication Technology (ICT) Frameworks in Telehealth, Springer International Publishing AG, 1st ed. 2022.
- Olga Ferrer Roca, Marcelo Sosa Iudicissa, "Handbook of Telemedicine", IOS Press, Netherland, 2002
- Khandpur R S, "TELEMEDICINE – Technology and Applications", PHI Learning Pvt Ltd., New Delhi, 2017

REFERENCE BOOKS:

- K Huang, "PACS and Imaging Informatics: Basic Principles and Applications" Wiley, New Jersey, 2010.
- Khandpur R S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003
- Keith J Dreyer, Amit Mehta, James H Thrall, "Pacs: A Guide to the Digital Revolution", Springer, New York, 2002.

E-RESOURCES:

- <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

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CO2	3	2	1	1	2	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-	-	2	-	-
CO4	3	2	1	1	2	-	-	1	-	-	-	-	2	-	-
CO5	3	2	1	1	2	-	-	1	-	-	-	-	2	-	-
AVG	3	2	1	1	2	-	-	1	-	-	-	-	2	-	-

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

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 theories and practices adopted in Hospital Information Systems in medical data format
- 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.

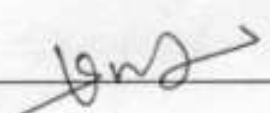
UNIT V RECENT TRENDS IN MEDICAL INFORMATICS

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

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COURSE OUTCOMES:

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

- CO1:** Gain knowledge on the structure of medical informatics and 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:** Discuss 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. Orpita Bosu 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

CO's – PO's & PSO's MAPPING

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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

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 design 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

- C01:** Demonstrate advanced medical devices and systems for patient monitoring, diagnosis, and emergency care.
- C02:** Apply principles of biomedical engineering to create innovative solutions for patient transportation and care
- C03:** Analyze safety and regulatory standards for medical devices and healthcare systems.
- C04:** Evaluate the efficiency and effectiveness of healthcare equipment and technology in clinical settings.
- C05:** Deduce insights from seminar presentations to improve the design and functionality of patient monitoring and emergency care systems.

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://ieeexplore.ieee.org/document/8336594/>

CO's - PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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 know 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

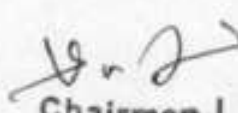
TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- C01:** Describe basic Telemetry, Biotelemetry & Telemedicine system/ subsystems
- C02:** Describe basic components and different methods of telemetry
- C03:** Explain the basics of telemedicine and health
- C04:** Identify and describe modern telemedical technologies
- C05:** Explain the application of Biotelemetry & Telemedicine in modern healthcare technology

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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://ieeexplore.ieee.org/document/624339>
3. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/biotelemetry>

CO's - PO's & PSO's MAPPING

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	-	3	-	-	3	2	-	-	-	3	2	3	2	-
C02	3	-	3	-	-	3	2	2	-	2	2	2	3	2	-
C03	1	-	3	-	-	3	2	2	-	2	2	2	2	2	2
C04	3	-	3	-	-	3	2	2	-	2	3	2	-	-	2
C05	1	-	3	-	-	3	2	2	-	2	2	2	-	-	-
AVG	2.2	-	3	-	-	3	2	2	-	2	2.4	2	2.6	2	2

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

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 implantation-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

- C01** Summarize various MEMS fabrication techniques.
- C02** Elucidate different types of mechanical and thermal sensors and actuators and their principles of operation at the micro Scale level.
- C03** Describe different types of various electrostatic and piezoelectric sensors and actuators and their principles of operation at the micro Scale level.
- C04** Explain microfluidic systems
- C05** Illustrate MEMS in different field of medicine.

TEXT BOOKS:

1. TaiRan Hsu, MEMS and Microsystems Design and Manufacture, Tata McGrawHill Publishing Company, New Delhi, 2020.
2. WanJun Wang and Stephen A. Soper, BioMEMS: Technologies and Applications, CRC Press, New York, 2007.
3. Chang Liu, Foundations of MEMS, Pearson Education International, New Jersey, USA, 2011.

REFERENCE BOOKS:

1. Ellis Meng, Biomedical Microsystems, CRC Press, Boca Raton, FL, 2011.
2. P. Tabeling, S. Chen, Introduction to microfluidics, Oxford University Press, 2010.
3. Alok Pandya, Vijai Singh, Micro/Nanofluidics and Lab-on-Chip Based Emerging Technologies for Biomedical and Translational Research Applications - Part B, Academic Press, 2022

E-RESOURCES:

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	PO12	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	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

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.

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	PO12	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

23BME73

HUMAN ASSIST 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:** Explain 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:** Describe 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.

