VEL TECH MULTI TECH Dr. RANGARAJAN Dr. SAKUNTHALA ENGINEERING COLLEGE

B.E. DEGREE (BIOMEDICAL ENGINEERING PROGRAMME)

(AN AUTOTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)

REGULATIONS 2019

CREDIT DISTRIBUTION

S. No.	Code	Category	Credits (Regular)	Credits (Lateral)
1	HSS	Humanities and Social Sciences	**8**	**2**
2	BS	Basic Sciences	**23**	**6**
3	ES	Engineering sciences	**19**	**4**
4	PC	Programme Core	**80**	**73**
5	PE	Programme Electives	**18**	**18**
6	OE	Open Electives	**6**	**6**
7	MC	Mandatory Courses	0	0
8	PROJ	Project	**12**	**12**
Total Credits			**166**	**121**

COURSES OF STUDY

SEMESTER – I

Sl. No	Course Code `	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191HS101	English for Engineering Students	HSS	3	0	0	3
2	191CH101	Engineering Chemistry	BS	3	0	0	3
3	191PH101	Engineering Physics	BS	3	0	0	3
4	191MA101	Engineering Mathematics I	BS	3	0	0	3
5	191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
6	191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
7	191ME112	Engineering Graphics	ES	2	2	0	3
PRACTICAL							
1	191PH10A	Physics Laboratory	BS	0	0	2	1
2	191CH10A	Chemistry laboratory	BS	0	0	2	1
	Total			19	4	4	23

SEMESTER – II

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191HS201	Environment Science and Engineering	HSS	3	0	0	3
2	191MA201	Engineering Mathematics II	BS	2	2	0	3
3	191PH201	Materials Science For Electronics Engineering	BS	3	0	0	3
4	191EC21A	Electronic Devices and Circuits	ES	3	0	0	3
5	191BM221	Introduction To Biomedical Engineering	PC	3	0	0	3
6	191BM222	Fundamentals Of Biochemistry	PC	3	0	0	3

PRACTICAL							
1	191ME21A	Engineering Practices Laboratory	ES	0	0	4	2
2	191EC21A	Circuits and Devices Laboratory	ES	0	0	2	1
3	191BM22A	Bio-Chemistry Laboratory	PC	0	0	2	1
	Total			17	2	8	22

SEMESTER – III

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191MA301	Linear Algebra And Numerical Methods	BS	2	2	0	3
2	191CS311	Data Structures In C	ES	3	0	0	3
3	191BM321	Anatomy And Human Physiology	PC	3	0	0	3
4	191BM322	Digital Logic Design	PC	3	0	0	3
5	191BM323	Signals And System	PC	3	0	0	3
6	191BM324	Biosensors & Instrumentation	PC	3	0	0	3
PRACTICAL							
7	191CS31A	Data Structures In C Laboratory	ES	0	0	2	1
8	191BM32A	Anatomy And Human Physiology Laboratory	PC	0	0	2	1
9	191BM32B	Digital Design Laboratory	PC	0	0	2	1
				17	2	6	21

SEMESTER – IV

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191MA401	Probability And Random Process	BS	2	2	0	3
2	191BM421	Biomedical Instrumentation	PC	3	0	0	3
3	191BM422	Biomechanics	PC	3	0	0	3
4	191BM423	Biosignal Processing	PC	3	0	0	3
5	191BM424	Pathology And Microbiology	PC	3	0	0	3
6	191BM425	Bioethics & Intellectual Property Rights (IPRs)	PC	3	0	0	3
PRACTICAL							
7	191HS40A	Reading And Writing Skill Laboratory	HSS	0	0	2	1
8	191BM42B	Biosignal Processing Lab	PC	0	0	2	1

9	191BM42A	Pathology And Microbiology Lab	PC	0	0	2	1
				16	4	6	21

SEMESTER – V

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191BM521	Diagnostic And Therapeutic Equipment	PC	3	0	0	3
2	191BM522	Hospital Management	PC	2	2	0	3
3	191BM523	Control Systems in medicine	PC	3	0	0	3
4	191BM524	Biomaterials & Artificial Organs	PC	3	0	0	3
5	191BM525	Microprocessor& Microcontroller	PC	3	0	0	3
6		Program Elective-I	PE	3	0	0	3
PRACTICAL							
7	191BM52B	Diagnostic And Therapeutic Equipments Lab	PC	0	0	2	1
8	191BM52A	Microprocessor & Microcontroller Lab	PC	0	0	2	1
				16	**4**	**4**	**20**

SEMESTER – VI

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191BM621	Advanced Microcontrollers and its Applications	PC	3	0	0	3
2	191BM622	Communication Systems	PC	3	0	0	3
3	191BM623	Medical Informatics	PC	3	0	0	3
4	191BM624	Radiological Equipments	PC	3	0	0	3
5		Program Elective-II	PE	3	0	0	3
6		Open Elective-I	OE	3	0	0	3
PRACTICAL							
7	191HS60A	Communication Skills Laboratory	HSS	0	0	2	1

8	191BM62A	Communication Systems Laboratory	PC	0	0	2	1
9	191BM62B	Innovation Practices Laboratory	PC	0	0	2	1
				18	0	6	21

