SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

CURRICULUM & SYLLABI

M.E. MEDICAL ELECTRONICS

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS – 2023

(For the Students Admitted in the Academic Year 2023-2024 onwards)

Note: The regulations hereunder are subject to amendments as may be decided by the Academic Council of the Sengunthar Engineering College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the program under the same Regulation as may be decided by the Academic Council.

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

DEPARTMENT

OF

MEDICAL ELECTRONICS

REGULATION 2023

CURRICULUM AND SYLLABI

FOR M.E. – MEDICAL ELECTRONICS

(For the Students admitted in the Academic Year 2023-2024 onwards)

FIRST SEMESTER

TO

FOURTH SEMESTER

INDEX

SCHEME FOR CURRICULUM

M.E. – Medical Electronics

REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

M.E. MEDICAL ELECTRONICS

VISION

- To emerge as a leading department in the field of medical electronics education and research through industry collaboration for sustainable development in the healthcare, by training the students into holistic and highly skilled professionals to address the present and future challenges in medical devices to meet the societal needs.

MISSION

- To impart technical education through effective teaching learning process to students for implementing engineering principles and emerging ideas in medical electronics.
- To collaborate with leading industries and medical regulation experts to ensure safe and effective healthcare devices.
- To foster the culture of innovative research and entrepreneurship for developing patentable medical equipments.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates can

- ✓ Apply their adequate knowledge to become good professional in Medical Electronics associated industries, higher education and research.
- ✓ Conduct innovative research and develop solutions on problems of social relevance.
- ✓ Work in a challenging environment, exhibiting collaboration, adaptability, goal oriented and lifelong learning.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development ofsolutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigationsof complex problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**	Apply reasoning informed by the contextual knowledgeto assess societal, health, safety, legal and culturalissues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**:	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**:	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1	Ability to understand the fundamental concepts, analyze, design, develop, implement using mathematical foundations and domain knowledge for medical equipment design with "R" policy (recycle, reduce, reusable, reverse engineering, renewable) and providing solutions to Problems, Challenges in Healthcare Industry by applying the new ideas and innovations on par with international standards.
PSO2	Ability to work and communicate effectively in a team environment and foster the professional skills towards industrial and societal needs.
PSO3	Ability to grasp the advancements in hardware / software tools and creating a career path to become an entrepreneur, lifelong learner with moral values and ethics.

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	I	23PMM101 - Applied Mathematics for Medical Engineers	2.0	2.0	1.0	1.0	-	-	-	-	-	-	-	1.0	2.0	-	-
		23PGT101 - Research Methodology and IPR	3.0	2.0	1.6	1.6	1.6	1.0	-	-	-	-	2.0	1.0	2.0	1.0	1.4
		23PMT101 - Advanced Bio Signal Processing	1.8	1.4	1.0	2.4	1.6	1.0	1.0	-	-	1.0	-	1.8	2.4	-	1.4
		23PMT102 - Anatomy and Human Physiology	1.0	1.4	1.0	1.0	-	1.0	1.0	1.0	-	2.0	-	2.0	2.0	1.0	1.0
		23PME101 - Biomedical Instrumentation	1.0	2.0	1.0	-	2.0	1.0	-	-	-	1.0	-	1.0	3.0	2.0	1.0
		Professional Elective - I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23PEE101 - Research Paper Writing and Seminar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	II	23PMT201 - Biomedical Sensors and Measurements	3.0	2.8	2.4	1.6	2.2	-	-	-	-	1.0	-	2.2	3.0	2.0	1.4
		23PMT202 - Advanced Diagnostic and Therapeutic Equipment's	3.0	2.0	1.0	1.0	1.0	-	2.0	-	-	-	-	-	3.0	2.0	1.0
		23PMT203 - Design of Medical Equipment Device	3.0	2.8	2.4	1.6	2.2	-	-	-	-	1.0	-	2.2	3.0	2.0	1.4
		23PMT204 - BioMEMS in Artificial Organs	3.0	2.0	1.0	1.0	2.0	-	2.0	-	-	-	-	-	3.0	2.0	1.0
		23PME201 - Applied Medical Image Processing	2.0	1.1	1.6	2.1	1.6	1.3	2.0	-	-	-	1.0	-	1.8	2.0	1.0
		Professional Elective - II															
		23PEE202 - Hospital / Biomedical Industry Training	2.0	-	1.0	-	3.0	-	-	-	2.0	2.0	1.0	3.0		2.0	2.0
II	III	Professional Elective - III	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Professional Elective - IV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Open Elective	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23PEE301 - Project Work (Phase - I)	3.0	3.0	2.0	2.0	1.0	1.0	-	-	-	1.0	1.0	1.0	3.0	2.0	2.0
	IV	23PEE401 - Project Work (Phase - II)	3.0	3.0	2.0	2.0	1.0	1.0	-	-	-	1.0	1.0	1.0	3.0	2.0	2.0

PROFESSIONAL ELECTIVE COURSES

S.NO.	Course Name	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	23PMP101 - Bio Statistics	3.0	2.0	-	-	-	1.0	-	1.0	1.0	-	1.0	1.0	2.0	-	-
2	23PMP102 - Introduction to Clinical Trials	3.0	2.0	1.0	-	-	1.0	-	1.0	-	-	-	-	2.0	1.0	-
3	23PMP103 - Artificial Intelligence and Machine Learning	2.4	1.4	2	1.8	0.8	-	-	-	1.8	-	1.6	-	1.0	1.0	-
4	23PMP104 - Biomedical optics	3.0	1.2	2.2	1.6	2.0	2.0	-	-	-	-	-	-	1.0	-	1.0
5	23PMP105 - Ultrasound Principles and its Medical Applications	2.2	2.4	1.6	2.2	2.0	1.8	-	-	-	-	-	-	2.4	1.6	-
6	23PMP201 - Telemedicine Technology	2.2	1.6	2.4	1.8	2.2	2.0	-	-	-	1.0	-	-	-	1.0	-
7	23PMP202 - Tissue Engineering and its Applications	1.6	2.2	2.0	1.0	2.0	1.0	-	1.0	-	1.0	-	1.0	-	-	1.0
8	23PMP203 - Wearable Technology	2.8	2.2	2.0	1.0	1.0	1.2	1.0	2.0	1.0	-	0.8	-	1.0	-	1.0
9	23PMP204 - Principles of Genetic Analysis	2.8	2.2	1.2	1.6	1.0	1.0	2.0	-	1.0	1.0	-	-	1.0	1.0	1.0
10	23PMP205 - Advanced Neural Computing	2.8	1.6	2.4	1.0	1.2	1.0	1.0	-	1.0	-	1.0	-	1.8	1.0	-
11	23PMP301 -Biomechanics	2.4	1.6	2.4	1.2	1.0	1.2	-	1.0	-	1.0	-	2.0	-	1.0	1.2
12	23PMP302 - Rehabilitation Engineering and Assistive Technology	2.8	3.0	2.4	1.2	1.4	1.0	1.2	1.0	-	-	1.4	2.2	2.4	1.0	1.0
13	23PMP303 - Computer based Medical Instrumentation	3.0	2.8	1.0	1.2	1.0	1.4	1.2	1.4	1.0	-	1.0	1.2	-	1.2	2.2
14	23PMP304 - Quality and safety assurance in hospital	2.8	3.0	2.4	1.6	1.2	-	1.6	1.4	-	1.0	1.2	1.8	1.0	1.8	1.0
15	23PMP305 - Virtual Reality and Augmented Reality	3.0	2.0	1.0	-	2.0	-	-	1.0	-	-	-	-	1.0	-	1.0
16	23PMP306 - Biometric Systems	3.0	2.0	1.0	1.0	1.0	-	2.0	-	-	-	-	-	3.0	2.0	1.0
17	23PMP307 - Hospital Planning, Organization and Management	3.0	2.0	1.0	1.0	1.0	-	1.0	-	-	-	-	-	3.0	1.0	1.0
18	23PMP308 - Pattern Recognition Techniques and its Applications	3.0	2.0	1.0	1.0	1.0	-	1.0	-	-	-	-	-	3.0	1.0	1.0
19	23PMP309 - Physiological Modeling Systems	3.0	2.0	1.0	1.0	1.0	-	2.0	-	-	-	-	-	3.0	1.0	2.0
20	23PMP310 - Advanced Brain Computer Interface	3.0	2.0	1.0	1.0	1.0	-	3.0	-	-	-	-	-	3.0	1.0	1.0

OPEN ELECTIVE COURSES																
S.NO.	Course Name	PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	23PGO201 - Disaster Management	3.0	2.0	2.0	2.0	1.0	1.0	1.0	-	-	1.0	1.0	1.0	3.0	2.0	1.0
2	23PGO202 - Cost Management of Engineering Projects	3.0	3.0	3.0	3.0	2.0	1.0	1.0	1.0	1.0	1.0	3.0	1.0	2.0	2.0	1.0
3	23PGO203 - Constitution of India	3.0	2.0	2.0	1.0	-	1.0	-	1.0	1.0	1.0	-	1.0	2.0	1.0	1.0
4	23PGO204 - Business Analytics	3.0	3.0	3.0	3.0	2.0	1.0	-	1.0	1.0	1.0	2.0	1.0	3.0	2.0	1.0
5	23PGO205 - Digital Marketing	3.0	3.0	3.0	3.0	2.0	1.0	-	1.0	1.0	1.0	1.0	1.0	3.0	2.0	1.0

CURRICULUM AND SYLLABI

FOR M.E / M.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

DEPARTMENT OF MEDICAL ELECTRONICS

M.E - MEDICAL ELECTRONICS - FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23PMM101	Applied Mathematics for Medical Engineers	FC	3	1	0	4	40	60	100
23PGT101	Research Methodology and IPR	FC	3	0	0	3	40	60	100
23PMT101	Advanced Bio Signal Processing	PC	3	1	0	4	40	60	100
23PMT102	Anatomy and Human Physiology	PC	3	1	0	4	40	60	100
	Professional Elective - I	PE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23PME101	Biomedical Instrumentation	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23PEE101	Research Paper Writing and Seminar	EEC	1	0	0	0	100	-	100
TOTAL CREDITS IN SEMESTER - I			22						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

M.E - MEDICAL ELECTRONICS - SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23PMT201	Biomedical Sensors and Measurements	PC	3	1	0	4	40	60	100
23PMT202	Advanced Diagnostic and Therapeutic Equipments	PC	3	1	0	4	40	60	100
23PMT203	Design of Medical Equipment Device	PC	3	0	0	3	40	60	100
23PMT204	BioMEMS in Artificial Organs	PC	3	0	0	3	40	60	100
	Professional Elective - II	PE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23PME201	Applied Medical Image Processing	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23PEE202	Hospital / Biomedical IndustryTraining	EEC	0	0	2	2	40	60	100
TOTAL CREDITS IN SEMESTER - II			23						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

M.E - MEDICAL ELECTRONICS - THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
	Professional Elective - III	PE	3	0	0	3	40	60	100
	Professional Elective - IV	PE	3	0	0	3	40	60	100
	Open Elective	OE	3	0	0	3	40	60	100
EMPLOYABILITY ENHANCEMENT COURSE									
23PEE301	Project Work (Phase - I)	EEC	0	0	12	6	40	60	100
TOTAL CREDITS IN SEMESTER - III			15						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

M.E - MEDICAL ELECTRONICS - FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
EMPLOYABILITY ENHANCEMENT COURSE									
23PEE401	Project Work (Phase - II)	EEC	0	0	24	12	40	60	100
TOTAL CREDITS IN SEMESTER - IV			12						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

LIST OF FOUNDATION COURSES (FC)

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23PMM101	Applied Mathematics for Medical Engineers	FC	3	1	0	4	40	60	100
23PGT101	Research Methodology and IPR	FC	3	0	0	3	40	60	100

LIST OF PROFESSIONAL CORE (PC)

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23PMT101	Advanced Bio Signal Processing	PC	3	1	0	4	40	60	100
23PMT102	Anatomy and Human Physiology	PC	3	0	0	3	40	60	100
23PME101	Biomedical Instrumentation	PC	3	0	2	4	50	50	100
23PMT201	Biomedical Sensors and Measurements	PC	3	1	0	4	40	60	100
23PMT202	Advanced Diagnostic and Therapeutic Equipments	PC	3	1	0	4	40	60	100
23PMT203	Design of Medical Equipment Device	PC	3	0	0	3	40	60	100
23PMT204	BioMEMS in Artificial Organs	PC	3	0	0	3	40	60	100
23PME201	Applied Medical Image Processing	PC	3	0	2	4	50	50	100

LIST OF PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE- I - SEMESTER I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23PMP101	Bio Statistics	PE	3	0	0	3	40	60	100
23PMP102	Introduction to Clinical Trials	PE	3	0	0	3	40	60	100
23PMP103	Artificial Intelligence and Machine Learning	PE	3	0	0	3	40	60	100
23PMP104	Biomedical optics	PE	3	0	0	3	40	60	100
23PMP105	Ultrasound Principles and its Medical Applications	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE- II – SEMESTER II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23PMP201	Telemedicine Technology	PE	3	0	0	3	40	60	100
23PMP202	Tissue Engineering and its Applications	PE	3	0	0	3	40	60	100
23PMP203	Wearable Technology	PE	3	0	0	3	40	60	100
23PMP204	Principles of Genetic Analysis	PE	3	0	0	3	40	60	100
23PMP205	Advanced Neural Computing	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE- III – SEMESTER III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23PMP301	Biomechanics	PE	3	0	0	3	40	60	100
23PMP302	Rehabilitation Engineering and Assistive Technology	PE	3	0	0	3	40	60	100
23PMP303	Computer based Medical Instrumentation	PE	3	0	0	3	40	60	100
23PMP304	Quality and Safety Assurance in Hospital	PE	3	0	0	3	40	60	100
23PMP305	Virtual Reality and Augmented Reality	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE- IV – SEMESTER III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23PMP306	Biometric Systems	PE	3	0	0	3	40	60	100
23PMP307	Hospital Planning, Organization and Management	PE	3	0	0	3	40	60	100
23PMP308	Pattern Recognition Techniques and its Applications	PE	3	0	0	3	40	60	100
23PMP309	Physiological Modeling Systems	PE	3	0	0	3	40	60	100
23PMP310	Advanced Brain Computer Interface	PE	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVE COURSES

OPEN ELECTIVE – SEMESTER III

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23PGO201	Disaster Management	OE	3	0	0	3	40	60	100
23PGO202	Cost Management of Engineering Projects	OE	3	0	0	3	40	60	100
23PGO203	Constitution of India	OE	3	0	0	3	40	60	100
23PGO204	Business Analytics	OE	3	0	0	3	40	60	100
23PGO205	Digital Marketing	OE	3	0	0	3	40	60	100

LIST OF EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23PEE101	Research Paper Writing and Seminar	EEC	1	0	0	0	100	-	100
23PEE202	Hospital / Biomedical Industry Training	EEC	0	0	2	2	40	60	100
23PEE301	Project Work (Phase - I)	EEC	0	0	12	6	40	60	100
23PEE401	Project Work (Phase - II)	EEC	0	0	24	12	40	60	100

SCHEME FOR SYLLABI

M.E. – Medical Electronics

DEPARTMENT OF MEDICAL ELECTRONICS
M.E. MEDICAL ELECTRONICS
SEMESTER I

23PMM101 APPLIED MATHEMATICS FOR MEDICAL ENGINEERS L T P C
3 1 0 4

OBJECTIVES

- To study the system of equations and find the characteristics of the system.
- To understand the uses of Fourier transforms to convert the problem from one domain to another domain.
- To know the Simplex Algorithm for solving linear programming problems arising in various fields.
- To understand about how to define a graph, identifying edges and vertices.
- To learn the concept of stochastic process deals with time varying function and its importance in modeling physical phenomenon.

UNIT I ADVANCED MATRIX THEORY 9+3

Some important matrix factorizations - The Cholesky decomposition - QR factorization - Least squares method - Singular value decomposition - Toeplitz matrices and some applications.

UNIT II FOURIER SERIES AND EIGENVALUE PROBLEMS 9+3

Fourier Trigonometric series: Periodic function as power signals - Convergence of series - Even and odd function: cosine and sine series - Power signals: Exponential Fourier series - Parseval's theorem and power spectrum - Eigen value problems and orthogonal functions - Regular Sturm - Liouville systems - Generalized Fourier series.

UNIT III LINEAR PROGRAMMING 9+3

Mathematical Formulation - Graphical solution of linear programming models - Simplex method - Transportation and Assignment models.

UNIT IV GRAPH THEORY 9+3

Graphs and graph models - Graph terminology and special types of graphs - Matrix representation of graphs and graph isomorphism - Connectivity - Euler and Hamilton paths.

UNIT V STOCHASTIC PROCESS 9+3

Classification - Stationary process - Markov process - Markov chains - Transition probabilities - Limiting distributions - Poisson process - Birth and death Processes.

TOTAL: 45 + 15 = 65 PERIODS

OUTCOMES

Upon Completion of the course, Students will be able to:

- Apply various methods in matrix theory to solve system of linear equations.
- Compute Fourier series for periodic functions, exponential Fourier series, Eigen value problems and orthogonal functions.
- Formulate and solve the LPP using graphical method, simplex method, and transportation and assignment methods.
- Apply graph theoretic algorithms in design of systems.
- Classify the first and second order stationary processes and solve the problems involving Markov and Poisson processes.