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	PO12	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

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

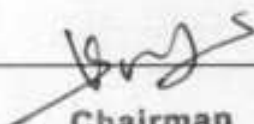
At the end of the course, the students will be able to

- CO1: Interpret the need for digital methods of handling medical records
- CO2: Explain the digital radiology
- CO3: Modify the tools and methods for work flow in E-Health
- CO4: Identify the available technology for wearable healthcare devices
- CO5: Compare 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

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3. Samuel A. Fricker, Christoph Thümmel, Anastasios Gavras, "Requirements Engineering For Digital Health", Springer, 2015

REFERENCE BOOKS:

1. Rick Krohn (Editor), David Metcalf, Patricia Salber, "Health-e Everything: Wearables and The Internet of Things for Health, ebook. 2013.
2. Khandpur, R.S., "Handbook of Biomedical Instrumentation", Second Edition. Tata Mc Graw Hill Pub. Co., Ltd. 2014
3. John, G. Webster. Medical Instrumentation: Application and Design. Second Edition. Wiley Publisher, New Delhi. 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	PO12	PSO1	PSO2	PSO3
C01	3	2	1	1	1	-	-	-	-	-	-	-	1	1	-
C02	3	2	1	1	1	-	-	-	-	-	-	-	1	1	-
C03	3	2	1	1	1	-	-	-	-	-	-	-	1	1	-
C04	3	2	1	1	1	-	-	-	-	-	-	-	1	1	-
C05	3	2	1	1	1	-	-	-	-	-	-	-	1	1	-
AVG	3	2	1	1	1	-	-	-	-	-	-	-	1	1	-

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

23BME75

ASSISTIVE TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To know the hardware requirement various assistive devices.
- To understand the concept of wearable dialysis devices.
- To study the basic principles behind hearing aids.
- To understand the prosthetic and orthodic devices.
- To know the developments in assistive technology.

UNIT-I CARDIAC ASSIST DEVICES 9

Principle of External counter pulsation techniques, intra aortic balloon pump, Auxiliary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT-II HEMODIALYSERS 9

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.

UNIT-III HEARING AIDS 9

Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT-IV PROSTHETIC AND ORTHODIC DEVICES 9

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, and sensory assist devices.

UNIT-V RECENT TRENDS 9

Transcutaneous electrical nerve stimulator, bio-feedback.

TOTAL: 45 PERIODS

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

- CO1:** Study various mechanical techniques that will help in assisting the heart functions.
- CO2:** Describe the underlying principles of hemodialyzer machine.
- CO3:** Indicate the methodologies to assess the hearing loss.
- CO4:** Evaluate the types of assistive devices for mobilization.
- CO5:** Explain about TENS and biofeedback system.

TEXT BOOKS:

1. Samin Sharma, Timothy J. Vittorio, Muhammad Saad, Devices in Cardiac Critical Care, McGraw Hill / Medical, 2024.
2. Joseph D. Bronzino, the Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006.
3. Marion. A. Hersh, Michael A. Johnson, Assistive Technology for visually impaired and blind, Springer Science & Business Media, 1st edition, 12-May-2010.

REFERENCE BOOKS:

1. Kenneth J. Turner Advances in Home Care Technologies: Results of the match Project, Springer, 1st edition, 2011.
2. Gerr M. Craddock Assistive Technology-Shaping the future, IOS Press, 1st edition, 2003.
3. 3D Printing in Orthopaedic Surgery, Matthew Dipaola , Elsevier 2019 ISBN 978 -0-323-662116.
4. Cardiac Assist Devices, Daniel Goldstein (Editor), Mehmet Oz (Editor), Wiley-Blackwell April 2000 ISBN: 978-0-879-93449-1

E-RESOURCES:

1. https://onlinecourses.swayam2.ac.in/aic19_ge01/

CO's - PO's & PSO's MAPPING

CO/ PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	-	1	-	2
CO2	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-
CO3	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-
CO4	3	1	1	1	1	-	-	-	-	-	-	-	1	-	2
CO5	3	1	1	1	1	-	-	-	-	-	-	-	1	-	-
AVG	3	1	1	1	1	-	-	-	-	-	-	-	1	-	2

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

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 & 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

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

- CO1:** Suggest suitable therapeutic devices for ailments related to cardiology, pulmonology, neurology, etc
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	PO12	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

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 NEMS, 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

- C01** Describe the basic science behind the properties of materials
- C02** Explain the basics properties of Nanoscience.
- C03** Explain the basics properties of MEMS & NEMS.
- C04** Outline the applications of nanomedicine.
- C05** 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

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	PO12	PSO1	PSO2	PSO3
C01	3	2	-	1	-	-	-	-	-	-	-	3	3	2	2
C02	3	2	-	1	-	-	-	-	-	-	-	3	3	2	2
C03	3	1	-	2	-	-	-	-	-	-	-	3	2	2	2
C04	3	1	2	3	-	-	-	-	-	-	-	3	2	3	2
C05	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

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

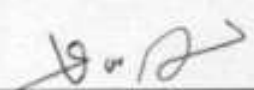
Wireless Communication Basics - Types of Wireless Network - Body Area Network - Emergency Rescue - Remote Recovery – General health assessments Technology in medical information processing- Future Trends in Healthcare Technology.

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,

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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, medical device utilization and advancements in healthcare technology through case studies.

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. Lodewijk Bos, "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>

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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	-

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