SEMESTER – VII

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191BM721	Medical Device Design	PC	3	0	0	3
2	191BM722	Medical Imaging Processing	PC	2	2	0	3
3	191BM723	Medical Robotics	PC	3	0	0	3
4		Program Elective-III	PE	3	0	0	3
5		Program Elective-IV	PE	3	0	0	3
6		Open Elective-II	OE	3	0	0	3
PRACTICAL							
7	191BM72A	Medical Devices Laboratory	PC	0	0	2	1
8	191BM72B	Medical Image Processing Laboratory	PC	0	0	2	1
9	191BM77A	Project Work Phase-I	PROJ	0	0	4	2
				17	2	8	22

SEMESTER – VIII

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1		Program Elective-V	PE	3	0	0	3
2		Program Elective-VI	PE	3	0	0	3
PRACTICAL							
3	191BM87A	Project Work Phase-II	PROJ	0	0	20	10
				6	0	20	16

HUMANITIES AND SOCIAL SCIENCES (HSS)

S.NO	Course Code	Course Title	Category	L	T	P	C
1	191HS101	English for Engineering Students	HSS	3	0	0	3
2	191HS201	Environment Science and Engineering	HSS	3	0	0	3
3	191HS40A	Reading And Writing Skill Laboratory	HSS	0	0	2	1
4	191HS60A	Communication Skills Laboratory	HSS	0	0	2	1

BASIC SCIENCES (BS)

S.NO	Course Code	Course Title	Category	L	T	P	C
1	191CH101	Engineering Chemistry	BS	3	0	0	3
2	191PH101	Engineering Physics	BS	3	0	0	3
3	191MA101	Engineering Mathematics I	BS	3	0	0	3
4	191PH10A	Physics Laboratory	BS	0	0	2	1
5	191CH10A	Chemistry laboratory	BS	0	0	2	1
6	191MA201	Engineering Mathematics II	BS	2	2	0	3
7	191PH201	Materials Science For Electronics Engineering	BS	3	0	0	3
8	191MA301	Linear Algebra And Numerical Methods	BS	2	2	0	3
9	191MA401	Probability And Random Process	BS	2	2	0	3

ENGINEERING SCIENCES (ES)

S.NO	Course Code	Course Title	Category	L	T	P	C
1	191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
2	191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
3	191ME112	Engineering Graphics	ES	2	2	0	3
4	191EC21A	Electronic Devices and Circuits	ES	3	0	0	3

5	191ME21A	Engineering Practices Laboratory	ES	0	0	4	2
6	191EC21A	Circuits and Devices Laboratory	ES	0	0	2	1
7	191CS311	Data Structures In C	ES	3	0	0	3
8	191CS31A	Data Structures In C Laboratory	ES	0	0	2	1

PROFESSIONAL CORE

S.NO	Course Code	Course Title	Category	L	T	P	C
1	191BM221	Introduction To Biomedical Engineering	PC	3	0	0	3
2	191BM222	Fundamentals Of Biochemistry	PC	3	0	0	3
3	191BM321	Anatomy And Human Physiology	PC	3	0	0	3
4	191BM322	Digital Logic Design	PC	3	0	0	3
5	191BM323	Signals And System	PC	3	0	0	3
6	191BM324	Biosensors & Instrumentation	PC	3	0	0	3
7	191BM32A	Anatomy And Human Physiology Laboratory	PC	0	0	2	1
8	191BM32B	Digital Design Laboratory	PC	0	0	2	1
9	191BM421	Biomedical Instrumentation	PC	3	0	0	3
10	191BM422	Biomechanics	PC	3	0	0	3
11	191BM423	Biosignal Processing	PC	3	0	0	3
12	191BM424	Pathology And Microbiology	PC	3	0	0	3
13	191BM425	Bioethics & Intellectual Property Rights (IPRs)	PC	3	0	0	3
14	191BM42B	Biosignal Processing Lab	PC	0	0	2	1
15	191BM42A	Pathology And Microbiology Lab	PC	0	0	2	1
16	191BM521	Diagnostic And Therapeutic Equipment	PC	3	0	0	3
17	191BM522	Hospital Management	PC	2	2	0	3
18	191BM523	Control Systems in medicine	PC	3	0	0	3
19	191BM524	Biomaterials & Artificial Organs	PC	3	0	0	3
20	191BM525	Microprocessor& Microcontroller	PC	3	0	0	3

21	191BM52B	Diagnostic And Therapeutic Equipments Lab	PC	0	0	2	1
22	191BM52A	Microprocessor & Microcontroller Lab	PC	0	0	2	1
23	191BM621	Advanced Microcontrollers and its Applications	PC	3	0	0	3
24	191BM622	Communication Systems	PC	3	0	0	3
25	191BM623	Medical Informatics	PC	3	0	0	3
26	191BM624	Radiological Equipments	PC	3	0	0	3
27	191BM62A	Communication Systems Laboratory	PC	0	0	2	1
28	191BM62B	Innovation Practices Laboratory	PC	0	0	2	1
29	191BM721	Medical Device Design	PC	3	0	0	3
30	191BM722	Medical Imaging Processing	PC	2	2	0	3
31	191BM723	Medical Robotics	PC	3	0	0	3
32	191BM72A	Medical Devices Laboratory	PC	0	0	2	1
33	191BM72B	Medical Image Processing Laboratory	PC	0	0	2	1

LIST OF PROGRAM ELECTIVES

SEMESTER-V
PROGRAM ELECTIVE-I

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM531	Biomechanics	3	0	0	3
2	191BM532	Biometric Systems	3	0	0	3
3	191BM533	Tissue Engineering	3	0	0	3
4	191BM534	VLSI Design	3	0	0	3