TEXT BOOKS

1. Richard Bronson,"Matrix Operation",Schaum's outline series,McGraw Hill,Second Edition, 2011.
2. Larry.C.Andrews,Ronald L.Phillips,"Mathematical Techniques for Engineers and Scientists",Prentice - Hall of India Private Limited,2005.

REFERENCES

1. David C. Lay,"Linear Algebra and its applications",Pearson,New Delhi, Fourth Edition,2018.
2. Bondy,U.S.R.Murty,"Graph theory with applications",Elsevier Science Publishing Co.,Inc,USA, Fifth Edition,2008.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/111/104/111104137/ (Linear Algebra and its Applications)
2. https://www.digimat.in/nptel/courses/video/110106062/L01.html (Operations Research, an Introduction).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	1	1	-	-	-	-	-	-	-	1	2	-	-
2	2	2	1	1	-	-	-	-	-	-	-	1	2	-	-
3	2	2	1	1	-	-	-	-	-	-	-	1	2	-	-
4	2	2	1	1	-	-	-	-	-	-	-	1	2	-	-
5	2	2	1	1	-	-	-	-	-	-	-	1	2	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.0**	**2.0**	**1.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.0**	**2.0**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PGT101	RESEARCH METHODOLOGY AND IPR (Common to all PG Engineering Courses)	L T P C 3 0 0 3

OBJECTIVES

- To learn the problem formulation, analysis and solutions.
- To know the effective literature study approaches.
- To write Technical papers / presentations without violating professional ethics.
- To understand the process of process and procedure of patenting.
- To gain basic knowledge on intellectual property rights.

UNIT I RESEARCH PROBLEM **9**

Meaning of research problem – Sources of research problem – Criteria characteristics of a good research problem – Errors in selecting a research problem – Scope and objectives of research problem – Approaches of investigation of solutions for research problem – Data collection – Analysis – Interpretation – Necessary instrumentations.

UNIT II LITERATURE REVIEW **9**

Effective literature studies approaches – Analysis – Plagiarism and research ethics.

UNIT III TECHNICAL WRITING /PRESENTATION **9**

Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Nature of Intellectual Property – Patents, Designs – Trade and Copyright – Process of Patenting and Development: technological research – Innovation, patenting, development – International Scenario: International cooperation on Intellectual Property – Procedure for grants of patents, Patenting under PCT.

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Patent Rights: Scope of Patent Rights – Licensing and transfer of technology – Patent information and databases – Geographical Indications – New Developments in IPR: Administration of Patent System – IPR of Biological Systems, Computer Software etc – Traditional knowledge Case Studies, IPR and IITs.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Identify research problems.
- Apply effective literature studies in research work.
- Develop effective technical papers/presentations.
- Describe that today's world is controlled by Computer, Information Technology, but tomorrow the world will be ruled by ideas, concepts, and creativity.
- Explain about IPR and filing patents in R & D.

TEXT BOOKS

1. Ranjith Kumar,"Research Methodology: A step-by-step guide for beginners",Sage Publications,Fourth Edition,2014.
2. Neeraj Pandey,Khushdeep Dhrani,"Intellectual Property Rights",PHI Learning Private Limited, First Edition,2014.

REFERENCES

1. Heather Silyn–Roberts,"Writing for Science and Engineering:Papers,Presentations and Reports",Elsevier, Second Edition,2013.
2. Douglas C.Montgomery,"Design and Analysis of Experiments",Wiley Publishers,Nineth Edition 2017

E–RESOURCES

1. https://nptel.ac.in/courses/121/106/121106007/ (Introduction to Research).
2. https://nptel.ac.in/courses/109/106/109106137/ (IPR).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	1	-	-	-	-	**2**	1	2	1	2
2	3	2	2	2	2	1	-	-	-	-	2	1	2	1	2
3	3	2	1	1	1	1	-	-	-	-	2	1	2	1	1
4	3	2	2	2	2	1	-	-	-	-	2	1	2	1	1
5	3	2	1	1	1	1	-	-	-	-	2	1	2	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.6**	**1.6**	**1.6**	**1.0**	**-**	**-**	**-**	**-**	**2.0**	**1.0**	**2.0**	**1.0**	**1.4**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMT101 **ADVANCED BIO SIGNAL PROCESSING** **L T P C**
3 1 0 4

OBJECTIVES

- To learn the fundamental information of different biosignals.
- To understand the linear and non-linear filtering techniques to extract desired information.
- To learn the significance of wavelet detection applied in biosignal processing.
- To study the techniques for automated classification and decision making to aid diagnosis.
- To understand the time frequency and multivariant analysis provides some temporal information and some spectral information.

UNIT I SIGNAL SYSTEM AND SPECTRUM **9+3**

Characteristics of some dynamic biomedical signals, Noises- random, structured and physiological noises. Filters- IIR and FIR filters. Spectrum – power spectral density function, cross-spectral density and coherence function, Cepstrum and homomorphic filtering. Estimation of mean of finite time signals.

UNIT II TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION **9+3**

Time series analysis, linear prediction models, process order estimation, lattice representation, non-stationary process, fixed segmentation, adaptive segmentation, application in EEG, PCG signals, Time varying analysis of Heart-rate variability, model based ECG simulator. Spectral estimation, Blackman Tukey method, periodogram, and model based estimation. Application in Heart rate variability and PCG signals.

UNIT III ADAPTIVE FILTERING AND WAVELET DETECTION **9+3**

Filtering, LMS adaptive filter, adaptive noise cancelling in ECG, improved adaptive filtering in FECG, Wavelet detection in ECG, structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.

UNIT IV BIO-SIGNAL CLASSIFICATION AND RECOGNITION **9+3**

Signal classification and recognition, Statistical signal classification, linear discriminate function, direct feature selection and ordering, Back propagation neural network based classification. Application in Normal versus Ectopic ECG beats.

UNIT V TIMES FREQUENCY AND MULTIVARIATE ANALYSIS **9+3**

Time frequency representation, spectrogram, Wigner distribution, Time, scale representation, scalogram, wavelet analysis, Data reduction techniques, ECG data compression, ECG characterization, Feature extraction, Wavelet packets, Multivariate component analysis, PCA, ICA.

TOTAL : 45+15 = 60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the different types of signals & systems.
- Analyze signals in time series domain & estimate the spectrum.
- Understand the significance of wavelet detection applied in biosignal processing.
- Describe the performance of the classification of bio signals.
- Describe time frequency analysis and data reduction techniques to biomedical signals.

TEXT BOOKS

1. Willis J.Tompkins,"Biomedical Digital Signal Processing",Prentice Hall of India, New Delhi, Reprint,Third Editon,2018.
2. Rangaraj M Rangayyan, "Biomedical Signal Analysis A Case Study Approach",John Wiley, Second Editon,2015.

REFERENCES

1. Arnon Cohen, "Biomedical Signal Processing", Vol.I and Vol.II, CRC Press Inc.,Boca Raton, First Edition Reprint,2019.
2. Reddy D C,"Biomedical Signal Processing-Principles and Techniques",The McGraw Hill Publishing Company Limited, New Delhi,Fourth Edition, 2015.

E-RESOURCES

1. https://www.youtube.com/watch?v=CSZF9YStfGk (Time Frequency Representation).
2. https://onlinecourses.nptel.ac.in/noc20_ee41/preview (Biomedical Signal Processing).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	1	3	3	1	1	-	-	1	-	1	2	-	2
2	2	1	1	3	1	1	1	-	-	1	-	1	3	-	1
3	1	1	1	2	2	1	1	-	-	1	-	2	3	-	2
4	2	1	1	2	1	1	1	-	-	1	-	2	2	-	1
5	2	2	1	2	1	1	1	-	-	1	-	3	2	-	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**1.8**	**1.4**	**1.0**	**2.4**	**1.6**	**1.0**	**1.0**	**-**	**-**	**1.0**	**-**	**1.8**	**2.4**	**-**	**1.4**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMT102 **ANATOMY AND HUMAN PHYSIOLOGY** **L T P C**
3 1 0 4

OBJECTIVES

- To understand the scientific study of the body's structures.
- To learn about the skeletal and muscular system
- To study the structure and function of cardiovascular and respiratory system.
- To learn the structure and function of digestive and excretory systems.
- To know about the chemical structure and function of various harmones.

UNIT I BASIC OF GENERAL PHYSIOLOGY **9+3**

The Human Body: An Orientation, Cell , Cell junctions, Cell Transport, Cell Communication, Cell Division, Tissues. Acid base balance.Action potential,Tissues.

UNIT II SKELETAL AND MUSCULAR SYSTEM **9+3**

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+3**

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+3**

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 ENDOCRINOLOY SYSTEM **9+3**

Introduction to Endocrinology- chemical structure , synthesis of hormones- hormone secretion – mechanism of action of hormones- pituitary hormone and its control by hypothalamus- thyroid metabolic hormones- synthesis, secretion , functions of thyroid hormones- adreno cortical hormones- insulin , glucagon, diabetes mellitus.

TOTAL: 45 + 15 = 60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the basic elements of human body.
- Explain the functions of lymphatic and integumentary system.
- Describe the functions of circulatory system and its relationship with biophysical parameters.
- Analyze the structure, function of kidneys, body fluids and its regulation.
- Describe the physiological process of endocrinology system.

TEXTBOOKS

1. Elaine.N.Marieb,"Essential of Human Anatomy and Physiology",Pearson Education,New Delhi, Nineth Edition, 2018.
2. Frederic H.Martini,Judi L.Nath,Edwin F.Bartholomew,"Fundamentals of Anatomy and Physiology",Pearson Publishers, Twelveth Edition,2016

REFERENCES

1. John E.Hall, Michael E.Hall,"Guyton and Hall Text book of Medical Physiology",Elsevier-UK, Fourteenth Edition,2020.
2. Ranganathan T S,"Text book of Human Anatomy", S.Chand & Co. Ltd.,New Delhi,First Edition Reprint,2017.

E-RESOURCES

1. https://byjus.com/biology/human-circulatory-system-transportation/ (Circulatory System).
2. https://www.youtube.com/watch?v=RDLeGvRVr8E (Endocrinology System**).**

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	1	1	-	1	1	1	-	2	-	2	2	1	1
2	1	2	1	1	-	1	1	1	-	2	-	2	2	1	1
3	1	2	1	1	-	1	1	1	-	2	-	2	2	1	1
4	1	1	1	1	-	1	1	1	-	2	-	2	2	1	1
5	1	1	1	1	-	1	1	1	-	2	-	2	2	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**1.0**	**1.4**	**1.0**	**1.0**	**-**	**1.0**	**1.0**	**1.0**	**-**	**2.0**	**-**	**2.0**	**2.0**	**1.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PME101 **BIOMEDICAL INSTRUMENTATION** **L T P C**
3 0 2 4

OBJECTIVES

- To study about the different bio potential electrodes for the measurement of bio signals.
- To understand the biosignal characteristics and the electrode placement for recording.
- To know the different signal conditioning circuits.
- To learn the different measurement techniques for non-electrical parameters.
- To understand the different biochemical measurements.
- To know about the preamplifiers and signal conditioning circuits for ECG, EOG and EMG acquisition with its concept of designing an isolation amplifier.

UNIT I BIO POTENTIAL ELECTRODES **9**

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Biochemical-and Transcutaneous- electrodes: pH, pO2, pCO2.

UNIT II ELECTRODECONFIGURATIONS **9**

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

UNIT III BIOAMPLIFIERS **9**

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

UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS **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 ultrasound blood flow measurement

UNIT V BIO-CHEMICAL MEASUREMENT **9**

Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors, Blood gas analyzers - colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description) – Bio Sensors – Principles – Amperometric and Voltometric techniques.

LIST OF EXPERIMENTS

1. Design a circuit for temperature measurement.
2. Design of EMG amplifier.
3. Design a suitable circuit to detect QRS complex and measure heart rate.
4. Design of frontal EEG amplifier.
5. Design a right leg driven ECG amplifier.
6. Design a Pulse oximeter and Measure O2 Saturation and HR.
7. Measurement of pH and conductivity.
8. Measurement of blood pressure using sphygmomanometer.
9. Design a PCB layout for any bio amplifier using suitable software tool.
10. Simulation of musculoskeletal model using MATLAB.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

Upon Completion of the course, Students will be able to:

- Explain the origin of bio potentials and electrodes for its measurement.
- Describe the biosignal characteristics and the electrode placement for various physiological recording.
- Design bio amplifier for various physiological recording.
- Classify various techniques for measuring non-electrical parameters.
- Apply different techniques for biochemical measurements.
- Design and implement preamplifiers and signal conditioning circuits for ECG EEG, EOG, EMG signal acquisition.

TEXTBOOKS

1. John G.Webster, Amit J. Nimunkar, "Medical Instrumentation application and design",(An Indian Adaptation) Wiley India, Fifth Edition,2021.
2. Joseph J.Carr,John M. Brown, "Introduction to Biomedical Equipment Technology",Pearson education, Fourth Edition,2015.

REFERENCES

1. Leslie Cromwell,"Biomedical Instrumentation and Measurement",Prentice hall of India,Second Edition,2015.
2. Khandpur R.S,"Handbook of Biomedical Instrumentation",Tata McGraw Hill, New Delhi, Third Edition, 2014.

E-RESOURCES

1. https://youtu.be/i2mZylgP1Fk- overview of biomedical instrumentation part 1.
2. https://youtu.be/mK6sPBbChqc-Fundamentals of biopotentials and applications.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	1	-	2	1	-	-	-	1	-	1	3	2	1
2	1	2	1	-	2	1	-	-	-	1	-	1	3	2	1
3	1	2	1	-	2	1	-	-	-	1	-	1	3	2	1
4	1	2	1	-	2	1	-	-	-	1	-	1	3	2	1
5	1	2	1	-	2	1	-	-	-	1	-	1	3	2	1
6	1	2	1	-	2	1	-	-	-	1	-	1	3	2	1
AVG.	**1.0**	**2.0**	**1.0**	**-**	**2.0**	**1.0**	**-**	**-**	**-**	**1.0**	**-**	**1.0**	**3.0**	**2.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PEE101 RESEARCH PAPER WRITING AND SEMINAR L T P C
1 0 0 0

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (at least 15 journal papers).
4. Preparing a draft outline of research work.
5. Studying the papers and understanding the authors contributions and critically analyzing each paper.
6. Linking the papers and preparing a draft of the paper.
7. Preparing conclusions based on the reading of all the papers.
8. Writing the Final Paper and giving final Presentation.
9. Maintaining a file for records of activities.

Activities to be carried out

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and topic Stating an Objective	You are requested to select an area of interest, topic and state an objective	2nd week	**3 %** based on clarity of thought, current relevance and clarity in writing
Collecting Information about your area & topic	1. List 1 Special Interest Groupsorprofessional society. 2. List 2 journals 3. List 2 conferences, symposia orworkshops. 4. List 1 thesis title 5. List 3 web presences (mailing lists,forums, news sites) 6. List 3 authors who publish regularly inyour area 7. Attach a call for papers (CFP) from your area.	3rd week	**3%** (the selected information must be area specific and of international and national standard)
Collection of Journalpapers	• You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read try to:		

inthe topic in the contextof the objective — collect 20 & then filter	• Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them, • Favour papers from well-known journals and conferences, • Favour–firstIlor–foundational papers in the field (as indicated in other people's survey paper), • Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect to each other and to your topic area (classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered.	4th week	**6%** (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process • For each paper form a table answering the following questions • What is the main topic of the article? • What was / were the main issue(s) the author said they want to discuss? • Why did the author claim it wasimportant? • How does the work build on other'swork, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they weregoing to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? • Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)	5th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is basedon your conclusions about each paper)

Reading and notes for next 5 papers	Repeat Reading Paper Process	6th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on our conclusions about each paper)
Draft outline1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8th week	**8%** (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstractand give a presentation	9th week	**6%** (Clarity, purpose and conclusion) **6%** Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	**5%** (Clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram inkeeping with the goals of your survey	11thweek	**10%** (this component will be evaluated based on the linking and classification among the papers)
Your conclusions	Write your conclusionsand future work	12th week	**5%** (conclusions - clarity and your ideas)
Final Draft	Complete the final draft of your paper	13th week	**10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report
Seminar	A brief 15 slides on yourpaper	14th & 15th week	**10%** (based on presentation and Viva-voce)

TOTAL: 30 PERIODS

SEMESTER – II

23PMT201	**BIOMEDICAL SENSORS AND MEASUREMENTS**	**L T P C** **3 1 0 4**

OBJECTIVES

- To understand the characteristics and classifications of biomedical sensors and transducers.
- To understand the key component in various medical diagnostic instruments and equipment.
- To study specific biological, chemical, or physical processes of the sensors.
- To understand the non – electrical parameters measurements.
- To learn recorders and display units of biomedical sensors instruments.

UNIT I TRANSDUCERS **9+3**

Characteristics- Static, Dynamic, Errors in the measurements, Classification of transducers -Resistive, Capacitive, Inductive, Photoelectric, piezoelectric and mechano electronics.

UNIT II ELECTRODES & AMPLIFIERS **9+3**

Half cell potential, Reference electrodes, polarization effects, Polarisable and non polarisable electrodes, Micro electrodes, Equivalent Circuits, Signal Conditioning circuits- Characteristics of Amplifiers, Differential Amplifiers, Filters, Bridge circuits, A/D Converters.

UNIT III CHEMICAL AND OPTICAL TRANSDUCERS **9+3**

PH, PO2, PCO2, HCO3 electrodes, Ion sensor, Anion and Cation sensor, Liquid and solid ion exchange membrane electrode, Enzyme electrode, Principle of fiber optic cable, fiber optic sensors, Photo acoustic sensors, PPG sensors.

UNIT IV NON ELECTRICAL PARAMETERS MEASUREMENTS **9+3**

Measurements of Respiration Rate, Temperature, Pulse rate, Blood pressure Measurements- Direct, Indirect, Blood flow Measurements – Invitro, Invivo, Gas flow measurements.

UNIT V RECORDERS AND DISPLAY **9+3**

Types of recorders, Ink jet, heated stylus, Photographic recorder, Multicolor dot scanners, CRO, storage type, long persistence, digital scope, magnetic tape recorders.

TOTAL : 45 + 15 = 60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the Characteristics of physiological Transducer to measure a specific physiological parameter.
- Analyze the principles of bio potential sensing and electrodes to biomedical applications.
- Develop the chemical and optical transducers based on the basic transduction principles.
- Analyze the techniques used for measurement of various non electrical physiological parameters.

- Describe the different types of display and recording devices.

TEXT BOOKS

1. John G.Webster, "Medical Instrumentation, Application and Design", Fifth Edition, John willey and sons, 2021.
2. John G. Webster, Halit Eren, "Measurement, Instrumentation and Sensors Handbook" CRC Press, Second Edition, 2017.

REFERENCES

1. Udip Paul, Angana Saikia, Vinayak Majhi, Vinay Kumar Pandey,"Introduction to Biomedical Instrumentation and Its Applications",Academic Press,Second Edition, 2022.
2. Leslie Cromwell,"Biomedical Instrumentation and measurements", Pearson Education India, New Delhi, First Edition,2015.

E-RESOURCES

1. https://youtu.be/DNSvULGsZGw (Introduction to Optical Transducers)
2. https://youtu.be/edE21TMq6iY (Introduction to Biomedical Equipment Technology)

Mapping of Cos-PoS & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	2	-	-	-	-	1	-	2	3	2	1
2	3	2	2	2	2	-	-	-	-	1	-	3	3	2	2
3	3	3	2	1	2	-	-	-	-	1	-	2	3	2	1
4	3	3	3	2	3	-	-	-	-	1	-	2	3	2	2
5	3	3	3	2	2	-	-	-	-	1	-	2	3	2	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.8**	**2.4**	**1.6**	**2.2**	**-**	**-**	**-**	**-**	**1.0**	**-**	**2.2**	**3.0**	**2.0**	**1.4**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMT202 ADVANCED DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS L T P C
3 1 0 4

OBJECTIVES

- To know the different types of normal and abnormal bio potential recording.
- To understand the Pacemaker and defibrillator performance.
- To study the diathermy and stimulator with electrical safety analyzer.
- To learn the different types of human assist devices in medical field.
- To understand the latest medical device trends, organizations growth.

UNIT I BIO POTENTIAL RECORDING 9+3

Introduction to ECG, EEG, EMG, PCG, EOG, lead system and recording methods, typical waveform, frequency spectrum, abnormal waveforms. Evoked response, Electroencephalography, Electrocardiography, Electromyography, ERG

UNIT II CARDIAC CARE UNITS 9+3

External and Implantable Pacemaker, Performance aspects of Implantable Pacemaker - DC defibrillator, Modes of operation and electrodes, Performance aspects of dc-defibrillator, Implantable defibrillator, defibrillator analyzers, patient monitoring system, principles of bio telemetry.

UNIT III DIATHERMY AND STIMULATOR 9+3

Physiological effects of HF radiation, Depth of Penetration, short wave, Ultrasonic and microwave diathermy, Surgical diathermy, Galvani, Faradic stimulators, Interferential therapy, Electrical safety-Leakage current, Micro and macro electric shock, GFI units, Earthing Scheme, Electrical safety Analyzer, TENS, Ultra sound Transducers, Ultra sound application in medical.

UNIT IV ASSIST DEVICES 9+3

Heart lung machine-Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process. Hemodialyser-Indication and Principle of Hem dialysis, Membrane, Dialysate, Different types of hemodialysers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type. Respiratory aids- Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters.

UNIT V RECENT TRENDS 9+3

Principles and application of thermograph, Detection circuits, Principles of cryogenic Technique and application, principles of Fiber optics cables, Endoscopy, principles of Lithotripsy.PET Scan,CT,MRI Techniques, Dental applications.

TOTAL : 45 + 15 = 60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Describe the different types of electrodes, signal conditioning circuits for acquiring and recording various bio potential.
- Explain the specific parts in Cardiac care units and working mechanisms of Cardiac Units.
- Describe the various techniques used in diathermy procedure and electrical safety in medical systems.
- Analyze the working principle of assist devices and monitoring systems.
- Explain the principles of Thermography, Fiber Optics cables, endoscopy, laparoscopy and lithotripsy.

TEXT BOOKS

1. Murugan Veerabadhram,"Diagnostic and Therapeutic Equipment",Notion Press,Second Edition, 2021.
2. Christoph fox, "Diagnostic and Therapeutic Endoscopy",Foster Academics,First Edition,2019.

REFERENCES

1. John G. Webster, "Medical Instrumentation Application and Design", Fourth Edition, John Wiley and sons, New Jersey, 2015
2. Carr Brown, "Introduction to Biomedical Equipment Technology", Pearson,First Edition,2015.

E-RESOURCES

1. https://slideplayer.com/slide/4716768/ (Introduction to Biomedical Equipment Technology).
2. https://www.youtube.com/watch?v=VvYcxTn_UY4 (Medical Instrumentation Application and Design).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
2	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
3	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
4	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
5	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	**1.0**	**1.0**	**-**	**2.0**	**-**	**-**	**-**	**-**	**-**	**3.0**	**2.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMT203 DESIGN OF MEDICAL EQUIPMENT DEVICE L T P C
3 0 0 3

OBJECTIVES

- To understand the concepts of designing power system for medical electronics.
- To learn the essential circuit try needed for sensor design.
- To know about data acquisition system design.
- To study the knowledge about noise cancellation system.
- To understand the necessary knowledge about the hardware implementation of DSP.

UNIT I DESIGN OF POWER SUBSYSTEMS IN MEDICAL ELECTRONICS 9

Transient voltage protections- Electromagnetic interference- Inrush current control Overvoltage protection- Under voltage protection- Overload protection- Output filtering- Power failure warning- Flightback switch back power supplies- Half-bridge Flyback converter.

UNIT II SENSOR DESIGN FUNDAMENTALS 9

Sensor parameters- Sensor Interfacing- Signal conditioning amplifiers- Instrumentation amplifiers- Isolation amplifiers- Charge-coupled device sensors- Position and motion sensors Accelerometers- Temperature sensors- Fiber optics based medical sensors.

UNIT III DATA ACQUISITION SYSTEMS 9

Sample and hold conversion- Multichannel acquisition- High speed sampling in ADC- Selection of drive amplifier for ADC performance- Driving ADCs with switched capacitor inputs- ADC input protection- External protection of amplifiers- High speed ADC architectures.

UNIT IV NOISE AND INTERFERENCE ISSUES IN ANALOG CIRCUITS 9

Noise calculations in Op-Amp- Internal noise in Op-Amps- Proper power supply decoupling Bypass capacitors and resonances- Designing power bus rails in power-ground planes for noise control- ASIC.

UNIT V HARDWARE APPROACH TO DIGITAL SIGNAL PROCESSING 9

DSP hardware- Arithmetic logic unit- Multiplier-accumulator- Shifter- Data address generators Program sequencer- Serial ports- Interfacing ADCs and DACs to digital signal processors Parallel ADCs o DSP interface- Parallel DAC to DSP interface- Serial interfacing to DSP processors

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the various power systems used in the design of medical electronics devices.
- Develop and classify the biosensors design according the types of device.
- Develop the interpret data from the sensors.
- Analyze the noise interference issues in the devices.
- Explain the signal processing system in medical electronic devices.

TEXT BOOKS

1. Peter J.Ogrodnik, "Medical Device Design: Innovation from Concept to Market", Kindle Edition Academic Press, Second Edition,2019.
2. Reinaldo Perez, "Design of Medical Electronic Devices Hardcover" ,Academic Press,First Edition 2015.

REFERENCES

1. Kunal Pal, Heinz-Bernhard Kraatz, Anwesha Khasnobish, "Bioelectronic and Medical devices", Elsevier,Third Edition,2019.
2. Rudiger Kramme, Klaus Peter Hoffmann, Robert Steven Pozos,"Handbook of Medical Technology", Kindle Edition Academic Press,Second Edition, 2016.

E-RESOURCES

1. https://www.youtube.com/watch?v=aBeRFdAA2og (Sensor Design Fundamentals).
2. https://www.youtube.com/watch?v=WwQSfk6SSSo **(**Data Acquisition Systems).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	2	-	-	-	-	1	-	2	3	2	1
2	3	2	2	2	2	-	-	-	-	1	-	3	3	2	2
3	3	3	2	1	2	-	-	-	-	1	-	2	3	2	1
4	3	3	3	2	3	-	-	-	-	1	-	2	3	2	2
5	3	3	3	2	2	-	-	-	-	1	-	2	3	2	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.8**	**2.4**	**1.6**	**2.2**	**-**	**-**	**-**	**-**	**1.0**	**-**	**2.2**	**3.0**	**2.0**	**1.4**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMT204 **BIOMEMS IN ARTIFICIAL ORGANS** **L T P C**
3 0 0 3

OBJECTIVES

- To know the basic properties of biomaterials.
- To study the materials used for medical field.
- To understand the sterilization of biomaterials.
- To learn the testing process of materials.
- To understand the implants in medical fields.

UNIT I INTRODUCTION **9**

Definition of biomaterials, mechanical properties, surface chemistry of materials, surface modification, Tissue Reaction, Wound Kinetics, and Bio Compatibility.

UNIT II MATERIALS FOR MEDICINE **9**

Metals, Ceramics, Polymers and Biomimetic Materials, Composites. Material preparation, chemical composition, Properties, uses in medicine and biosciences and failure mechanisms.

UNIT III STERLIZATION OF BIOMATERIALS **9**

Sterilization techniques:–process and mechanism of action of steam sterilization,radiation sterilization, and electron beam sterilization, ethylene oxide, and chlorine dioxide and plasma gas sterilization.

UNIT IV TESTING OF MATERIALS **9**

Testing with Tissue Culture – in vitro and in vivo assessment of biocompatibility, testing with Soft Tissues and testing at non Thrombogenic surface - blood compatibility and thromobogenicity, ISO 10993- standard for assessment of biocompatibility.

UNIT V HARD AND SOFT TISSUE REPLACEMENT **9**

Orthopedic Implants, Neuromuscular Implants, Dental Implants, Transcutaneous Implants, Intraocular lenses Cardiac Implants, Blood Interfacing Implants, Percutaneous and Skin Implants.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze how the properties of the biomaterials affect interactions with cells and tissues.
- Explain the relationship between structure and function polymers, biomimetic, composites, ceramics and metals as biomaterials.
- Explain the various sterilization techniques used for obtaining sterility of materials.
- Develop the role of material testing by using knowledge of engineering concerns and hemodynamic assessment of organs.
- Explain the different types of hard and soft tissue replacement.

TEXT BOOKS

1. Dimitrios Stamatialis, "Biomedical Membranes And Bio artificial Organs" (World Scientific Series In Membrane Science And Technology: Biological And Biomimetic Applications, Energy And The Environment Book 2), Kindle Edition,First Edition,2017.
2. Buddy D.Ratner, Allan S .Hoffman, Frederick J. Schoen, Jack E. Lemons, "Biomaterial Science; An Introduction to Materials in Medicine", Third Edition, Elsevier Academic Press,2015.

REFERENCES

1. Joseph D. Bronzino,Donald R. Peterson,"The Biomedical Engineering Handbook", CRC Press Taylor & Francis, Fourth Edition,2015.
2. Antonios G. Mikos ,Johnna S. Temenoff,"Biomaterials:The Intersection of Biology and Materials Science",Pearson International,Third Edition,2016.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc20_bt12/preview- (Biomaterials An Introduction).
2. https://nptel.ac.in/courses/112104181- (BIOMEMS and Micro Systems).

Mapping of Cos-PoS & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	2	-	2	-	-	-	-	-	3	2	1
2	3	2	1	1	2	-	2	-	-	-	-	-	3	2	1
3	3	2	1	1	2	-	2	-	-	-	-	-	3	2	1
4	3	2	1	1	2	-	2	-	-	-	-	-	3	2	1
5	3	2	1	1	2	-	2	-	-	-	-	-	3	2	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	**1.0**	**2.0**	**-**	**2.0**	**-**	**-**	**-**	**-**	**-**	**3.0**	**2.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PME201 APPLIED MEDICAL IMAGE PROCESSING L T P C
3 0 2 4

OBJECTIVES

- To understand the fundamentals of images.
- To learn the image restoration and enhancement techniques.
- To study about medical image analysis and their classification.
- To know the Morphological image processing and compression
- To study about image registration and visualization processes..

UNIT I IMAGE FUNDAMENTALS 9

Image perception, MTF of the visual system, Image fidelity criteria, Color Vision model, Image sampling and quantization – Two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – DFT, DCT, DST, Hadamard Transform, Haar Transform, KLT, SVD.

UNIT II IMAGE ENHANCEMENT AND RESTORATION 9

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic mean filters, Homomorphic filtering, Color image enhancement. Image Restoration - Degradation model, Unconstrained and constrained restoration, Inverse filtering- Wiener filtering, Maximum entropy restoration.

UNIT III MEDICAL IMAGE ANALYSIS AND CLASSIFICATION 9

Image segmentation- Pixel based, Edge based, Region based segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, Feature and Image classification – Statistical, Rule based, Regression analysis, Neural Network approaches.

UNIT IV MEDICAL IMAGE COMPRESSION AND MORPHOLOGICAL PROCESSING 9

Fundamentals – Image compression standards- Lossy and lossless Compression - Coding: Run length – Huffman – Arithmetic - Bit plane – Predictive and Wavelet. Dilation, Erosion, Open, Close, Skeleton operations, Top-hat algorithm - Morphology based segmentation.

UNIT V IMAGE REGISTRATIONS AND VISUALIZATION 9

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Medical image Fusion, SPECT/CT, MR/CT, PET/CT. Image visualization – 2D display methods, 3D display methods, Virtual reality based interactive visualization.

LIST OF EXPERIMENTS

1. Preprocessing of medical images.
2. Apply 2-D DFT, DCT and transform for medical images.
3. Implement DWT analysis of medical images.
4. Develop an algorithm for medical image enhancement using histogram equalization.
5. Develop a non-linear filtering for medical image enhancement.
6. Create an algorithm to segment CT images using edge detection, line detection and boundary detection.
7. Apply watershed transform for medical image segmentation.
8. Perform thresholding functions using optimal threshold & Otsu's Technique for medical images.
9. Apply image compression techniques for 3D medical images.
10. Perform the morphological operations of medical images.

TOTAL : 45+15 = 60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Describe the image perception, color vision models, image sampling and quantization methods with image transforms.
- Explain the intensity transformation techniques to enhance the images in spatial and frequency domain and restoration of images using spatial filtering techniques.
- Develop an algorithms employed for segmentation and apply Neural Network approaches for image classification.
- Explain the compression techniques and morphological operations for segmentation.
- Analyze the image registration with different modalities; render their volumes for visualization and medical image fusion.
- Develop the segment CT images using edge detection, line detection and boundary detection.

TEXT BOOKS

1. Anil. K. Jain, "Fundamentals of Digital Image Processing",Pearson Education,Second Edition,2015
2. S Esakkirajan, T Veerakumar, S Jayaraman, "Digital Image Processing", Tata Mc-Graw Hill India,Third Edition,2015.

REFERENCES

1. Rafael C, Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education Asia, Fourth Edition, 2018.
2. Wolfgang Birkfellner "Applied Medical Image Processing A Basic Course",CRC Press, Second Edition,2015.

E-RESOURCES

1. https://nptel.ac.in/courses/108105091 (Medical Image Analysis).
2. https://onlinecourses.nptel.ac.in/noc20_ee41/preview(Biosignal land Biomedical Image Processing).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	2	2	1	2	-	-	-	1	-	2	2	1
2	2	1	2	3	2	1	2	-	-	-	1	-	2	2	1
3	2	1	2	2	1	1	2	-	-	-	1	-	2	2	1
4	2	2	2	3	3	2	2	-	-	-	1	-	1	2	1
5	3	1	1	2	1	2	2	-	-	-	1	-	2	1	1
6	1	1	1	1	1	1	2	-	-	-	1	-	2	3	1
AVG.	**2.0**	**1.1**	**1.6**	**2.1**	**1.6**	**1.3**	**2.0**	**-**	**-**	**-**	**1.0**	**-**	**1.8**	**2.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PEE202 HOSPITAL / BIOMEDICAL INDUSTRY TRAINING L T P C
0 0 2 2

OBJECTIVES

- To learn the practical experience at place where biomedical equipments are utilized.

LIST OF EXPERIMENTS

1. Study of Ventilator functioning.
2. Study of Ultrasound machine.
3. Study of Heart Lung Model.
4. Troubleshooting, maintenance and servicing of medical equipments.
5. Presentation on various departments and equipments in the Hospital. Students have to undergo two weeks practical training in hospitals with the prior approval from the institution during semester holidays of that particular academic year. At the end of the training student will submit a report as per the prescribed format to the department.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	1	-	3	-	-	-	2	2	1	3		2	2
AVG.	**2.0**	**-**	**1.0**	**-**	**3.0**	**-**	**-**	**-**	**2.0**	**2.0**	**1.0**	**3.0**		**2.0**	**2.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

SEMESTER - III

23PEE301	**PROJECT WORK (PHASE - I)**	**L T P C** **0 0 12 6**

OBJECTIVES

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva– voce examination.