SEMESTER-VI
PROGRAM ELECTIVE-II

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM631	Medical Optics	3	0	0	3
2	191BM632	Nanotechnology And	3	0	0	3

		Applications				
3	191BM633	Telehealth Technology	3	0	0	3
4	191BM634	Virtual Reality	3	0	0	3

SEMESTER-VII
PROGRAM ELECTIVE-III

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM731	Brain Computer Interface And Its Applications	3	0	0	3
2	191BM732	Drug Delivery System	3	0	0	3
3	191BM733	Lasers In Medicine	3	0	0	3
4	191BM734	Physiological Modelling	3	0	0	3

SEMESTER-VII
PROGRAM ELECTIVE-IV

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM735	Biofluids And Dynamics	3	0	0	3
2	191BM736	Bioinformatics	3	0	0	3
3	191BM737	Computer Networks	3	0	0	3
4	191BM738	Pattern Recognition And Neural Networks	3	0	0	3

SEMESTER-VIII
PROGRAM ELECTIVE-V

S.NO	Course Code	Course Title	Category	L	T	P
	191BM831	Assist Devices	3	0	0	3
1	191BM832	Neural Engineering	3	0	0	3
3	191BM833	Principles Of Management	3	0	0	3
4	191BM834	Soft Computing Techniques	3	0	0	3

SEMESTER-VIII
PROGRAM ELECTIVE-VI

S.NO	Course Code	Course Title	Category	L	T	P
	191BM835	Electrical Safety And Quality Assurance	3	0	0	3
1	191BM836	Embedded And Real Time Systems	3	0	0	3
2	191BM837	Rehabilitation Engineering	3	0	0	3
3	191BM838	Wearable Systems	3	0	0	3

OPEN ELECTIVE OFFERED TO OTHER DEPARTMENTS

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	191BM541	Basic Of Bioinformatics	3	0	0	3
2	191BM542	Electronics In Medicine	3	0	0	3
3	191BM543	Introduction To Biomedical Devices	3	0	0	3
4	191BM544	Introduction To Human Anatomy Systems	3	0	0	3
5	191BM545	Principles Of Telemedicine	3	0	0	3

OPEN ELECTIVE OFFERED BY OTHER DEPARTMENTS

S.NO	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**CREDITS**	**DEPT**
1.	191CE541	Advanced course in Entrepreneurship(should be opted as Open Elective II)	3	0	0	3	CIVIL
2.	191CE542	Air Pollution And Control Engineering	3	0	0	3	CIVIL
3.	191CE543	Construction materials and Techniques	3	0	0	3	CIVIL
4.	191CE544	Foundational Course on Entrepreneurship	3	0	0	3	CIVIL
5.	191CE545	Disaster Management	3	0	0	3	CIVIL
6.	191CE546	Housing Planning and management	3	0	0	3	CIVIL
7.	191CE547	Maintanence,Repair and rehabilitation structures	3	0	0	3	CIVIL
8.	191CE548	Municipal Solid waste management	3	0	0	3	CIVIL
9.	191CE549	Railways, Airports, Docks and harbors Engineering	3	0	0	3	CIVIL
10.	191CE5410	Tall buildings	3	0	0	3	CIVIL
11.	191CE5411	Traffic Engineering and Management	3	0	0	3	CIVIL

12.	191CS541	Big Data Analytics	3	0	0	3	CSE
13.	191CS542	Data Warehousing and Data Mining	3	0	0	3	CSE
14.	191CS543	Grid and Cloud Computing	3	0	0	3	CSE
15.	191CS544	Human Computer Interaction	3	0	0	3	CSE
16.	191CS545	Information Security	3	0	0	3	CSE
17.	191CS546	Information Theory and Coding	3	0	0	3	CSE
18.	191CS547	Internet-of-Things	3	0	0	3	CSE
19.	191CS548	Machine Learning Techniques	3	0	0	3	CSE
20.	191CS549	Multi-Core Architectures and Programming	3	0	0	3	CSE
21.	191CS5410	Problem Solving and Python Programming	3	0	0	3	CSE
22.	191CS5411	Soft Computing	3	0	0	3	CSE
23.	191CS5412	Software Testing	3	0	0	3	CSE
24.	191CS5413	Software Project Management	3	0	0	3	CSE
25.	191EC541	Cognitive Radio	3	0	0	3	ECE
26.	191EC542	Computer Networks	3	0	0	3	ECE
27.	191EC543	Digital Image Processing	3	0	0	3	ECE
28.	191EC544	Medical Electronics	3	0	0	3	ECE
29.	191EC545	MEMS and NEMS	3	0	0	3	ECE
30.	191EC546	Speech Signal Processing	3	0	0	3	ECE
31.	191EC547	Robotics and Automation	3	0	0	3	ECE
32.	191EC548	Satellite Communication	3	0	0	3	ECE
33.	191EC549	Sensors and Transducers	3	0	0	3	ECE
34.	191EC5410	Telecommunication Network Management	3	0	0	3	ECE
35.	191EC5411	Wireless Communication	3	0	0	3	ECE
36.	191EC5412	Wireless Networks	3	0	0	3	ECE
37.	191EE541	Basics of electric power generation	3	0	0	3	EEE
38.	191EE542	Design,Estimation and costing of electrical systems	3	0	0	3	EEE
39.	191EE543	Electrical machines and appliactions	3	0	0	3	EEE
40.	191EE544	Energy management and audit	3	0	0	3	EEE
41.	191EE545	Electrical power utilization and safety	3	0	0	3	EEE
42.	191EE546	Introduction to smart grid	3	0	0	3	EEE
43.	191EE547	Non- conventional energy sources	3	0	0	3	EEE
44.	191EE548	Power Electronics and applications	3	0	0	3	EEE
45.	191IT541	Artificial Intelligence	3	0	0	3	IT
46.	191IT542	Blockchain Technologies	3	0	0	3	IT
47.	191IT543	C# & .Net Programming	3	0	0	3	IT
48.	191IT544	Cloud Computing	3	0	0	3	IT
49.	191IT545	Database Management systems	3	0	0	3	IT
50.	191IT546	Machine Learning	3	0	0	3	IT
51.	191IT547	Mobile computing	3	0	0	3	IT