GUIDELINE FOR REVIEW AND EVALUATION

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva–voce examination by a panel of examiners including one external examiner.

TOTAL : 180 PERIODS

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks (Continuous Assessment):40 marks.
   (Decided by review committee consist of HoD, Guide and senior faculty member conducting 3 reviews).
2. End semester assessment (Evaluation of Project Report & Viva voce examination):60 marks.
   (Evaluated by the internal & external examiner appointed by the CoE and approval by HoD)

OUTCOMES

- At the end of the course project the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	1	1	-	-	-	1	1	1	3	2	2
AVG.	**3.0**	**3.0**	**2.0**	**2.0**	**1.0**	**1.0**	-	-	-	**1.0**	**1.0**	**1.0**	**3.0**	**2.0**	**2.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

SEMESTER – IV

23PEE401	**PROJECT WORK (PHASE - II)**	**L**	**T**	**P**	**C**
		0	**0**	**24**	**12**

OBJECTIVES

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.
- To train the students in preparing project reports and to face reviews and viva– voce examination

GUIDELINE FOR REVIEW AND EVALUATION

The student should continue the phase–I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL : 360 PERIODS

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks (Continuous Assessment): 40 marks.
   (Decided by review committee consist of HoD, Guide and senior faculty member conducting 3 reviews)
2. End semester assessment (Evaluation of Project Report & Viva voce examination): 60 marks. (Evaluated by the internal & external examiner appointed by the CoE and approval by HoD)

OUTCOMES

- On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	1	1	-	-	-	1	1	1	3	2	2
AVG.	**3.0**	**3.0**	**2.0**	**2.0**	**1.0**	**1.0**	-	-	-	**1.0**	**1.0**	**1.0**	**3.0**	**2.0**	**2.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

PROFESSIONAL ELECTIVES

23PMP101 **BIO STATISTICS** **L T P C**
3 0 0 3

OBJECTIVES

- To understand common statistical tests and tools..
- To know strength and limitations of measures of central tendency and variability
- To learn Confidence Interval on the Variance and Standard Deviation of a Normal Distribution.
- To study about Inference for a Difference in Means of Two Normal Distributions with Variances Known
- To study about replication and local control-Completely randomized design. randomized block design

UNIT I FUNDAMENTAL STATISTICAL TOOLS IN ENGINEERING RESEARCH 9

The Engineering Method and Statistical Thinking - Collecting Engineering Data - Basic Principles - Retrospective Study - Observational Study - Designed Experiments -Observing Processes Over Time - Mechanistic and Empirical Models. Data Description and Representation: Collection of data- Classification and Tabulation of data - Stem-and-Leaf Diagrams - Frequency Distributions and Histograms - Box Plots - Time Sequence Plots - Probability Plots.

UNIT II DESCRIPTIVE STATISTICS 9

Measures of central Tendency-Measures of Dispersion- Skewness and Kurtosis. Correlation and Regression: Types of Correlation – Scatter Diagram – Karl Pearsons Coefficient of Correlation and Spearmen's Rank Correlations- Method of Least Squares - Regression (The two regression lines).

UNIT III SAMPLING 9

Different types of sampling - Sampling Distributions - Sampling Distribution of Mean. Point Estimation of Parameters: General Concepts of Point Estimation - Unbiased Estimators - Variance of a Point Estimator - Standard Error- Methods of Point Estimation (Method of Moments - Method of Maximum Likelihood). Statistical Intervals for a Single Sample: Confidence Interval on the Mean of a Normal Distribution with Variance Known - Confidence Interval on the Mean of a Normal Distribution with Variance Unknown - Confidence Interval on the Variance and Standard Deviation of a Normal Distribution - A Large- Sample Confidence Interval for a Population Proportion.

UNIT IV TESTS OF HYPOTHESES FOR A SINGLE SAMPLE 9

Tests of Statistical Hypotheses - General Procedure for Hypothesis Testing –Tests on the Mean of a Normal Distribution with Variance Known - Tests on the Mean of a Normal Distribution with Variance Unknown - Tests on the Variance and Standard Deviation of a Normal Distribution. Statistical Inference for Two Samples: Inference for a Difference in Means of Two Normal Distributions with Variances Known - Inference for a Difference in Means of Two Normal Distributions with Variances Unknown -Inference on the Variances of Two Normal Distributions – Inference on Two Population Proportions.

UNIT V THE ANALYSIS OF VARIANCES **9**

Concept- Assumptions- One way classification and two-way classifications. Designing Engineering Experiment: Concept of Randomization, Replication and local control-Completely Randomized Design. Randomized Block Design- Latin square Design.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the role of Statistics and basic principles of data description and representation in solving engineering problems.
- Explain the requirements for the existence of a relationship between two variables.
- Develop the acquaint with the concept of different sampling methods.
- Analyze the hypotheses on the samples to arrive at conclusions on the population.
- Explain the difference between fixed and random factors.

TEXT BOOKS

1. Dieter Rasch, Rob Verdooren, Jurgen Pilz, "Applied Statistics", First Edition, Wiley, 2019.
2. Neil Weiss , "Introductory Statistics" Pearson, Tenth Edition , 2016.

REFERENCES

1. Chap T. Le, Lynn E. Eberly, "Introductory Biostatistics", John Wiley & Sons Inc, Second Edition, 2016.
2. Jay L. Devore,"Probability and Statistics for Engineering and the Sciences", Cengage India Private Limited ,Ninth edition, 2020 .

E-RESOURCES

1. https://youtu.be/AAuuh-72HxY- Introduction to Biostatistics.
2. https://youtu.be/WbKiJe5OkUU- Descriptive Statistics with R Software.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	-	-	1	-	1	1	-	1	1	2	-	-
2	3	2	-	-	-	1	-	1	1	-	1	1	2	-	-
3	3	2	-	-	-	1	-	1	1	-	1	1	2	-	-
4	3	2	-	-	-	1	-	1	1	-	1	1	2	-	-
5	3	2	-	-	-	1	-	1	1	-	1	1	2	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**-**	**-**	**-**	**1.0**	**-**	**1.0**	**1.0**	**-**	**1.0**	**1.0**	**2.0**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP102 INTRODUCTION TO CLINICAL TRAILS L T P C
3 0 0 3

OBJECTIVES

- To understand ethical and regulatory aspects of clinical research.
- To know the clinical research process as it relates to health and medical products.
- To study about each individual has an equal probability to be assigned to one or the other treatment.
- To learn data points that provides insight into operational performance.
- To understand the Double data entry and checking.

UNIT I BASIC CONCEPTS IN CLINICAL RESEARCH 9

Basics of epidemiology, Definition, scope, and uses of epidemiology Measures of disease and death frequency, Mortality and morbidity, epidemiological study designs, Observational studies, descriptive studies, experimental studies, Ecological studies, cross sectional studies, cohort studies, case control studies, incidence, prevalence, odds ratio, relative risk, ethical and regulatory aspects of clinical research, ethical issues in preclinical (animal studies and clinical studies).

UNIT II CLINICALTRIAL DESIGNS 9

Basics of Clinical Trials: need clinical trials, Brief History of Clinical Trials, Glossary of Common Terms in clinical Trials: Clinical Research, Healthy Volunteer, Inclusion/Exclusion Criteria, Informed Consent, Patient Volunteer, Phases of Clinical Trials, Placebo, Protocol, Principal Investigator, Randomization, Single- or Double-Blind, Studies, Types of Clinical Trials. - Diagnostic trials, Prevention trials, Quality of life trials, Screening trials, Treatment trials. Clinical Trial Protocol and its components. Type analyses: ITT, and PP.

UNIT III RANDOMIZED CONTROLLED TRAIL 9

Randomized controlled trial - Reasons for randomization, Features of RCT – design and conduct of RCT - Random allocation, Allocation concealment, Blinding, Conduct, Outcome ascertainment, Sample size, Power of a study. Reporting of RCT- Randomization and Masking, Overview of Clinical Study Design.

UNIT IV MANAGEMENT OF CLINICAL DATABASE 9

Clinical Trials Metrics Collection, Clinical Data Management, Data Processing – Database -Definition of Data Management and its benefits -Types of data: data collection methods, raw, physical collection, models, images etc. –Data entry - File naming – Data assurance: quality control and assurance of data, medical coding, dictionary management and maintenance of quality documents.

UNIT V DATA SAFETY 9

Missing data, submitting data, Metadata: Metadata standards, submitting Data, File formats, preserve: Backup of data, Migration: Transformation of data, discovering data, Integrate: Merging of multiple

data sets, Data Citation, Data retrieval, Archiving, Double data entry and checking, Quality control and Data Cleaning.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Understand the importance of spreading and measurement of disease.
- Develop the terms, phases of clinical trails and study of different clinical trails.
- Acquire the features and different methods of randomized control trail.
- Explain the different types of data and its management in clinical trails.
- Understand the types of file format for the safety maintenance of data.

TEXTBOOKS

1. P. Michael Dubinsky, Karen A. Henry "The fundamentals of clinical research: A universal guide for implementing good clinical practice" wiley, First Edition, 2021.
2. Lawrence M. Friedman, Curt D. Furberg, David L. DeMets, David M. Reboussin, Christopher B. Granger "Fundamentals of clinical trails", Springer Cham, Fifth Edition , 2015.

REFERENCES

1. Tom Brody, "clincal trails", Academic Press ,Second Edition, 2016.
2. P. Michael Dubinsky , Karen A. Henry , "The Fundamentals of Clinical Research: A Universal Guide for Implementing Good Clinical Practice", First edition, 2022.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/127/106/127106137/ (The fundamentals of clinical research).
2. http://www.digimat.in/nptel/courses/video/109106095/L20.html (Health Research Fundamentals)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	1	-	1	-	-	-	-	2	1	-
2	3	2	1	-	-	1	-	1	-	-	-	-	2	1	-
3	3	2	1	-	-	1	-	1	-	-	-	-	2	1	-
4	3	2	1	-	-	1	-	1	-	-	-	-	2	1	-
5	3	2	1	-	-	1	-	1	-	-	-	-	2	1	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	**-**	**-**	**1.0**	**-**	**1.0**	**-**	**-**	**-**	**-**	**2.0**	**1.0**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP103 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING L T P C
3 0 0 3

OBJECTIVES

- To understand the computer functions which are related to human knowledge.
- To study of a linear regression model is to find a relationship between one or more features and a continuous target variable.
- To understand the distance function provides distance between the elements of a set**.**
- To learn the various graphical models.
- To understand Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans.

UNIT I INTRODUCTION 9

Probability theory - model selection - Decision theory - Information theory - Entropy and mutual information. Types of machine learning - Supervised learning - Unsupervised learning - Reinforcement learning - Basic concepts of machine learning - parametric and non-parametric models - linear and logistic regression.

UNIT II LINEAR MODELS 9

Least squares method - Multivariate linear regression - regularized regression - perceptron - Support Vector Machines - hard SVM, soft SVM - going beyond linearity - generalization and overfitting - Regularization.

UNIT III DISTANCE BASED MODELS 9

Nearest neighbour models - K means - clustering around medoids - silhouettes - hierarchical clustering - Decision tree - univariate tree - multivariate trees - Dimensionality reduction - principle component analysis - linear discriminate analysis.

UNIT IV GRAPHICAL MODEL 9

Naive Bayes classifier - hidden Markov model - Linear regression - Reinforcement learning - Elements of reinforcement learning - model based learning - temporal difference learning - generalization.

UNIT V DEEP LEARNING TECHNIQUES 9

Deep generative model - deep directed networks - deep Boltzmann machines - deep belief networks– multilayer perceptrons - auto encoders - stacked denoising auto encoders - application of deep networks.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the mathematical foundation for machine learning.
- Explain a support vector machine algorithm and a linear regression model using regularization technique.
- Develop various distance based models such as nearest neighbor models, hierarchical clustering.
- Explain the classifier and comprehend the reinforcement learning model and perform generalization technique.
- Explain the various deep learning model such as deep directed network and auto encoder network.

TEXT BOOKS

1. Peter Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, First Edition ,2012.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, First Edition ,2016.

REFERENCES

1. Tom M Mitchell "Machine Learning", First Edition, McGraw Hill Education, 2017.
2. Shai Ben-David,Shai Shalev-Shwartz, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, Third Edition ,2015.

E-RESOURCES

1. https://www.digimat.in/nptel/courses/video/106105152/L01.html (Pattern Recognition and Machine Learning).
2. https://www.youtube.com/watch?v=bjG3gS3Mh1U (Machine Learning).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	-	-	-	-	1	-	3	-	1	1	-
2	1	1	1	3	1	-	-	-	1	-	2	-	1	1	-
3	2	1	2	1	1	-	-	-	2	-	1	-	1	1	-
4	3	1	3	1	-	-	-	-	2	-	1	-	1	1	-
5	3	2	1	1	2	-	-	-	3	-	1	-	1	1	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.4**	**1.4**	**2**	**1.8**	**0.8**	**-**	**-**	**-**	**1.8**	**-**	**1.6**	**-**	**1.0**	**1.0**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP104 **BIOMEDICAL OPTICS** **L T P C**
3 0 0 3

OBJECTIVES

- To understand the various optical properties of the tissues.
- To study the introduction to the basic setups, apparatus, and system components for readers from other research fields.
- To understand the various surgical application of lasers.
- To study the various Diagnostic applications.
- To know the various therapeutic applications.

UNIT I OPTICAL PROPERTIES OF THE TISSUES **9**

Refraction, Scattering, absorption, light transport inside the tissue, tissue properties - Light interaction with tissues - opto-thermal interaction, fluorescence.

UNIT II INSTRUMENTATION IN PHOTONICS **9**

Instrumentation for absorption, scattering and emission measurements, excitation light sources – high pressure arc lamp, solid state LEDs, Lasers, optical filters, solid state detectors – optical detectors - time resolved and phase resolved detectors.

UNIT III SURGICAL APPLICATIONS OF LASERS **9**

Laser in tissue welding, lasers in dermatology - lasers in ophthalmology, otolaryngology, Urology - Lasers in Neurosurgery - Laser Treatment of Breast Tumors - Therapeutic Applications of Lasers in Gastroenterology.

UNIT IV DIAGNOSTIC APPLICATIONS **9**

Optical coherence tomography, Elastography - Fluorescence Imaging, Raman Imaging, SEM, TEM, FLIM, X-Ray Diagnostic Techniques, Speckle Correlometry - Near-Field Imaging in Biological and Biomedical Applications.

UNIT V THERAPEUTIC APLLICATIONS **9**

Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and non-oncological applications of PDT - Biostimulation effect – applications.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the fundamentals of optical properties of tissues.
- Describe the components of instrumentation in medical photonics and configurations.
- Analyze surgical applications of lasers.
- Develop the photonics and its diagnostic applications.
- Explain the emerging techniques in medical optics.

TEXT BOOKS

1. Tuan Vo Dirh, "Biomedical Photonics-Handbook",CRC Press,Bocaraton,Second Edition 2019.
2. Mark E. Brezinski, "Optical Coherence Tomography: Principles and Applications", Academic Press, First Edition, 2015.

REFERENCES

1. Lihong V. Wang, Hsin-i Wu, "Biomedical Optics Principles and Imaging", Wiley, Third Edition 2012.
2. Pitris, David A. Boas, Nimmi Ramanujam,"Handbook of Biomedical Optics",CRC press, First Edition ,2016.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_ee81/preview (Optical Engineering).
2. https://archive.nptel.ac.in/courses/104/104/104104085/ (Introduction to Lasers).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	1	1	-	-	-	-	-	-	1	-	1
2	3	1	2	2	2	2	-	-	-	-	-	-	1	-	1
3	3	1	2	1	2	2	-	-	-	-	-	-	1	-	1
4	3	2	2	2	3	3	-	-	-	-	-	-	1	-	1
5	3	-	3	2	2	2	-	-	-	-	-	-	1	-	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**1.2**	**2.2**	**1.6**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**-**	**1.0**	**-**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP105 ULTRASOUND PRINCIPLES AND ITS MEDICAL APPLICATIONS L T P C
3 0 0 3

OBJECTIVES

- To understand the principles of ultrasonic and its interaction with tissue ,Ultrasound scanning techniques, real time scanners and medical applications of these principles.
- To study about the basic interactions of tissue with ultrasound provides the basis of avoiding errors and misdiagnosis.
- To learn the various imaging method that uses the sound waves to produce images of structures within your body.
- To understand the various methods used in real time ultrasound scanners
- To know the various applications used in ultrasonic.

UNIT I PRINCIPLES OF ULTRASONICS 9

Introduction, Piezo Electric Devices, The Fields of simple CW excited sources, The Pulsed Acoustic field, Effects of human body on Beam Propagation, Beam formation by transducer arrays, Magnitudes of Acoustic Field variables, Displacement detectors Thermal mechanisms, Cavitation, Radiation Pressure.

UNIT II TISSUE-ULTRASOUND INTERACTION 9

Introduction, Absorption in biological tissues, Tissue-Ultrasound interaction cross sections, Theory of mechanisms for the absorption of ultrasonic longitudinal waves, Measurement of attenuation and Absorption Coefficients in tissues, Acoustic properties reflecting different levels of tissue organization, Molecular aspects of soft tissue mechanics, Structural contribution to bulk and shear acoustic properties of tissues. Relevance to tissue characterization, Ultrasound quantization and tissue characterization.

UNIT III SCANNING TECHNIQUES 9

Ultrasound transducers, Construction of ultrasonic probe, Measurement of ultrasonic energy, pulse echo imaging, Pulse echo equation, Transducer motion, Transmit steering and focusing, Beam forming and Dynamic focusing, Transmitter, Receiver, Positional information, Scan converter-Analog, Digital. Image display, Image position, Transducer output, signal processing, adjustment of controls. Scanning Techniques- Acoustic windows, Scanning motion, Transducer Selection, Scan Indexing. Basic Image Interpretation-Contour, Internal Echo pattern, Attenuation, Classification, Artifacts.

UNIT IV REAL TIME ULTRASONIC SCANNERS 9

Different modes of display-A mode, B mode, M mode, B-scan System, The Principles of Ultrasound Motion Detection, Techniques for Measuring Target Velocity, Phase Fluctuation (Doppler Methods), Envelope Fluctuation Methods, Phase Tracking Methods, Envelope Tracking Techniques, Ultrasound Imaging Systems, Considerations Specific To Color Flow Imaging, Angle Independent Velocity Motion Imaging, Tissue Elasticity & Echo Strain Imaging, Performance Criteria, Use of Contrast Media, Real Time Echo, 2-D and 3-D Scanners, Color Doppler.

UNIT V ULTRASONIC APPLICATIONS **9**

Ultrasonic diagnosis in Abdomen, Breast, Thyroid, Heart, Chest, Eye, Kidney, Skull, Pregnant and Non Pregnant uterus, 3-Dimensional Ultrasonic Imaging of The Fetus, Advantages And Limitations of 3-Dimensional Ultrasound.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the principles of Ultrasonic and its interaction with living systems.
- Analyze interactions between ultrasound and biological tissues.
- Develop the suitable ultrasonic scanning method for imaging different organs
- Develop real time Scanners to view inside the body.
- Explain the 3-Dimensional Ultrasound scanner to diagnosis diseases.

TEXT BOOKS

1. Khandpur R.S , "Biomedical Instrumentation" , Tata Mc Graw Hill publication, New Delhi, Third Edition, 2014.
2. C.R.Hill, Jeff C.Bamber, Gail Haa, "Physical Principles of medical Ultrasonics" ,John Wiley & Sons Ltd,First Edition, 2007.

`

REFERENCES

1. Graham Arthurs ,Trevor Frankel, "Principles of medical ultrasound",2017.
2. Yufeng Zhou,"Principles and Applications of Therapeutic Ultrasound in Healthcare", 2015.

E- RESOURCES

3. https://www.youtube.com/watch?v=UdDmP_CDH5I (Medical Engineering).
4. https://www.youtube.com/watch?v=a8xcsXDez5M (Ultra sonic Imaging Systems).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	1	2	1	1	-	-	-	-	-	-	2	1	-
2	2	2	2	2	2	2	-	-	-	-	-	-	2	2	-
3	2	2	1	2	2	2	-	-	-	-	-	-	2	1	-
4	2	3	2	3	3	2	-	-	-	-	-	-	3	2	-
5	3	3	2	2	2	2	-	-	-	-	-	-	3	2	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.2**	**2.4**	**1.6**	**2.2**	**2.0**	**1.8**	**-**	**-**	**-**	**-**	**-**	**-**	**2.4**	**1.6**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP201 **TELE MEDICINE TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES

- To understand the various concepts of telemedicine.
- To study the various fundamentals of telemedicine
- To learn the various technology used in telemedicine.
- To know the various mobile telemedicine techniques.
- To understand the various applications of telemedicine.

UNIT I FUNDAMENTALS OF TELEMEDICINE **9**

Telemedicine – Biomedical Telemetry – History of Telemedicine – Benefits of Telemedicine – Types of Telemedicine services. Delivery mechanisms in Telemedicine – Telemedicine standards and guidelines.

UNIT II TELEMEDICINE SYSTEMS **9**

Tele medicine process – Essential parameters – Components of telemedicine systems – Delivery modes in Telemedicine: Store and Forward Telemedicine – Real time Telemedicine – Hybrid Systems – Remote Monitoring.

UNIT III TELEMEDICAL TECHNOLOGY **9**

Information sources in a Telemedicine system – Data transmission – Transmission of still images: Image compression, Data compression, DICOM. Transmission of video: Video compression technology – Transmission of Audio: Voice compression – Speech codecs. Telecommunication technologies: POTS, DDS, ISDN, Internet, DSL, ADSL, Satellite communication.

UNIT IV MOBILE TELEMEDICINE **9**

mHealth – Key technologies for mHealth – Wireless connectivity in mHealthv – Ubiquitous Healthcare – Wireless Body Area Network (WBAN) – Wireless Personal Area Network (WPAN) – Wireless Sensor Network (WSN) – mHealth in Intensive care monitoring– Mobile Telemedicine.

UNIT V APPLICATIONS OF TELEMEDICINE **9**

Tele radiology: Types of Imaging modalities– Components of a Teleradiology system – Tele ultrasonography. Telepathology– Telecardiology – Teleophthalmology - Telesurgery: Telementoring – Robot assisted surgery. Telerehabilitation.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the fundamentals of telemedicine.
- Acquire knowledge on various telemedical technologies.
- Analyse the protocols and techniques of transmission of data.
- Develop the key technologies for mobile telemedicine.
- Explain the applications of Telemedicine in Telehealth care.

TEXT BOOK

1. R.S. Khandpur "Telemedicine: Technology and Applications (mHealth, TeleHealth and eHealth)", PHI Learning Private Limited, 2017.
2. Bernard Fong, A.C.M. Fong, C.K. Li, "Telemedicine Technologies: Information Technologies in Medicine and Tele health", Wiley, 2011.

REFERENCES

1. Wootton, R., Craig, J., Patterson, V., "Introduction to Telemedicine. Royal Society of Medicine" Press Ltd, Taylor & Francis 2006.
2. Magnuson, J.A., Fu, Jr., Paul C. (Eds.), "Public Health Informatics and Information systems",ISBN 978-1-4471-4237-9, Springer,2014.

E-RESOURCES

1. https://www.youtube.com/watch?v=60zAe27su_E (Wireless Body Area Network).
2. https://youtu.be/jZX7nQGScNM (The Basics of Telemedicine).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	1	2	1	-	-	-	1	-	-	-	1	-
2	2	2	2	2	2	2	-	-	-	1	-	-	-	1	-
3	2	1	2	2	2	2	-	-	-	1	-	-	-	1	-
4	2	2	3	2	3	3	-	-	-	1	-	-	-	1	-
5	3	2	3	2	2	2	-	-	-	1	-	-	-	1	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.2**	**1.6**	**2.4**	**1.8**	**2.2**	**2.0**	**-**	**-**	**-**	**1.0**	**-**	**-**	**-**	**1.0**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP202 TISSUE ENGINEERING AND ITS APPLICATIONS L T P C
3 0 0 3

OBJECTIVES

- To Analyze the fundamentals of tissue Engineering
- To Study the various fundamentals of cell mechanism.
- To Study the various biomaterials used in tissue engineering.
- To learn the various stem cells used in tissue engineering.
- To know the idea about various applications used in tissue engineering.

UNIT I FUNDAMENTALS OF TISSUE ENGINEERING 9

Introduction to Tissue Engineering - Objectives of Tissue Engineering - Basic definitions - Structure and organization of Tissues – Development of Tissue – Tissue exchange and diffusion of simple metabolites – Tissue Equivalent - Wound Healing Process - Biocompatibility and toxicity assessment.

UNIT II FUNDAMENTALS OF CELL MECHANISMS 9

Cell adhesion, Cell migration and Cell aggregation – Cell growth and Cell cycle. Cellular Interactions: Cell – Cell and Cell – Matrix. Control of Cell migration in Tissue Engineering –Cell delivery and Recirculation – Cell Culture in vitro – 3D culture in Tissue Engineering - In vitro Organogenesis - Cell transplantation.

UNIT III BIOMATERIALS IN TISSUE ENGINEERING 9

Definition – Biological vs Nonbiological materials – Extra Cellular Matrix – Collagen, Chitin & Degradable and Nondegradable materials – Polymer, Ceramics and Metals – Cell interaction with different materials –- Scaffolds - Control releaser agents in Tissue Engineering – Cell interaction with suspension and gels – Tissue response to implants.

UNIT IV STEMCELLS IN TISSUE ENGINEERING 9

Introduction of Stem cells – Hematopoietic Stem cells - Embryonic Stem cells - Adult stem cells – Cancer Stem cells – Cord Blood cells – Induced Pluripotent Stem cells - Stem cell identification - Surface markers & FACS analysis – Differentiation, Dedifferentiation and Immortalization – Application of stem cells in tissue Engineering.

UNIT V TISSUE ENGINEERING APPLICATIONS 9

Synthetic components – Artificial organs – Joints and dental prostheses - Connective Tissue Engineering – Cardiovascular Tissue Engineering – Neural Tissue Engineering - Cell and Drug Delivery systems.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the importance of tissue engineering in the field of biomedical engineering.
- Explain the mechanisms involved in interaction of different materials with cells.
- Describe and characterize biomaterials for tissue engineering applications.
- Develop new stem cells-based tissue engineering approaches.
- Analyze and create new models in drug delivery systems using synthetic and naturals caffolds.

TEXT BOOKS

1. Gary E Wnek, Gary L Browlin ,"Encyclopedia of Biomaterials and Biomedical Engineering" , Marcel Dekker Inc New York,Second Edition, 2008.
2. R.Lanza, J.Gearhart et.al, (Eds), "Essential of Stem cell Biology, Elsevier Academic Press", Second Edition, 2009.

REFERENCES

1. Robert P. Lanza, Robert Langer and Joseph Vacanti, "Principles of Tissue Engineering", Second Edition, Academic press, Elsevier 2013.
2. SujataV.Bhatt, "Biomaterials" ,Narosa Publishing House, Second Edition, 2005.

E-RESOURCES

1. https://www.youtube.com/watch?v=bgRjFW5agvA (Tissue Engineering – Introduction).
2. https://www.youtube.com/watch?v=5H2Aabqkk10 (Cell Source).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	2	1	2	1	-	1	-	1	-	1	-	-	1
2	2	2	2	1	2	1	-	1	-	1	-	1	-	-	1
3	1	2	2	1	2	1	-	1	-	1	-	1	-	-	1
4	2	2	2	1	2	1	-	1	-	1	-	1	-	-	1
5	2	3	2	1	2	1	-	1	-	1	-	1	-	-	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**1.6**	**2.2**	**2.0**	**1.0**	**2.0**	**1.0**	**-**	**1.0**	**-**	**1.0**	**-**	**1.0**	**-**	**-**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP203 **WEARABLE TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES

- To study the various wearable applications.
- To study the various wearable devices used for healthcare.
- To learn about various vital parameters used in healthcare.
- To know about various technologies used in communication.
- To understand the various data processing and validation methods.

UNIT I INTRODUCTION TO WEARABLES **9**

Wearable Systems- Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Types of Wearable Systems, Components of Wearable Systems, Physiological Parameters Commonly Monitored in Wearable Applications, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles, Sport Application, Smart Fabrics: Intelligent Textiles.

UNIT II WEARABLE DEVICES FOR HEALTHCARE AND VITAL PARAMETERS **9**

Vital Parameters Monitored and their Significances, Bio-potential Signal Recordings (ECG, EEG, EMG), Dry Electrodes Design and Fabrication methods, Cuff-less Blood Pressure Measurement, PPG, Galvanic Skin Response (GSR), Body Temperature Measurements, Activity Monitoring for Energy Expenditure, Respiratory parameters, Wearable sensors for Body Temperature: Intermittent and Continuous temperature monitoring, Detection principles – thermistor, infrared radiation, thermopile.

UNIT III COMMUNICATION TECHNOLOGIES **9**

Principles of different sensors, Micro-Motors and Communication Channels - Accelerometers, Optical sensor, GPS- Various Input Methods, Power Requirements, Wearable Systems Packaging, Batteries and Charging, Wireless Communication Technologies and Protocols, Receiver Systems.

UNIT IV WIRELESS BODY AREA NETWORKS **9**

Wireless Body Area Networks – Introduction, Personal Area Networks (PAN), Application in Vital Physiological Parameter monitoring, Design of Sensor & Sink Nodes, Architecture, Communication & Routing Protocols, Security, Power and Energy Harvesting, Mobile Applications Based Devices.

UNIT V DATA PROCESSING AND VALIDATION **9**

Classification Algorithms, Data Mining and Data Fusion, Signal Processing Algorithms in Wearable Applications, Issues of Wearable Physiological Monitoring Systems, Statistical Validation of Parameters, Certifications of Medical Devices and Patenting.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the basics of wearable system and Physiological Parameters Commonly Monitored in Wearable Applications.
- Describe the use of Smart Sensors to monitor vital parameters of ECG, EEG, EMG signals.
- Develop Wireless Body Area Networks using short and long range communication technologies.
- Explain the use of various wearable BAN network for monitoring.
- Analyze the different algorithms to identify the category of new observations and validate it.

TEXT BOOKS

1. Edward Sazonov, Micheal R Neuman, "Wearable Sensors: Fundamentals, Implementation and Applications", Elseiver, Second Edition, 2014.
2. Annalisa Bonfiglo, Danilo De Rossi, "Wearable Monitoring Systems", Springer, Third Edition, 2011.

REFERENCES

1. Aimé Lay,Ekuakille ,Subhas Chandra Mukhopadhyay,"Wearable and Autonomous Biomedical Devices and Systems for Smart Environment", 2010.
2. Gieras,"The proliferation of patient-worn wireless telemetry technologies within the U.S. Healthcare environment", 2003.

E-RESOURCES

1. https://www.youtube.com/watch?v=gp_X_DwoyC4 (Introduction to Wireless systems).
2. https://www.coursera.org/lecture/intellectual-property-healthcare-industry/module-4-introduction-and- ip-review-IxCep (introduction and IP Review).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	1	2	1	2	1	-	1	-	1	-	1
2	3	2	2	1	1	2	1	2	1	-	1	-	1	-	1
3	3	2	2	1	1	-	1	2	1	-	1	-	1	-	1
4	3	2	2	1	1	2	1	2	1	-	1	-	1	-	1
5	2	3	2	1	1	-	1	2	1	-	-	-	1	-	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.8**	**2.2**	**2.0**	**1.0**	**1.0**	**1.2**	**1.0**	**2.0**	**1.0**	**-**	**0.8**	**-**	**1.0**	**-**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP204 **PRINCIPLES OF GENETIC ANALYSIS** **L T P C**
3 0 0 3

OBJECTIVES

- To understand the fundamental principles of genetics and to describe the concepts used to establish them.
- To understand the various genetic Inheritance.
- To gain the idea about DNA and phenotype
- To understand the isolation and manipulation and various tools used in gene expression
- To study the various impact of genetic variation.

UNIT I GENETIC INHERITANCE **9**

Organization of DNA, Chromosomal inheritance, Eukaryotic genomes – repetitive and non-repetitive sequence, Genetic mapping - restriction cleavage, RFLP and SNPs.

UNIT II DNA AND PHENO TYPE **9**

DNA structure and replication, DNA sequencing, amplification and hybridization. DNA Polymorphism, RNA transcription and processing, translation and its post translation modification. Regulation of gene expression.

UNIT III ENGINEERING OF GENES **9**

Gene isolation and manipulation, mutations, repair and recombination, site directed mutagenesis, in vivo techniques of genetic manipulation, tools for analyzing gene expression and genetically modified organisms.

UNIT IV HUMAN GENOME PROJECT **9**

Human Genome Project (HGP) – an overview of the project, goals of the project, major scientific strategies & approaches used in HGP, physical mapping, gene ontology, gene annotation, techniques in HGP – microsatellite markers, STS, EST,DNA sequencing and DNA microarray, scientific & medical benefits of this project.

UNIT V IMPACT OF GENETIC VARIATION **9**

Gene involvement in the generation of genetic variations, Integral view of natural strategies to generate genetic variations: Local sequence change, DNA rearrangement, DNA acquisition. Population Genetics, Quantitative Genetics, Evolution Genetics.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain different forms of inheritance patterns and identify them in genetic data.
- Analyze the evolutionary levels of genetic sequence.
- Interpret the outcomes of statistical analysis associated with the genome research project.
- Evaluate the molecular genetic information.
- Develop a research project involving the analysis of real molecular genetic data.

TEXT BOOKS

1. Anthony J.F. Griffiths, Susan R. Wessler, Sean B. Carroll, John Doebley, "Introduction to Genetics Analysis", W.H Freeman company, Eleventh Edition ,2015.
2. Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten ,"Molecular Biotechnology-Principles and application of Recombinant DNA", ASM Press, Fourth Edition 2010.

REFERENCES

1. Karp, Gerald ,"Cell and Molecular Biology. Concepts and Experiments",John Wiley Sons, Seventh Edition,2013.
2. Melanie Mitchell, "An Introduction to Genetic Algorithms", Prentice Hall of India, New Delhi Sixth Edition,1998.