52.	191IT548	Software engineering and design	3	0	0	3	IT
53.	191ME541	Advanced Materials	3	0	0	3	MECH
54.	191ME542	Design Thinking	3	0	0	3	MECH
55.	191ME543	Energy Conservation And Management	3	0	0	3	MECH
56.	191ME544	Lean Six Sigma	3	0	0	3	MECH
57.	191ME545	Material Science and technology	3	0	0	3	MECH
58.	191ME546	Renewable energy sources	3	0	0	3	MECH
59.	191ME547	Testing Of Materials	3	0	0	3	MECH

SUMMARY

S.NO	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	PERCENTAGE
		I	II	III	IV	V	VI	VII	VIII		
	HSS	3	3		1		1			8	5%
	BS	11	6	3	3					23	14%
	ES	9	6	4						19	11.4%
	PC		7	14	17	17	14	11		80	48%
	PE					3	3	6	6	18	10.8%
	OE						3	3		6	3.6%
	PROJ							2	10	12	7.2%
	TOTAL	23	22	21	21	20	21	22	16	166	

CURRICULAM SYLLABUS

SEMESTER – I

COURSE CODE	NAME OF THE COURSE	CATEGORY	L	T	P	CREDIT-S
191HS101	English for Engineering Students	HSS	3	0	0	3
191CH101	Engineering Chemistry	BS	3	0	0	3
191MA101	Engineering Mathematics - I	BS	2	2	0	3
191PH101	Engineering Physics		3	0	0	3
191ME111	Basic Civil and Mechanical Engineering	ES	3	0	0	3
191EE111	Basic Electrical and Electronics Engineering	ES	3	0	0	3
191ME112	Engineering Graphics	ES	2	2	0	3
191PH10A	Physics Laboratory	BS	0	0	2	1
191CH10A	Chemistry Laboratory	BS	0	0	2	1
		Total	19	4	4	23

191HS101/ENGLISH FOR ENGINEERING STUDENTS **L T P C**

3 0 0 3

COURSE OBJECTIVES

- Equip students with the English language skills required for the successful undertaking of academic studies.
- Improve general and academic listening skills
- Provide guidance and practice in basic geranial and classroom conversation and to engage in specific academic speaking activities
- Strengthen the reading and writing skills of students of engineering.

SYLLABUS

UNIT-I VOCABULARY BUILDING **9**

Word formation - Prefixes and Suffixes – Root words from foreign languages – Synonyms – Antonyms – Compound Nouns – Standard Abbreviations

UNIT-II GRAMMATICAL COMPETENCY **9**

Noun, Verb, Adjective – Subject-Verb Agreement – Articles – Prepositions – Purpose expressions –Model Verbs

UNIT-III BASIC WRITING SKILLS **9**

Sentence structure – Phrases – Clauses – Coherence – Cohesion (using linking words) – Paragraph Writing (Descriptive and Narrative).

UNIT-IV READING SKILLS **9**

Reading Strategies – Skimming and Scanning – Reading Comprehension exercises with multiple choice and open-ended questions – Transforming Information in the form of charts – Note Making

UNIT-V ORAL COMMUNICATION **9**

(This unit involves interactive practice sessions in Language Lab) o Listing Comprehension o Pronunciation, Syllable and Stress, Rhythm and Intonation o General conversations and dialogues, common in everyday situations o Short Speech

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Infer meanings of unfamiliar words from context

CO2 Enable to achieve linguistic competence and be able to use grammar as a tool or resource in the comprehension and creation of oral and written discourse efficiently according to the situation.

CO3 Write cohesively, coherently and flawlessly with a wide range of vocabulary and organizing their ideas logically on a topic.

CO4 Activate and reinforce the habit of reading and writing effectively in their discipline.

CO5 Collaborate with multicultural environment.

TEXT BOOKS

- APAART:SpeakWell1(Englishlanguage andcommunication)
- APAART:SpeakWell2(SoftSkills).

REFERENCES

- AlanMc'carthyandO'dell–EnglishVocabularyinUse–ThirdEdition–CambridgeUniversityPress2017
- Dr.SarojHiremath– Business Communication– NiraliPrakashan

WEB REFERENCES

- Train your mind to perform under pressure- Simon sinek https://curiosity.com/ videos/simon- sinek-on-training-your-mind-to-perform-under-pressure-captureyour-flag/
- Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/ video/simon-sinek-explains-why-you-should-put-peoplebefore-numbers.html
- Will Smith's Top Ten rules for success https://www.youtube.com/ watch? v=bBsT9omTeh0

CO-PO&PSO MAPPING															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
CO 2	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
CO 3	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
CO 4	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
CO 5	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
CO	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-

191CH101 / ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To acquaint the students with the development of microscopic chemistry in terms of atomic, molecular and intermolecular forces and acquires the knowledge of water treatment. The students will be able to analyze the properties and applications of polymer and advanced materials.