E-RESOURCES

1. https://www.youtube.com/watch?v=dopTgvQGg4g (Basics of DNA).
2. https://www.synthego.com/learn/genome-editing-engineering (Genome Engineering).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	2	1	1	2	-	1	1	-	-	1	1	1
2	3	3	2	2	1	1	2	-	1	1	-	-	1	1	1
3	3	2	1	1	1	1	2	-	1	1	-	-	1	1	1
4	2	2	1	2	1	1	2	-	1	1	-	-	1	1	1
5	3	2	1	1	1	1	2	-	1	1	-	-	1	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.8**	**2.2**	**1.2**	**1.6**	**1.0**	**1.0**	**2.0**	**-**	**1.0**	**1.0**	**-**	**-**	**1.0**	**1.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP205 **ADVANCED NEURAL COMPUTING** **L T P C**

3 0 0 3

OBJECTIVES

- Develop the idea about components of fuzzy logic and GA
- Analyze the study about Propagation Network, Boltzmann Machine.
- Design of Adaptive resonance theory (ART)
- Explain the Downhill Simplex method is a multidimensional optimization method
- Analyze the Artificial Neural Network(ANN) .

UNIT I BASIC CONCEPTS OF NEURAL COMPUTING **9**

Biological Neurons and their Artificial models, Models of artificial Neural Networks, Learning and Adaptation, Neural Network Learning Rules, Single Layer Perceptron Classifiers.

UNIT II BPN AND BAM **9**

Back Propagation Network, Generalized Delta Rule, BPN Application, Associative Memory definition, BAM, Hopfield Memory, Simulated Annealing – Information Theory and statistical mechanics - Boltzmann Machine.

UNIT III OTHER NEURAL NETWORKS **9**

Counter Propagation Network -CPN building blocks – CPN Data Processing - Feature Mapping, Self Organizing Feature Maps – SOM data processing – applications of SOM, Adaptive Resonance Theory (ART) Network Descriptions.

UNIT IV GENETIC ALGORITHMS & IMPLEMENTATION TECHNIQUES **9**

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling- Survival of the fittest - crossover- Inversion and Deletion-mutation-reproduction Generational cycle- rank method-rank space method- Other derivative free optimization simulated annealing- Random search- Downhill simplex search- Applications.

UNIT V ADVANCES AND APPLICATIONS **9**

Support Vector Machines, R B F Network, Neocognitron Evolving neural networks using GA, Applications of ANN in biomedical signal analysis and Medical image analysis.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain basic concepts of neural networks and learning rules used for neural computing.
- Analyze the back propagation neural networks and back propagation associative memory in soft computing.
- Describe the neural networks such counter propagation network, self organizing feature maps and adaptive resonance theory.
- Design the genetic algorithms and implementation techniques for various applications.
  Analyze the support vector machines and artificial neural networks in biomedical signal

TEXT BOOKS

1. Shenzhen, China," Neural Computing for Advanced Applications", First International Conference, NCAA 2020.
2. Jang J.S.R., Sun C.T and Mizutani E,"Neuro Fuzzy and Soft Computing: A Computational Approach to Learning Machine Intelligence", Prentice Hall, 1997.

REFERENCES

1. James A Freeman, David M.Skapra, "Neural Networks", Addison – Wesley, India 1999.
2. Melanie Mitchell, "An Introduction to Genetic Algorithms", Prentice Hall of India, New Delhi 1998.

E-RESOURCES:

1. https://www.youtube.com/watch?v=vpazs6nFs70 (Artificial Neural Network).
2. https://www.youtube.com/watch?v=FN_woOnEQCc (Adaptive Resonance Theory).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	1	1	1	1	-	1	-	1	-	2	1	-
2	3	2	2	1	2	1	1	-	1	-	1	-	2	1	-
3	3	1	2	1	1	1	1	-	1	-	1	-	1	1	-
4	2	2	2	1	1	1	1	-	1	-	1	-	2	1	-
5	3	1	3	1	1	1	1	-	1	-	1	-	2	1	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.8**	**1.6**	**2.4**	**1.0**	**1.2**	**1.0**	**1.0**	**-**	**1.0**	**-**	**1.0**	**-**	**1.8**	**1.0**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP301 **BIO-MECHANICS** **L T P C**
3 0 0 3

OBJECTIVES

- To understand the biomechanics of bio-fluid mechanics
- To learn the biomechanics of Flow properties of blood.
- To Study the section orthopedic biomechanics structures
- To learn the Cardio vascular control mechanism.
- To study the Experimental and Analytical method of analysis

UNIT I INTRODUCTION **9**

Introduction to bio-mechanics, relation between mechanics and Medicine, Newton's laws, biofluid mechanics, soft tissue mechanics, stress, strain, shear rate, viscosity, visco elasticity, non Newtonian viscosity.

UNIT II MECHANICS OF CIRCULATION **9**

Flow properties of blood, effect of shear rate, hematocrit, temperature and protein Content of blood, rheology of blood and micro vessels, dynamics of circulatory system,turbulence flow around prosthetic heart valves.

UNIT III MECHANICS APPLIED TO ORTHOPAEDICS **9**

Orthopedic biomechanics, mechanical properties of bones, stress induced bone growth,kinematics and kinetics of joints, lubrication of joints, analysis of force in orthopedic implants.

UNIT IV MECHANISM OF BIOLOGICAL SYSTEMS **9**

Skeletal muscles servo mechanism, Cardio vascular control mechanism, respiratory control mechanism. Mechanical properties of soft biological tissues.

UNIT V BIO MECHANICAL ASPECT OF ACCIDENT INVESTIGATION **9**

Experimental and Analytical method of analysis, Clinical evaluation, Head Injury tolerance, rotational injury, spine injury – Accident reconstruction, Analysis of impact, skid analysis – Damage analysis.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the bio-mechanics principles for analyzing stress and strain in biological systems.
- Develop the knowledge about blood flow properties, Rheology, circulatory dynamics.
- Explain the biomechanical principles to analyze orthopedic treatments, bone properties.
- Analyze skeletal muscles servo mechanism, cardiovascular control, respiratory control, and mechanical properties of soft tissues.
- Analyze the experimental and analytical methods to evaluate accidents, analyze impact, skid patterns, and assess damage, with an understanding of head and spine injury tolerance.

TEXTBOOKS

1. Y.C. Fung, "Bio-Mechanics Mechanical Properties of Tissues", Springer-Verlag,First Edition 2019
2. Subrata Pal, "Textbook of Biomechanics", Viva Books Private Limited, Second Edition, 2009

REFERENCES

1. D.Dawson and Right,"Introduction to Bio-mechanics of joints and joint replacement", Mechanical Engineering publications Ltd,Third Edition,1989.
2. Susan J.Hall , "Basics Bio Mechanics", McGraw Hill Publishing Co, Fourth Edition ,2022.

E-RESOURCES

1. https://www.youtube.com/watch?v=LnM74brIZPE (Mechanical properties in living tissue in mechanics).
2. https://www.youtube.com/watch?v=13unkw8KGBs (Introduction to Bio-mechanics of joints and joint replacement)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	1	1	1	-	1	-	1	-	2	-	1	1
2	2	2	2	2	1	2	-	1	-	1	-	2	-	1	2
3	2	1	2	1	1	1	-	1	-	1	-	2	-	1	1
4	2	2	2	1	1	1	-	1	-	1	-	2	-	1	1
5	3	1	3	1	1	1	-	1	-	1	-	2	-	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.4**	**1.6**	**2.4**	**1.2**	**1.0**	**1.2**	**-**	**1.0**	**-**	**1.0**	**-**	**2.0**	**-**	**1.0**	**1.2**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP302 REHABILITATION ENGINEERING AND ASSISTIVE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

- To understand the Concept of Rehabilitation
- To study about the Advance and automated prosthetics and orthosis.
- To learn about the DNA Different type of walking aids
- To study about the hearing aids and their types.
- To Know the Prevention and cure of visual impairments.

UNIT I PRINCIPLES OF REHABILITATION 9

Definition, Concept of Rehabilitation: Types of Physical Impairments**,** Principles of Assistive Technology Assessment, Principles of Rehabilitation Engineering- Key Engineering Principles, Key Ergonomic Principles**,** Engineering Concepts in Sensory & Motor rehabilitation.

UNIT II ORTHOTICS & PROSTHETICS IN REHABILITATION 9

Types of orthosis - FO,AFO,KAFO,HKAFO and Prosthesis - Partial Foot Prostheses - Foot-ankle assembly, Trans femoral Prostheses, Prosthetic Hand - Advance and automated prosthetics and orthosis, Externally powered and Controlled orthotics & prosthetics, -FES system, Restoration of Hand function, Restoration of standing and walking.

UNIT III MOBILITY AIDS 9

DNA Different type of walking aids - Walking frames, Parallel bars, Rollators, Quadripods, Tripods & walking sticks, Crutches, GAIT, Gait pattern with crutches, Electronic Travel Appliances (ETA) : Path Sounder, Laser Cane, Sonic Torch, Nottingham Obstacle Sensors, Electro cortical Prosthesis, Polarized Ultrasonic Travel aids, Wheelchairs-Categories and functions, Materials used for wheel chairs, Type of Wheel Chairs, design of wheel Chair.

UNIT IV AUDITORY AND SPEECH ASSIST DEVICES 9

Types of deafness, hearing aids and their types, batteries used in hearing aids, application of DSP in hearing aids, Cochlear implants, Voice synthesizer, Speech trainer.

UNIT V SENSORY AUGMENTATION AND SUBSTITUTIONS 9

Classification of Visual Impairments - Prevention and cure of visual impairments - Visual Augmentation - Tactile vision substitution, auditory substitution and augmentation, tactile auditory substitution, Assistive devices for the visual impaired, Accessible environment and accessible information.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain appropriate rehabilitation concept for Sensory & Motor rehabilitation.
- Analyze the different methods of orthopedic prosthetics and orthotics for rehabilitation.
- Develop the mobility aids and assist devices for needy people.
- Describe the auditory and speech aids for the augmentation of deaf people.
- Explain the proper sensory augmentation and substitution for visually disabled person.

TEXT BOOKS

1. Rory A Cooper, "An introduction to Rehabilitation Engineering", Taylor & Francis, CRC Press, Third edition,2016.
2. Joseph D.Bronzino, "The Biomedical Engineering Handbook", CRC Press, Third Edition ,2006.

REFERENCES

1. Dr. S.Sunder , "Textbook of Rehabilitation", Jaypee Medical Publications, New Delhi, Third Edition , 2010.
2. MacLachlan M and Gallagher P, "Enabling Technologies - Body Image and Body Function", Churchill Livingstone, 2004.

E-RESOURCES

1. https://www.youtube.com/watch?v=ia5l_plcBPU (Visual impairment/types of visual impairment).
2. https://www.youtube.com/watch?v=ggvdabS_BQM (Walking Aids).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	1	2	1	1	1	-	-	2	2	3	1	1
2	3	3	2	2	2	1	2	1	-	-	1	2	2	1	1
3	3	3	2	1	1	1	1	1	-	-	1	2	2	1	1
4	3	3	2	1	1	1	1	1	-	-	1	2	3	1	1
5	2	3	3	1	1	1	1	1	-	-	2	3	2	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.8**	**3.0**	**2.4**	**1.2**	**1.4**	**1.0**	**1.2**	**1.0**	**-**	**-**	**1.4**	**2.2**	**2.4**	**1.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP303 COMPUTER BASED MEDICAL INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES

- To know the system and peripheral control chips .
- To understand processors and memory management.
- To learn the Biomedical Telemetry.
- To study the Data acquisition using Serial Interfaces.
- To know the instrument drivers-serial port communication.

UNIT I COMPUTER HARDWARE AND INTERFACING 9

PC Motherboard components-System resources–System and peripheral control chips-Expansion buses and I/O ports-Peripherals-BIOS services. Expansion buses-ISA, EISA, PCI bus. Parallel port-standard parallel port-Enhanced parallel port-Enhanced capabilities port.

UNIT II PROCESSORS AND MEMORY MANAGEMENT 9

80X86 Processors- Architectures and Memory management–Pentium processors-Pentium Organization Overview of 80X86 based Mother boards

UNIT III COMPUTERIZED MEDICAL INSTRUMENTS 9

Computerized ECG, EEG and EMG-Patient Monitoring systems-Arrhythmia and Ambulatory Monitoring Instruments-Biomedical Telemetry

UNIT IV COMPUTERIZED DATA ACQUISITION AND INTERFACES 9

Plug-in-data acquisition and Control Boards. Data acquisition using GPIB: Overview of GPIB-GPIB commands-GPIB programming-Expanding GPIB –IEEE-488.2-SCPI-HS488 protocol. Data acquisition using Serial Interfaces –serial communication-serial interface standards-PC serial port-microcontroller serial interfaces-USB-IEEE1394.

UNIT V VIRTUAL INSTRUMENTATION 9

Basics of Virtual Instrumentation- Instrument control – GPIB– VISA – instrument drivers-serial port communication. Data Acquisition: Transducers and Signal conditioning, DAQ hardware- Analog inputs – Analog outputs- Digital I/O- DAQ assistant and configurations.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Develop the mother board components and identify the different interfacing peripherals for communication.
- Describe the various processors and their memory management techniques.
- Explain and discuss the working of computer based medical instruments.
- Discuss about the serial Interfaces and standards required for the computerized data acquisition systems.
- Develop and simulate the virtual instruments using software simulation tools.

TEXT BOOKS

1. N.Mathivanan, "PC Based Instrumentation Concepts and Practice",Prentice Hall of India, Second Edition,2016.
2. B.Govindarajalu, "Hardware,Trouble shooting and Maintenance", Tata McGraw Hill Publishing Company, New Delhi, 2005.

REFERENCES

1. Sanjay Gupta,"Virtual Instrumentation using labview",Tata McGraw Hill Education,Second Edition,2010.
2. Sudip Paul, Angana Saikia, Vinayak Majhi, Vinay Kumar Pandey," Introduction to Biomedical Instrumentation and Its Applications",First Edition ,2022.

E-RESOURCES

1. https://www.youtube.com/watch?v=_YfAG_I3aPI (PC Based Instrumentation Concepts and Practice).
2. https://www.youtube.com/watch?v=WwQSfk6SSSo (Data Acquisition System).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1	1	2	1	1	1	-	1	1	--	1	2
2	3	3	1	2	1	1	2	2	1	-	1	2	-	2	2
3	3	3	1	1	1	2	1	1	1	-	1	1	-	1	2
4	3	3	1	1	1	1	1	2	1	-	1	1	-	1	2
5	3	2	1	1	1	1	1	1	1	-	1	1	-	1	3
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.8**	**1.0**	**1.2**	**1.0**	**1.4**	**1.2**	**1.4**	**1.0**	**-**	**1.0**	**1.2**	**-**	**1.2**	**2.2**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP304	QUALITY AND SAFETY ASSURANCE IN HOSPITAL	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the Quality Management in Health care organization.
- To understand the Clinical Information Systems.
- To learn the major and minor sources of biomedical waste.
- To understand the OSHA Hearing Conservation Standard, Heating.
- To learn the Quality auditing, International Standards.

UNIT I STANDARDIZATION OF QUALITY MEASURES IN HEALTHCARE ORGANIZATION 9

Define Quality- Need for Standardization & Quality Management, QM in Health care organization- Quality assurance methods ,QA in (Medical Imaging & Nuclear medicine) Diagnostic services – Classification of equipments.

UNIT II 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 III BIOMEDICAL WASTE MANAGEMENT 9

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 IV SAFETY FACILITY 9

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 REGULATORY REQUIREMENTS AND QUALITY IN HOSPITAL 9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Develop the quality of healthcare equipments as per the standards of regulatory bodies.
- Analyze the Hospital as centralized one by implementing Hospital Information system and various supportive systems.
- Describe Manage and dispose the biomedical waste in Hospital environment to ensure the cleanliness of the hospital.
- Explain the various Safety measures to create safer environment in the Hospital.
- Design the Policies and procedures of various bodies to maintain the standards as per the need of the concern bodies.

TEXT BOOKS

1. B.M.Sakharkar, "Principles of Hospital administration and Planning",Medical Publishers (P) Ltd Third Edition, 2018.
2. Anantpreet Singh, Sukhjit Kaur,"Biomedical Waste Disposal",Jaypee Brothers Medical Publishers (P) Ltd,2012.

REFERENCES

1. Tweedy, James T, "Healthcare hazard control and safety management",CRC Press_Taylor , Francis ,2014.
2. G Welty,"Quality Assurance Problem Solving and Training Strategies for Success in the Pharmaceutical and Life Science Industries",First Edition , 2013.

E-RESOURCES

1. https://www.youtube.com/watch?v=X-QfACgCneQ (Hospital Quality Assurance Process).
2. https://www.youtube.com/watch?v=jq52ZjMzqyI (Quality Improvement in Healthcare).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	2	2	-	1	2	2	1	2	1
2	3	3	2	2	2	-	2	2	-	1	1	2	1	2	1
3	3	3	3	2	1	-	2	1	-	1	1	2	1	2	1
4	3	3	3	1	1	-	2	1	-	1	1	2	1	2	1
5	2	3	2	1	1	-	1	1	-	1	1	1	1	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**2.8**	**3**	**2.4**	**1.6**	**1.2**	**-**	**1.6**	**1.4**	**-**	**1.0**	**1.2**	**1.8**	**1**	**1.8**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP305 VIRTUAL REALITY AND AUGMENTED REALITY L T P C
3 0 0 3

OBJECTIVES

- To Study the Three-dimensional position trackers.
- To Understand the Geometric modeling.
- To Know the Methodology and terminology.
- To Learn the JS-pros and cons-building blocks.
- To Learn the military and robotics applications.

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 FOR VR 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 9

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 9

Medical applications-military applications-robotics applications- Advanced Real time Tracking- other applications- games, movies, simulations, therapy.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze and design a system or process to meet given specifications with realistic engineeringconstraints.
- Explain the problem statements and function as a member of an engineering design team.
- Analyze the implications and issues pertaining to VR
- Determine the technical documents and give technical oral presentations related to design miniproject results.
- Develop simple and portable VR applications using appropriate software.

TEXT BOOKS

1. C. Burdea & Philippe Coiffet,"Virtual Reality Technology", Gregory, John Wiley & Sons, Inc Second Edition,2015.
2. Jason Jerald,"The VR Book: Human- Centred Design for Virtual Reality",Association for Computing Machinery and Morgan & Claypool,2013.

REFERENCES

1. Dieter Schmalstieg ,Tobias Hollerer ,"Augmented Reality: Principles and Practice",Pearson Education (US), Addison-Wesley Educational Publishers Inc,Second Edition,2016.
2. Steve Aukstakalnis ,"Practical Augmented Reality:A Guide to the Technologies, Applications, and Human Factors for AR and VR",Addison Wesley Professional, First Edition, 2016.

E-RESOURCES

1. https://www.youtube.com/watch?v=vz0UUVDt2ps (Understanding Virtual Reality and Augmented Reality).
2. https://www.youtube.com/watch?v=04AMaTsXFJU (Virtual Reality And Augmented Reality).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	2	-	-	1	-	-	-	-	1	-	1
2	3	2	1	-	2	-	-	1	-	-	-	-	1	-	1
3	3	2	1	-	2	-	-	1	-	-	-	-	1	-	1
4	3	2	1	-	2	-	-	1	-	-	-	-	1	-	1
5	3	2	1	-	2	-	-	1	-	-	-	-	1	-	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	-	**2.0**	-	-	**1.0**	-	-	-	-	**1.0**	-	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP306 **BIOMETRIC SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES

- To understand the general principles of biometric systems and the underlying trade-offs.
- To understand the technologies of fingerprint, iris, face and speech recognition
- To know recognize personal privacy and security implications of biometrics based identification technology.
- To learn the issues in the realistic evaluation of biometrics based systems.
- To study the issues in designing a multi biometric system.

UNIT I INTRODUCTION TO BIOMETRICS **9**

Introduction and back ground – biometric technologies – passive biometrics – active biometrics - Biometrics Vs traditional techniques – Benefits of biometrics - Operation of a biometric system– Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems: FAR, FRR, FTE rate, FTA rate and rate- Need for strong authentication – Protecting privacy and biometrics and policy – Biometric applications

UNIT II FINGERPRINT IDENTIFICATION TECHNOLOGY **9**

Fingerprint Patterns, Fingerprint Features, Fingerprint Image, width between two ridges - Fingerprint Image Processing - Minutiae Determination - Fingerprint Matching: Fingerprint Classification, Matching policies.

UNIT III FACE RECOGNITION **9**

Introduction, components, Facial Scan Technologies, Face Detection, Face Recognition, Representation and Classification, Kernel- based Methods and 3D Models, Learning the Face Spare, Facial Scan Strengths and Weaknesses, Methods for assessing progress in Face Recognition.

UNIT IV VOICE SCAN **9**

Introduction, Components, Features and Models, Addition Method for managing Variability, Measuring Performance, Alternative Approaches, Voice Scan Strengths and Weaknesses, NIST Speaker Recognition Evaluation Program, Biometric System Integration.

UNIT V FUSION IN BIOMETRICS **9**

Introduction to Multibiometric - Information Fusion in Biometrics - Issues in Designing a Multibiometric System - Sources of Multiple Evidence - Levels of Fusion in Biometrics - Sensor level, Feature level, Rank level, Decision level fusion - Score level Fusion. Examples – biopotential and gait based biometric systems.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the demonstrate knowledge engineering principles underlying biometric systems.
- Analyze design in basic biometric system applications.
- Develop the promising new ideas in speaker recognition.
- Design the development of advanced technology incorporating these ideas.
- Describe gait based biometric systems and verifies people by their walking style and pace.

TEXT BOOKS

1. Massimo Tistarelli, Rama Chellappa, Dr. Rama Chellappa, Stan Z. Li, "Handbook of Remote Biometrics", Springer, Second Edition, 2024.
2. Amine Nait-Ali, "Biometrics under Biomedical Considerations", Springer Singapore Publisher, First Edition, 2019.

REFERENCES

1. Das R, "The Science of Biometrics Security Technology for Identity Verification", Taylor & Francis Ltd, 2019.
2. Anil K. Jain, Patrick Flynn, Arun A. Ross, "Handbook of Biometrics", First Edition, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/106104119 (Biometrics).
2. https://youtu.be/AZkc48X5yck (Fingerprint Recognition Works in Biometric Devices).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
2	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
3	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
4	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
5	3	2	1	1	1	-	2	-	-	-	-	-	3	2	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	**1.0**	**1.0**	**-**	**2.0**	**-**	**-**	**-**	**-**	**-**	**3.0**	**2.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP307 HOSPITAL PLANNING, ORGANIZATION AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

- To understand the organizational structure of Hospital.
- To know importance of management and Hospital.
- To understand the goals on productivity that health centers must maintain.
- To know that hospitals and other health care facilities provide the best care for each patient.
- To learn the selection, training, motivating and retaining of a personnel in the organization.

UNIT I FORMATIONS OF ORGANISATION 9

Sole proprietorship, Partnership, Company - public and private sector enterprises. Organizational structure: Governance – Duties and responsibilities of the governing board – governing board and conflict of interest. Management structure: Committee organization-the chief executive officer-Duties, Responsibilities and functions of CEO-the CEO and his management team-organizational chart.

UNIT II PRINCIPLE OF HOSPITAL MANAGEMENT 9

Importance of management and Hospital, Management control systems. Professional management of the hospital. Financial management: factions-design-organization-space requirements-other requirements-problem situations-internal control. Human resource management: factions-design-organization-space requirements-other requirements.

UNIT III STAFFING 9

Staffing pattern in hospitals, requirement and Selection, Recruiting process, Orientation, Training and development, Career development. Human Resources Development: Employee Development-Hospital Personnel, Physician Recruitment, and Professional Employer Organizations-Cultural Transformations. Strategic Planning: Capacity Workforce Management-Accounting Management. Leadership: Operations Management-Decision Making and Communications Management.

UNIT IV HOSPITAL AND MANAGEMENT 9

Basic concepts marketing, Principles of social marketing, Social marketing in health sector, Consumer behavior and research health, Advertising in Health Sector, Relevance of e-marketing of Health care services. Healthcare marketing strategies-the role of marketing in healthcare system-the impact of marketing strategies-effective marketing ideas in healthcare.

UNIT V COMMUNICATION SYSTEMS IN HOSPITAL 9

System Development life cycle. Communication Systems: Reasons to use telephone in hospital, Reasons to use computers in hospital, main categories of information systems in hospitals. Integrated Service Digital Network (ISDN)-Telemedicine, teleconsulting and net telephony- Nurse call system-Public address system and piped music- television and closed circuit television.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the general idea about the fundamentals of hospital organization.
- Design the idea of the overall Managerial Functions which can be applied in any organizational set up.
- Describe about the better understanding of human behavior in organization and selection of staffing.
- Develop the general idea about the fundamentals of marketing management.
- Analyze the equipped with the practical exposure to basics of computing.

TEXT BOOKS

1. Syed Amin Tabish, "Hospital and Nursing Homes Planning, Organizations and Management" Jaypee Brothers Medical Publishers, Second edition, 1 January 2022.
2. Joydeep Das Gupta, "Hospital Administration and Management: A Comprehensive Guide", Second Edition, 2018.

REFERENCES

1. Sakharkar BM, "Principles of Hospital Administration and Planning", Jaypee Brothers Medical Publishers, First Edition, 2018.
2. Amin Tabish, "Hospitals & Nursing Homes: Planning, Organisations & Management", Jaypee Brothers Medical Publishers (P) Limited, Third Edition, 2003.

E-RESOURCES:

1. https://www.youtube.com/watch?v=v9YkwuPPWxQ&list=PLCD408E74E6E853F3 - (Introduction to Organization Management, Nature , Scope and Complexity).
2. https://youtu.be/A2HFusWQIeE (Human Resource Management in Hospital.

Mapping of Cos- Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
2	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
3	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
4	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
5	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	**1.0**	**1.0**	**-**	**1.0**	**-**	**-**	**-**	**-**	**-**	**3.0**	**1.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP308 PATTERN RECOGNITION TECHNIQUES AND ITS APPLICATIONS L T P C
3 0 0 3

OBJECTIVES

- To understand the objects of interest into one of a number of categories or classes.
- To study the perceptual data using the tools from statistics, probability, computational geometry, machine learning, signal processing and algorithm design.
- To learn recognizable proof of verifiable items and relations about obtaining patterns.
- To know a class label to an input pattern and to offer visual clues to an underlying order.
- To know the individuals having the same characteristics into a fuzzy set.

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 criteria - Clustering algorithms Clustering concept –Hierarchial clustering, Partitional clustering- k-means algorithm – Validity of Clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 9

KL Transforms – Feature selection through functional approximation – Binary selection -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 – HMM Parameters-Training – Classification – Support vector Machine – Learning the Linear Discriminant Function - SVM for Classification - Feature Selection, Combination of Classifiers.

UNIT V RECENT ADVANCES AND APPLICATIONS 9

Fuzzy logic – Fuzzy Pattern Classifiers – Case Study Using Fuzzy Pattern Classifiers CAD system in breast cancer detection, ECG signal classification, Fingerprint recognition, cell cytology classification, Handwritten Digit Recognition.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the variety of pattern classification and pattern classifier combination techniques.
- Analyze hierarchical cluster and k-means clustering to identify clusters in multivariate data.
- Design about feature extraction through functional approximation and structural representation of patterns.
- Develop idea about the state machines, hidden Markov models and support vector machine.
- Describe the fuzzy logic using fuzzy pattern classifier for the various real time applications.

TEXT BOOKS

1. Andrew Webb, "Stastical Pattern Recognition", Third Edition, 2017.
2. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, Second Edition, 2016.

REFERENCES

1. M. Narasimha Murthy, V. Susheela Devi, "Pattern Recognition", Springer, First Edition, 2011.
2. S.Theodoridis, K.Koutroumbas, "Pattern Recognition", Academic Press, Fourth Edition, 2008.

E-RESOURCES

1. https://youtu.be/nOKSwQ5rLWc (Stastical Pattern Recognition).
2. https://youtu.be/ewQ18_MuE8Q (Pattern Recognition and Machine Learning).

Mapping of Cos-Pos & PSO's

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
2	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
3	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
4	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
5	3	2	1	1	1	-	1	-	-	-	-	-	3	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	**1.0**	**1.0**	**-**	**1.0**	**-**	**-**	**-**	**-**	**-**	**3.0**	**1.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP309 PHYSIOLOGICAL MODELING SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To understand the physiological systems through the models
- To know the physiological signal with feedback systems & simulation techniques.
- To study the accurate real-time models of a system's response to environmental.
- To learn the weaknesses in signaling pathways, or modeling of ion channel mutations.
- To understand the stimulation techniques improve the biological systems.

UNIT I INTRODUCTION **9**

System Concept, System Properties, Piece-Wise Linear Approximation, Electrical Analog for Compliance, Thermal Storage, Mechanical Systems, Step response of a Resistance/Compliant Systems, Pulse Response of First Order System.

UNIT II TRANSFER FUNCTION **9**

System as an Operator use of Transfer Function, Bio Engineering of a Coupled System, Example of Transformed Signals and Circuits for the Transfer Function with Impedance Concept, Prediction of Performance.

UNIT III PERIODIC SIGNALS **9**

Sinusoidal Functions, Sinusoidal Analysis of Instrumentation System, Evaluation of Transfer Functions from Frequency Response, Relationship between Phase Lag and Time Delay Transient Response of an Undamped Second Order system, General Description of Natural Frequency Damping, Physical Significance of Under Damped Responses.

UNIT IV FEEDBACK SYSTEMS **9**

Characterization of Physiological Feedback systems- Epiphysis & Hypothesis, adrenal systems, pupillary hippus, Uses and Testing of System Stability, Simulation-Hodgkin-Huxley model, Model of cardiovascular variability.

UNIT V SIMULATION OF BIOLOGICAL SYSTEMS **9**

Simulation of Skeletal muscle servomechanism, thermo Regulation, cardiovascular control System, Respiration controls, Occulo Motor System, Endocrine control system and Modeling of receptors.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain and appreciate the value and application of Physiological models and vital organs.
- Analyze the mathematical background the order of the system using transfer function.
- Develop the frequency and transient response for the closed loop transfer function with the given periodic input signals.
- Describe knowledge about simulating different Physiological Feedback systems.
- Analyze differential equations to describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.

TEXT BOOKS

1. Suresh R. Devasahayam , "Signals and Systems in Biomedical Engineering: Physiological Systems Modeling and Signal Processing", Springer Singapore, Second Edition, 2019.
2. Michael C. K. Khoo, "Physiological Control Systems: Analysis, Simulation, and Estimation", Wiley Press, First Edition, 2018.

REFERENCES

1. Wiley Blackwell, "Physiological Control Systems: Analysis, Simulation, and Estimation", Second Edition, 2019.
2. Joseph D. Bronzino, Donald R. Peterason, "The Biomedical Engineering Handbook", Fourth Edition, 2015.

E-RESOURCES

1. https://nptel.ac.in/courses/11210721 (Introduction to Modelling).
2. https://youtu.be/mn-2ob0F5e8 (Homeostasis and Feedback).

Mapping Of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	-	2	-	-	-	-	-	3	1	2
2	3	2	1	1	1	-	2	-	-	-	-	-	3	1	2
3	3	2	1	1	1	-	2	-	-	-	-	-	3	1	2
4	3	2	1	1	1	-	2	-	-	-	-	-	3	1	2
5	3	2	1	1	1	-	2	-	-	-	-	-	3	1	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	**1.0**	**1.0**	**-**	**2.0**	**-**	**-**	**-**	**-**	**-**	**3.0**	**1.0**	**2.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

23PMP310 ADVANCED BRAIN COMPUTER INTERFACE L T P C
3 0 0 3

OBJECTIVE

- To know the basic concepts of Brain Computer Interface.
- To study the electrophysiological study (EP study) is a test.
- To understand the feature extraction is to find the most compacted.
- To study feature translation methods.
- To learn application of brain-computer interfaces.

UNIT I INTRODUCTION TO BCI 9

Fundamentals of BCI – Structure of BCI system – Classification of BCI: Invasive, Non-invasive and Partially invasive BCI- Brain signal acquisition, Signal Preprocessing, Artifacts removal.

UNIT II ELECTROPHYSIOLOGICAL SOURCES 9

Sensorimotor activity –Neuronal activity in motor cortex and related areas- Electric and Magnetic fields produced by the brain- Signals reflecting Brain Metabolic Activity- Mu rhythm, Movement Related Potentials – Slow Cortical Potentials - P300 Event Related Potential – Visual Evoked Potential - Activity of Neural Cells - Multiple Neuro-mechanisms.

UNIT III FEATURE EXTRACTION METHODS 9

Time/Space Methods – Fourier Transform, Wavelets, AR, MA, ARMA models, Bandpass Filtering, Template Matching, Kalman Filter, PCA, Laplacian Filter – Linear and Non-Linear Features.

UNIT IV FEATURE TRANSLATION METHODS 9

Linear Discriminant Analysis –Nearest Neighbours, Support Vector Machines - Regression –Learning Vector Quantization – Gaussian Mixture Modeling – Hidden Markov Modeling – Neural Networks.

UNIT V APPLICATIONS OF BRAIN-COMPUTER INTERFACES 9

Introduction-BCIs for Assistive Technology – BCIs for Recreation - BCIs for Cognitive Diagnostics and Augmented Cognition - Rehabilitation and Prosthetics, Functional Near-Infrared Sensing (FNIR) and Environmental Control Applications - Near Infrared Sensing Technology – The OTIS System – Basic BCI Application – Environmental Control with FNIR, Brain-Computer Interfacing and Games.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Develop the Invasive and Non Invasive BCIs.
- Explain the signal enhancement to measure the Sensorimotor activity.
- Describe the dominant and required features using transform and filtering techniques.
- Analyze two or more classes of events using LDA, SVM, HMM and Neural networks
- Describe the application of Brain Computer Interface.

TEXT BOOKS

1. Chang S. Nam, Anton Nijholt, Fabien Lotte, "Brain–Computer Interfaces Handbook: Technological and Theoretical Advances", First Edition, 2018.
2. AE Hassanien, AA Azar, "Brain-Computer Interfaces", Springer London Publisher, First Edition, 2015.

REFERENCES

1. Andrew Webb, "Statistical Pattern Recognition", Wiley International, Second Edition, 2002.
2. Carlo Tomasi, "Estimating Gaussian Mixture Densities with EM – A Tutorial", Duke University, First Edition, 2000.

E-RESOURCES

1. https://youtu.be/lO8EzBUK8ao (Electrophysiology).
2. https://youtu.be/rsehh0SgpZs (Applications of Brain-Computer Interfaces (BCIs)).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	-	3	-	-	-	-	-	3	1	1
2	3	2	1	1	1	-	3	-	-	-	-	-	3	1	1
3	3	2	1	1	1	-	3	-	-	-	-	-	3	1	1
4	3	2	1	1	1	-	3	-	-	-	-	-	3	1	1
5	3	2	1	1	1	-	3	-	-	-	-	-	3	1	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	**3.0**	**2.0**	**1.0**	**1.0**	**1.0**	**-**	**3.0**	**-**	**-**	**-**	**-**	**-**	**3.0**	**1.0**	**1.0**

1 - Low, 2 - Medium, 3 - High, '-' - No correlation

OPEN ELECTIVE

23PGO201 DISASTER MANAGEMENT L T P C

3 0 0 3

OBJECTIVES

- To learn the basic conceptual understanding of disasters.
- To study different types of disasters.
- To learn about the disaster management techniques.
- To create awareness about disasters.
- To understand the concept of disaster risk assessment.