SYLLABUS

UNIT-I CHEMICALBONDING **9**

Types of chemical bonds - bond polarity- dipole moment – partial ionic character - consequences.Weak Interactions – Hydrogen bonding, van der Waals forces - influence on properties of matter.Metallicbond– freeelectrontheory,MOtreatment-bandtheory-metals,semiconductorsandinsulators.Nonstoichiometricsemiconductors,chalgogensemiconductors.Defectstructures ofcrystals–SchottkyandFrenkel defects

UNIT-II WATERCHEMISTRY **9**

Hardness - determination (EDTA method). Water softening - zeolite and demineralization processes.Desalination by electro-dialysis and reverse osmosis. Water analysis by fluoride ion, Water qualityparameters, Instrumental methods for water analysis- AAS, flame emission spectroscopy, ICP-MS andphotocolorimetry

UNIT-III ELECTROCHEMISTRY **9**

Electrode potential – standard and reference electrodes, Nernst equation, emf series – applications.Galvanicandconcentrationcells.Applicationsofpotentialmeasurements–glasselectrode-pHmeasurement,acid-basetitration,redoxtitration.Conductancemeasurement–applications–conductometrictitrations.

UNIT-IV POLYMERS **9**

Classification, degree of polymerization, molecular weight – Mn and Mw. Polymerization reactions.Glass transition temperature– factors affecting Tg - determination by DSC. Polymer processing-compounding, outline of moulding techniques compression, injection, extrusion and blow moulding.Charge transport in conjugated polymers - doped conjugated polymers - glucose biosensor. PolymersforLEDandLCDdisplays.

UNIT-V ADVANCED MATERIAL **9**

Carbon nanotubes and carbon fibres, graphene and polymer nano-composites-properties andapplications - morphological studies by SEM and TEM. Solid oxide materials and polymer electrolytes -energy storing applications. Polymer blends and alloys, photo and electroluminescence materials,insulatingmaterials,photopolymersandphotoresistsforelectronics,polymer photovoltaics.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Analyse microscopic chemistry in terms of atomic, molecular and Intermolecular forces for real time applications of semiconductors.

CO2 Investigate the various water treatment and softening methods.

CO3 Appraise the types and mechanism of electrochemical reaction in batteries and fuel cells.

CO4 Explain the basic principle, types and mechanism of polymerization process and techniques.

CO5 Assess the properties, characterization and applications of advanced materials for energy storage.

TEXT BOOKS

1. MaryJaneShultz,-"EngineeringChemistry",CengageLearning,USA,2009.
2. PalannaO.G.,-"EngineeringChemistry",TataMc.GrawHillEducationPvt.Ltd.,NewDelhi,2009.

REFERENCES

1. GesserH.D.,-"AppliedChemistry-ATextbookforEngineersandTechnologies",Springer, NewYork,2008.
2. GowarikarV.R.,ViswanathanN.V.andJayadevSreedhar,-"PolymerScience",NewAge International(P)Ltd., NewDelhi,2011.
3. VijayamohananK.PillaiandMeeraParthasarathy.–"FunctionalMaterials-AChemist'sPerspective" UniversitiesPress, India,2012.
4. ShashiChawla,-"ATextbookofEngineeringChemistry",DhanpatRai &Co,NewDelhi,2005

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

191MA101 / ENGINEERINGMATHEMATICS–I

L	T	P	C
2	2	0	3

COURSE OBJECTIVES

- To develop greater knowledge and understanding of mathematics and to attain the skills necessary for success in the study of higher mathematics.

SYLLABUS

UNIT-I MATRICES **12**

Characteristic equation–Eigen values and Eigen vectors of areal matrix – Properties of Eigen values - Cayley Hamilton theorem-Orthogonal reduction of asymmetric matrix to diagonal form – Reduction of quadratic form by orthogonal transformation - Applications.

UNIT-II GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS **11**

Curvature–Cartesian and Polar coordinates–Centre of curvature, Circle of curvature–Evaluates and Envelopes-Applications

UNIT-III FUNCTIONS OF SEVERAL VARIABLES **11**

Function of two variables – Partial derivatives – Total derivative – Change of Variables – Jacobians-Taylor's expansion–Maxima and Minima–Constrained Maxima and Minima by Lagrangian Multiplier method-Applications

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS **11**

Linear differential equations of second and higher order with constant coeeficients- method of variation of parameters- equations reducible to linear equations swith constant coefficients: Cauchy's homogeneous linear equation and legendre's linear equation – Simultaneous linear equations with constant coeffecients- applications.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Analyze the characteristics equation of a linear system with Eigen values and vectors for practical application.

CO2 Determine the bending of family of curves using differential calculus which deals in various disciplines.

CO3 Apply partial derivatives in various engineering problems.

CO4 Identify and solve the real time problems using higher order differential equations.