UNIT I INTRODUCTION 9

Definition and types of disaster Hazards and Disasters – Risk and Vulnerability in Disasters – Natural and Man-made disasters – Earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes – Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

UNIT II TYPES OF DISASTERS 9

Study of important disasters Earthquakes and its types – Magnitude and intensity – Seismic zones of India – Major fault systems of India plate – Flood types and its management – Drought types and its management – Landside and its managements – Case studies of disasters in Sikkim (e.g) Earthquakes, Landside) – Social economics and environmental impact of disasters.

UNIT III DISASTER MANAGEMENT 9

Mitigation and Management techniques of Disaster – Basic principles of disasters management – Disaster Management cycle – Disaster management policy – National and State Bodies for Disaster Management – Early Warming Systems – Building design and construction in highly seismic zones – Retrofitting of buildings.

UNIT IV DISASTER AWARENESS 9

Training, awareness program and project on disaster management – Training and drills for disaster preparedness – Awareness generation program – Usages of GIS and Remote sensing techniques in disaster management.

UNIT V RISK ASSESSMENT 9

Mini project on disaster risk assessment and preparedness for disasters with reference to disasters in Sikkim and its surrounding areas.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Describe the basic conceptual understanding of disasters.
- Explain the different types of disasters.
- Analyze the disaster mitigation and management techniques.
- Discuss the importance of disaster awareness programs for disaster management.
- Analyze the risk behind the disasters.

TEXT BOOKS

1. Harsh K Gupta, Disaster Management, Universities Press Pvt. Limited, 9th edition, 2018.
2. Sulphey M.M., "Disaster Management", PHI Learning Private Limited, 4th Edition, 2017.
3. Damon P. Copola, "Introduction to International Disaster Management", Elsevier Inc, 1st Edition, 2016.

REFERENCES

1. Sharma S.C., "Disaster Management", Khanna Book Publishing Co. (P) Ltd., 5th Edition, 2018.
2. Gupta A.K., Nair S.S. and Chatterjee S. "Disaster Management and Risk Reduction: Role of Environmental Knowledge", Narosa Publishing House, 4th Edition, 2018.
3. Murthy D.B.N., "Disaster Management", Deep & Deep Publications, 3rd Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/124/107/124107010/ (Disaster Management).
2. https://nptel.ac.in/courses/105/103/105103209/ (Plates and Shells)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	1	1	-	-	-	-	1	3	2	1
2	3	2	2	2	-	1	1	-	-	-	-	1	3	2	1
3	3	2	2	2	1	1	1	-	-	1	1	1	3	2	1
4	3	2	2	2	-	1	1	-	-	1	1	1	3	2	1
5	3	2	2	2	1	1	1	-	-	1	1	1	3	2	1
AVG	**3.0**	**2.0**	**2.0**	**2.0**	**1.0**	**1.0**	**1.0**	**-**	**-**	**1.0**	**1.0**	**1.0**	**3.0**	**2.0**	**1.0**

1-Low 2-Medium 3-High '-' – No Correlation

23PGO202 COST MANAGEMENT OF ENGINEERING PROJECTS L T P C
3 0 0 3

OBJECTIVES

- To understand the overview of cost management.
- To learn the different stages of project execution.
- To study the different analysis techniques adopted for project commissioning.
- To know the various pricing strategies followed in engineering projects.
- To study the different quantitative techniques used for cost management.

UNIT I INTRODUCTION 9

Introduction and overview of the strategic cost management process – Cost concepts in decision making – Relevant cost, Differential cost, Incremental cost and Opportunity cost – Objectives of a Costing System – Inventory valuation – Creation of a database for operational control – Provision of data for decision making.

UNIT II PROJECT 9

Meaning, different types, why to manage, cost overruns centres, various stages of project execution – Conception to commissioning – Project execution as conglomeration of technical and nontechnical activities – Detailed Engineering activities – Pre project execution main clearances and documents – Project team: Role of each member – Importance of project site – Data required with significance – Project contracts – Types and contents – Project execution – Project cost control – Bar charts and network diagram.

UNIT III PROJECT COMMISSIONING 9

Mechanical and process – Cost Behavior and Profit Planning – Marginal Costing – Distinction between marginal costing and absorption costing – Break-even Analysis – Cost volume-Profit Analysis – Various decision-making problems – Standard Costing and Variance Analysis.

UNIT IV PRICING STRATEGIES 9

Pareto Analysis – Target costing – Life cycle costing – Costing of service sector – Just-in-time approach – Material requirement planning – Enterprise resource planning – Total quality management and theory of constraints – Activity-based cost management – Bench marking – Balanced score card and value-chain analysis – Budgetary control – Flexible budgets – Performance budgets – Zero-based budgets – Measurement of divisional profitability pricing decisions including transfer pricing.

UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Quantitative techniques for cost management – Linear programming – PERT/CPM – Transportation problems – Assignment problems – Simulation – Learning curve theory.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the basics of cost management process.
- Analyze the detailed engineering activities associated in project execution.
- Apply suiltable analysis techniques for project commissioning.
- Discuss the various pricing strategies followed in project implementation.
- Analyze the different quantitative techniques used for cost management.

TEXT BOOKS

1. Charles T. Horngren, Srikant M. Datar and Madhav V. Rajan, "Cost Accounting A Managerial Emphasis", Pearson Education, 14th Edition, 2023.
2. Charles T. Horngren and George Foster, "Advanced Management Accounting", Pearson Education, 13th Edition, 2018.
3. Qiu Guo Lin, Cost management of engineering project, China Electric Power Press, 7th edition, 2017.

REFERENCES

1. Robert S Kaplan, Anthony A. Alkinson, "Management Accounting", Pearson Education, 4th Edition, 2022.
2. Ashish K. Bhattacharya, "Principles & Practices of Cost Accounting", PHI Learning Private Limited, 6th Edition, 2020.
3. Kenneth K Humpheys, Project and cost engineers' handbook (cost management), CRC Press, 4th edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106149/ (Types of Projects)
2. https://nptel.ac.in/courses/110/104/110104073/ (Cost Management for Projects)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	1	1	-	-	1	-	1	2	2	1
2	3	3	3	3	-	1	1	1	-	1	3	1	2	2	1
3	3	3	3	3	2	1	1	1	-	1	3	1	2	2	1
4	3	3	3	3	2	1	1	1	1	1	3	1	2	2	1
5	3	3	3	3	2	1	1	1	1	1	3	1	2	2	1
AVG	**3.0**	**3.0**	**3.0**	**3.0**	**2.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**3.0**	**1.0**	**2.0**	**2.0**	**1.0**

1-Low 2-Medium 3-High '-' – No Correlation

23PGO203 **CONSTITUTION OF INDIA** **L T P C**
3 0 0 3

OBJECTIVES

- To understand the basics of constitution law and constitutionalism.
- To learn the fundamental rights and duties.
- To know the constitution powers of union and state executives.
- To study the constitutional powers and procedures.
- To learn the powers and functions of public service commissions.

UNIT I INTRODUCTION **9**

Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – Preamble – Salient features and characteristics of the constitution of India – Citizenship.

UNIT II FUNDAMENTAL RIGHTS **9**

Scheme of the fundamental rights – The scheme of the fundamental duties and its legal status – The directive principles of state policy – Its importance and implementation.

UNIT III UNION AND STATE EXECUTIVE **9**

Federal structure and distribution of legislative and financial powers between the union and the states – Parliamentary form of Government in India – The constitution powers and status of the President of India – Governor – Appointment, powers and functions.

UNIT IV CONSTITUTIONAL POWERS **9**

Amendment of the constitutional powers and procedure – The historical perspectives of the constitutional amendments in India – Emergency Provisions – National emergency – President Rule – Financial Emergency.

UNIT V OTHER CONSTITUIONAL FUNCTIONARIES **9**

Election commission of India – Organization – Powers and functions – Union public service commission – State public service commission – Local self government.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Describe the features and characteristics of the constitution of India.
- Explain the importance of fundamental rights and duties.
- Analyze the constitution power of union and state executives.
- Discuss the amendment of constitutional powers and procedure.
- Examine the powers and functions of union and state public service commission.

TEXT BOOKS

1. Durga Das Basu, "Introduction to the Constitution of India", Lexis Nexis Publishers, 24th Edition, 2019.
2. Subhash C. Kashyap," Our Constitution", National Book Trust, 5th Edition, 2021.
3. P M Bakshi, The constitution of India, Universal Law Publishing, 14th edition, 2017.

REFERENCES

1. M.Laxmikanth, "Indian Polity", McGraw Hill Publications, 7th Edition, 2023.
2. Granville Austin, "The Indian Constitution: Cornerstone of a Nation", OUP India, 8th Edition, 2017.
3. V N Shukla, Constitution of India, Eastern Book Company, 4th Edition, 2019.

E–RESOURCES

1. https://nptel.ac.in/courses/129/106/129106002/(Constitution of India)
2. https://nptel.ac.in/courses/129/106/129106003/(Constitutional Studies)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	-	1	-	1	1	1	-	1	2	1	1
2	3	2	2	1	-	1	-	1	1	1	-	1	2	1	1
3	3	2	2	1	-	1	-	1	1	1	-	1	2	1	1
4	3	2	2	1	-	1	-	1	1	1	-	1	2	1	1
5	3	2	2	1	-	1	-	1	1	1	-	1	2	1	1
AVG	**3.0**	**2.0**	**2.0**	**1.0**	**-**	**1.0**	**-**	**1.0**	**1.0**	**1.0**	**-**	**1.0**	**2.0**	**1.0**	**1.0**

1-Low 2-Medium 3-High '-' – No Correlation

23PGO204 **BUSINESS ANALYTICS** **L T P C**
3 0 0 3

OBJECTIVES

- To learn the overview of business analysis.
- To know the importance of project life cycle and product life cycles.
- To understand the different types of requirements in business analytics.
- To study the various analysis techniques for transforming requirements.
- To learn about finalizing requirements.

UNIT I BUSINESS ANALYSIS **9**

Overview of business analysis – Overview of requirements – Role of the business analyst – Stakeholders: the project team, management, and the front line – Handling stakeholder conflicts.

UNIT II LIFE CYCLES **9**

Systems development life cycles – Project life cycles – Product life cycles – Requirement life cycles.

UNIT III FORMING REQUIREMENTS **9**

Overview of requirements – Attributes of good requirements – Types of requirements – Requirement sources – Gathering requirements from stakeholders – Common requirements documents.

UNIT IV TRANSFORMING REQUIREMENTS **9**

Stakeholder Needs Analysis – Decomposition Analysis – Additive/Subtractive Analysis – Gap Analysis – Notations (UML & BPMN) – Flowcharts – Swim Lane Flowcharts – Entity-Relationship Diagrams – State-Transition Diagrams – Data Flow Diagrams – Use Case Modeling – Business Process Modeling.

UNIT V FINALIZING REQUIREMENTS **9**

Presenting requirements – Socializing requirements and gaining acceptance – Prioritizing requirements – Managing requirements Assets – Change control – Requirement tools – Recent trends in embedded and collaborative business intelligence – Visual data recovery – Data storytelling and data journalism.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the role of business analyst in business proposals.
- Examine the necessity of product life cycle and requirement life cycle.
- Describe the overview of forming requirements.
- Analyze various transforming requirements used in business analytics.
- Apply requirement tools for finalizing requirements.

TEXT BOOKS

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications", Pearson FT Press, 3rd Edition, 2019.
2. James R Evans, "Business Analytics", Pearson FT Press, 3rd Edition, 2020.
3. Wayne L. Winston, "Business Analytics: Data analysis & decision making", South Western College Publishing, 6th Edition, 2017.

REFERENCES

1. Swain Scheps , "Business Intelligence for Dummies", Dummies Publishers, 4th Edition, 2018.
2. Ger Koole, "An Introduction to Business Analytics", MG Books, 1st Edition, 2019.
3. Walter R. Paczkowski, "Business Analytics: Data Science for Business Problems", Springer International Publishing, 1st Edition, 2022.

E–RESOURCES

1. https://nptel.ac.in/courses/110/107/110107092/ (Business analytics and data mining modeling)
2. https://nptel.ac.in/courses/110/105/110105089/ (Business analytics for management decision)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	1	-	-	-	1	2	1	3	2	1
2	3	3	3	3	2	1	-	1	1	1	2	1	3	2	1
3	3	3	3	3	2	1	-	1	1	1	2	1	3	2	1
4	3	3	3	3	2	1	-	1	1	1	2	1	3	2	1
5	3	3	3	3	2	1	-	1	1	1	2	1	3	2	1
AVG	**3.0**	**3.0**	**3.0**	**3.0**	**2.0**	**1.0**	**-**	**1.0**	**1.0**	**1.0**	**2.0**	**1.0**	**3.0**	**2.0**	**1.0**

1-Low 2-Medium 3-High '-' – No Correlation

23PGO205 **DIGITAL MARKETING** **L T P C**
3 0 0 3

OBJECTIVES

- To understand the origin of digital marketing.
- To learn the different types of social media marketing.
- To know the techniques adopted for search engine optimization.
- To study the importance of facebook marketing and mobile marketing in business.
- To learn the tools and methods of web analytics.

UNIT I: INTRODUCTION & ORIGIN OF DIGITAL MARKETING **9**

Traditional v/s digital marketing – Digital marketing strategy – The P-O-E-M framework – Segmenting & customizing messages – The digital landscape – Digital advertising market in India – Skills required in digital marketing – Digital marketing plan.

UNIT II: SOCIAL MEDIA MARKETING **9**

Meaning, purpose, types of social media websites – Blogging: types of blogs – Blogging platforms & recommendations – Social media engagement – Target audience – Sharing content on social media – Do's and don'ts of social media.

UNIT III: SEARCH ENGINE OPTIMIZATION **9**

Meaning – Common SEO techniques – Understanding search engines – Basics of keyword search – Google rankings – Link building – Steps to optimize website – Basics of Email marketing: Types of Emails – Mailing list – Email marketing tools – Email deliverability & Email marketing automation.

UNIT IV: FACEBOOK MARKETING **9**

Introduction – Facebook for business – Anatomy of an Ad campaign – Role of adverts – Types & targeting – Adverts budget & scheduling – Adverts objective & delivery – LinkedIn marketing- introduction & importance – LinkedIn strategies – Sales leads generation using LinkedIn – Content strategies – Mobile marketing – Introduction – Mobile usage – Mobile advertising – Mobile marketing tool kit – Mobile marketing features.

UNIT V: UNDERSTANDING WEB ANALYTICS **9**

Purpose, history, goals & objectives – Web analytic tools & methods – Web analytics mistakes and pitfalls – Basics of content marketing: Introduction – Content marketing statistics – Types of content – Types of blog posts – Content creation – Content optimization – Content management & distribution – Content marketing strategy – Content creation tools and apps – Challenges of content marketing.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the strategy of digital marketing.
- Describe the purpose of social media marketing.
- Apply the suitable technique for search engine optimization.
- Examine the importance of facebook marketing and linkedin marketing in business.
- Analyze the mistakes and pitfalls of web analytics.

TEXT BOOKS

1. Rajendra Nargundkar and Romi Sainy "Digital Marketing: Cases from India", Notion Press, 1st Edition, 2018.
2. Damian Ryan, "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation", Kogen Page Publishers, 3rd Edition, 2018.
3. Simon Kingsnorth, "Digital Marketing Strategy: An integrated approach to online marketing", Kogen Page Publishers, 2nd Edition, 2017.

REFERENCES

1. Hermawan Kartajaya, Philip Kotler and Iwan Setiawan , "Marketing 4.0 : Moving from Traditional to Digital", Wiley Publishers, 1st Edition, 2018.
2. Seema Gupta, "Digital Marketing", McGraw Hill Publications, 3rd Edition, 2022.
3. Prabir Rai Chaudhuri, "What is digital marketing: A comprehensive guide", WMG Publishing, 1st Edition, 2022.

E–RESOURCES

1. https://onlinecourses.swayam2.ac.in/cec19_mg23/preview (Basics of Digital Marketing)
2. https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview (Digital Marketing)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	1	-	1	1	1	1	1	3	2	1
2	3	3	3	3	2	1	-	1	1	1	1	1	3	2	1
3	3	3	3	3	2	1	-	1	1	1	1	1	3	2	1
4	3	3	3	3	2	1	-	1	1	1	1	1	3	2	1
5	3	3	3	3	2	1	-	1	1	1	1	1	3	2	1
AVG	**3.0**	**3.0**	**3.0**	**3.0**	**2.0**	**1.0**	**-**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**3.0**	**2.0**	**1.0**

1-Low 2-Medium 3-High '-' – No Correlation

SCHEME

Credit Summary

CURRICULUM AND SYLLABI

FOR M.E. / M.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

CREDIT SUMMARY

M.E.- MEDICAL ELECTRONICS

Category	Credits Per Semester				Credit Total
	I	II	III	IV	
FC	7	--	--	–	7
BS	--	--	--	--	--
ES	--	--	--	--	--
PC	12	18	--	--	30
PE	3	3	6	–	12
OE	–	–	3	–	3
EEC	–	2	6	12	20
MC	–	–	–	–	–
Total	22	23	15	12	72