TEXT BOOKS

1.Kreyszig.E,"Advanced Engineering Mathematics", John Wiley&Sons. Singapore,10th edition,2012
2.Grewal.B.S, Higher Engineering Mathematics, Khanna Publications,42ndEdition,2012

REFERENCES

1.Veerarajan.T,"Engineering Mathematics I",Tata Mc Graw Hill Publishing Co, NewDelhi,5th edition, 2006
2.Kandasamy.Pet.al. "Engineering Mathematics", Vol.I (4th revised edition), S.Chand& Co, NewDelhi,2000

CO-PO&PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	2	-	-	-	-	-	-	1	-	-	1
CO 2	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
CO 3	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
CO 4	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1
CO	3	3	2	2	1	-	-	-	-	-	-	1	-	-	1

191PH101 / ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- The course aims to equip engineering undergraduates with principles of Physics in a broader sense with a view to lay foundation for the various engineering courses

SYLLABUS

UNIT-I PROPERTIESOFSOLIDS **9**

Elasticity- Hooke's law – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- young's modulus by non-uniform bending (Theory and Experiment) - Torsional stress and twisting couple- Torsional Pendulum((Theory and Experiment) I-shaped girders

UNIT-II PRINCIPLES OFLASERS **9**

Properties of laser radiation and their significance-wavelength, power, mono-chromaticity, coherence. Types of lasers working media and their radiation characteristics-Power, wavelength and operational modes of He-Ne, Carbon-dioxide. Physical principles of Laser beam delivery systems. Applications-Industry and Medical. Selection of lasers for various applications

UNIT-III OPTICALFIBRESYSTEMS **9**

Optical Fibres- Propagation mechanism -Critical Angle- Snell's Law-Total Internal Reflection-Acceptance cone-Numerical aperture- Types of fibers- Attenuation-Active and passive fibre sensors(Temperature and Displacement)- Applications (Industry and Medical) - communication in opticalfiber-Endoscope

UNIT-IV WAVENATURE OFPARTICLES **9**

Introduction to Quantum mechanics, Black body radiation - Planck's Hypothesis - Compton Effect (Theory and Experiment)-Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Schrodinger equation for one dimensional problem– particle in a box-SEM and TEM.

UNIT-V SOLID STATE PHYSICS **9**

Crystalline and non crystalline materials-Lattice – Unit cell – Bravais lattice – Lattice planes – Millerindices – Expression for inter planar spacing- Bragg's law- Diffraction of X-rays by crystal planes - Co-ordination number. Atomic packing factors (SC, FCC, BCC and HCP structures) – Diamond and graphite structures(qualitative treatment)-Crystal growth techniques (Bridgman and Czochralski)

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Demonstrate the proficiency on the properties of matter and its applications

CO2 Describe the working principles of Laser and its developments in industrial and medical applications

CO3 Explain the propagation of waves in optical fibres and their applications

CO4 Apply the theory of wave nature of particles in various microscopic applications

CO5 Analyze the structure of materials and its crystal growth techniques

TEXT BOOKS

1. 'EngineeringPhysics',R.K.GaurandS.L.Gupta,DhanpatRaiPublications(P)Ltd.,8thEdition. **NewDelhi(2001).**
2. IntroductiontoSolidStatePhysics,7thEdition,CharlesKittel,Wiley,Delhi2007.
3. Halliday, D.,Resnick, R.&Walker,J.―Principles ofPhysics‖.Wiley,2015.

REFERENCES

1. Laser Fundamentals, William T. Silfvast, 2nd Edition, Cambridge University press, New York,2004.
2. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley andSons,NewYork2001.
3. E.Hecht,Optics,PearsonEducation,2008

CO-PO&PSO MAPPING															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 4	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO 5	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-

191ME111/ BASIC CIVIL AND MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To create awareness on fundamental knowledge on various domains of civil engineering
- To introduce the sources of water and treatment of water, sewage treatment and transportation modes
- To introduce the fundamentals of Power Plant Engineering
- To introduce the fundamentals of IC engines
- To introduce the fundamentals of Energy resources and refrigeration cycles

SYLLABUS

UNIT-I SCOPE OF CIVIL ENGINEERING 9

Introduction – Functions and role of Civil Engineer- Branches of Civil Engineering. Materials – Properties, classification and characteristics of building stones, bricks, timber, cement and cement concrete, reinforcing steel- Components of residential building. Foundation – Types and necessity.

UNIT-II WATER RESOURCES & ENVIRONMENTAL ENGINEERING 9

Sources of water – Hydrologic cycle – Rain water harvesting – importance – methods of rain water harvesting. - Water demand estimation – Sources of water – Quality of water – Treatment of water- Water distribution. Sewerage – collection, treatment and disposal of sewage – Septic tanks.

UNIT-III POWER PLANTS, PUMPS AND TURBINES 9

Introduction to Power Plant, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric, Geo-thermal and Nuclear Power plants – Merits and Demerits. Pumps and turbines – working principle of single acting and double acting Reciprocating pumps – Centrifugal Pump.

UNIT-IV IC ENGINES 9

Introduction to Internal combustion engines – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

UNIT-V RENEWABLE ENERGY AND REFRIGIRATION 9

Introduction to renewable energy sources - Non renewable energy sources-Comparison of Electrical Energy Storage Technologies. Vapour compression Refrigeration system, Vapour absorption refrigeration system.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Explain the usage of construction material and proper selection of construction materials

CO2 Explain about water resources, sewage treatment and transportation systems

CO3 Explain about the components use in power plants

CO4 Describe the internal combustion engines

CO5 Explain about the renewable energy sources and refrigeration cycles

TEXT BOOKS

I. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 1996.

REFERENCES

1. T. Jha and S.K. Sinha, "Construction and Foundation Engineering", Khanna publishers, Delhi, 2003 2. S.K. Garg, "Water Supply Engineering", Khanna publishers, Delhi, 2005 3. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. 1999.

CO-PO&PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO2	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO3	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO4	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO5	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-
CO	3	3	1	1	-	2	2	1	-	-	-	2	-	-	-

191EE111 /BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand the structure of Electric Power Systems
- To execute safety precautions to study about Electric laws
- To know about construction of meters
- To understand about Electronics and Communication systems

SYLLABUS

UNIT-I INDIAN ELECTRICITY SCENARIO 9

Electric Power-Generation resources, Transmission types & Distribution system (levels of voltage, power ratings and statistics)- Regulatory Authorities governing Indian Electricity Protection & Safety-Hazards of electricity-shock, effects of electricity on the human body. Electrical safety practices, Protection devices.

UNIT-II BASICS OF ELECTRICAL COMPONENTS 9

Evolution of Electricity and Electrical inventions -Charge, Electric potential, voltage, current, power, energy, DC ,AC, time period, frequency, phase, flux, flux density, RMS, Average, Peak, Phasor & Vector diagram.

UNIT-III BASIC LAWS OF ELECTRIC SYSTEMS& MEASUREMENTS 9

ElectricCircuits-Passivecomponents(RLC),Ohm'slaw,KCL,KVL,Faraday'slaw,Lenz'slaw-Illustrative examples-Analog Moving Iron, Moving Coil and Digital meters–Types and usage

UNIT-IV BASICS ELECTRONICS 9

Electrical Vs Electronics, Electronic products and systems, Electronic Devices (Diode–Forward bias, reverse bias, Transistor (CE, CB, CC), Electronic components, Electronic Circuits-Rectifier, Regulator &IC-Basic Amplifiers and Oscillators- Communication system Block diagram (Transmitter and Receiver)

UNIT-V BASICS OF COMMUNICATION ENGINEERING 9

Amplitude Modulation–AM, DSBSC, SSBSC, VSB–PSD, modulators and demodulators–Angle modulation–PM and FM–PSD.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Summarizes about different structures of Power system and safety measures.

CO2 Explain about the basics of Electricity

CO3 Discuss on various electric circuits and use of measuring instruments

CO4 Clarify the working of basic electronic devices such as diode, transistor and operational amplifiers

CO5 Infer about Digital Electronics and Communication System

TEXT BOOKS

1. S SalivahananRangarajan,Basic Electrical Electronics & Measurement Engineering , Tata McGraw Hill Publishing Co Ltd
2. Basic Electric Engineering, DP Kothari &Nagrath, Tata McGraw Hill
3. C.L.Wadhwa, ―Generation, Distribution and Utilisation of Electrical Energy‖, New Age international pvt.ltd.,2003.

REFERENCES

1. AlbertPaulMalvino, "ElectronicPrinciples",TataMcgrawHill,2002
2. SimonHaykin,"CommunicationSystems",WileyEastern,ThirdEdition,1996
3. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.
4. M.Morris Mano, Digital Design, Third Edition, Pearson Publication

CO-PO&PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	1	1	1	-	-	-	-	-	-	-	-	-	-
CO5	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO	3	2	2	1	1	-	-	-	-	-	-	-	-	-	-

191ME112 / ENGINEERING GRAPHICS

L	T	P	C
2	2	0	3

COURSE OBJECTIVES

- To explain the importance of an engineering drawing and explain the role of computer aided design
- To convey the basics of engineering drawing of curves and concepts of free hand sketching
- To teach different methods of making views of simple objects resembling points, lines and surfaces
- To relate the visualizations of simple solid objects as per principles of orthographic projection
- To establish the importance of sections and developments made in drawing
- To develop an intuitive understanding of underlying significance of using pictorial drawings

SYLLABUS

UNIT-I PLANE CURVES AND FREE HAND SKETCHING 9

Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views-Free hand sketching of multiple orthographic views from single pictorial view of objects.

UNIT-II PROJECTION OF POINTS, LINES AND PLANE SURFACES 9

Orthographic projections - Introduction - Principles -Principal Planes-First angle projection. Projection of points located in all quadrants. Projection of straight lines inclined to both the principal planes, Determination of true lengths and true inclinations by rotating line method, traces. Projection of planes (regular polygonal and circular surfaces) inclined to both the principal planes by rotating object method

UNIT-III SECTION OF SOLIDS & DEVELOPMENT OF LATERAL SURFACES OF SOLIDS 9

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

UNIT-IV SECTION OF SOLIDS & DEVELOPMENT OF LATERAL SURFACES OF SOLIDS 9

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

UNIT-V ISOMETRIC AND PERSPECTIVE PROJECTIONS 9

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

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Draw engineering curves and apply the concepts of free hand sketching

CO2 Draw orthographic views of points, lines and surfaces

CO3 Draw visualizations of simple solid objects as per orthographic projections

CO4 Draw sections and developments made in drawing

CO5 Draw pictorial drawings of simple objects

TEXT BOOKS

N.D. Bhatt, Engineering Drawing, 49th edition, Charotar Publishing House, 2006Basic Electric Engineering, DP Kothari &Nagrath, Tata McGraw Hill

REFERENCES

1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008
3. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008. 4. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.

CO-PO&PSO MAPPING															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	2	-	3	1	-	-	-	1	1	1	_	_	_
CO2	1	1	2	-	3	1	-	-	-	1	1	1	_	_	_
CO3	1	1	2	-	3	1	-	-	-	1	1	1	_	_	_
CO4	1	1	2	-	3	1	-	-	-	1	1	1	_	_	_
CO5	1	1	2	-	3	1	-	-	-	1	1	1	_	_	_
CO	1	1	2	-	3	1	-	-	-	1	1	1	_	_	_

191PH10A / PHYSICS LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

- Students will be able to demonstrate an understanding of the scientific method, so that they may use the training beneficial in their higher pursuits.

SYLLABUS

LIST OF EXPERIMENTS

1. Determination of Rigidity modulus–Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. Determination of Planck's Constant and work function of materials using photo electriceffect experiment
4. Determination of wavelength, and particle size using Laser
5. Determination of acceptance angle in an optical fiber

DEMONSTRATION:

1. Determination of wavelength of mercury spectrum–spectrometer grating
2. Demonstration of Crystal Growth Technique
3. Determination of fiber thickness –Air Wedge method.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Apply the principles of properties of matter in determining the various elastic properties
CO2	Attains the practical knowledge, to apply principles of optics for various engineering applications
CO3	Demonstrate the technical knowledge on Quantum Mechanical concepts

REFERENCES

1. WilsonJ.D.andHernandezC.A.,-"PhysicsLaboratoryExperiments",HoughtonMifflinCompany,New York2005.

CO-PO&PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-

191CH10A / CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

- To furnish the conceptual understanding of the basic principles involved in chemical analysis.
- To attain the analytical knowledge of students by conducting various experiments.

SYLLABUS

LIST OF EXPERIMENTS

1. Determination of total, permanent, temporary, calcium and magnesium hardness of water by EDTA method.
2. Conductometric titration -determination of strength of an acid
3. Estimation of iron by potentiometry.
4. Determination of molecular weight of polymer by viscosity average method
5. Determination of dissolved oxygen in a water sample by Winkler's method
6. Determination of Na/K in water sample by Flame photometry (Demonstration)
7. Estimation of Copper in ore
8. Estimation of nickel in steel
9. Determination of total alkalinity and acidity of a water sample
10. Determination of rate of corrosion by weight loss method

COURSE OUTCOMES

On completion of the course, students will be able to

CO1 Acquireknowledgeonquantitativechemicalanalysisbyinstrumentationandvolumetric method

CO2 Analyzethewatersampleforhardness,chloride,sodium/potassiumcontent,dissolved oxygenetc.

CO3 Solveanalyticalproblemsinspectrometerandflamephotometerfortheidentificationand quantification

CO-PO&PSO MAPPING

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

CURRICULUM AND SYLLABUS
SEMESTER – II

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191HS201	Environment Science and Engineering	HSS	3	0	0	3
2	191MA201	Engineering Mathematics II	BS	2	2	0	3
3	191PH201	Materials Science For Electronics Engineering	BS	3	0	0	3
4	191EC21A	Electronic Devices and Circuits	ES	3	0	0	3
5	191BM222	Fundamentals Of Biochemistry	PC	3	0	0	3
6	191BM221	Introduction To Biomedical Engineering	PC	3	0	0	3
PRACTICAL							
1	191EC21A	Circuits and Devices Laboratory	ES	0	0	2	1
2	191ME21A	Engineering Practices Laboratory	ES	0	0	4	2
3	191BM22A	Bio-Chemistry Laboratory	PC	0	0	2	1
	Total			17	2	8	22

191HS201-ENVIRONMENTAL SCIENCE ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES:

1. This course provides the basic knowledge of structure and function of ecosystem and better understanding of natural resources, biodiversity and their conservation practices.
2. It describes the need to lead more sustainable lifestyles, to use resources more equitably.
3. It helps to create a concern for our environment that will trigger pro-environmental action, including activities we can do in our daily life to protect it.
4. Furthermore, it deals the social issues and ethics to develop quality engineer in our country.

UNIT 1: ENVIRONMENT - AN OVERVIEW: **(9)**

Ecosystem - concept-structure-function-types. Energy flow in eco-system. Biodiversity and its conservation- values of bio- diversity-threats to biodiversity conservation of biodiversity. Natural resources-types, uses.

UNIT 2*:* ENVIRONMENTAL IMPACT OF ENERGY SOURCES: **(9)**

Sources of primary energy- present and future consumption of energy- environmental impacts of energy development- oil, natural gas, coal, hydro electric, nuclear power, wind mill and solar panels- Urban problems related to energy - case studies. .

UNIT 3: CLIMATIC CHANGE AND SOLID WASTE MANAGEMENT: **(9)**

Environmental pollution- air, water, soil, marine and noise pollution-green house gases- causes, effects-global warming, ozone layer depletion, acid rain-sources and effects. Pollution control strategies-preventive measures- green technologies-green building concepts- standards and regulations- role of individuals. Sustainable development. Hazardous wastes- e-waste- source- effect, management. Nuclear waste-sources, effects, management. Recycling of waste. Future challenges.

UNIT 4: HUMAN POPULATION AND THE ENVIRONMENT **(9)**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

UNIT 5*:* ENVIRONMENTAL LAWS AND ETHICS: **(9)**

Legal provision in India- environmental acts-air, water, forest, soil and wildlife. Environmental ethics-theories and codes- resource consumption patterns, equity-disparity, urban-rural equity issues, need for gender equity, preserving resource for future generation, right of animals, ethical basis of environment education and awareness, ethical problem solving- changing attitude, conservation ethics and traditional value systems of India. Effect of social media on the adolescent.

TEXT BOOKS:

1. ErachBharucha, "Text book for Environmental sciences for Undergraduate cources", UGC, 2004 (Unit I, III &IV)
2. Kaushik, A &Kaushik, CP, Environmental Science and engineering", 3rd Edition, New Age International (P) Limited, New Delhi, 2009. (Unit I)
3. Henry, JG &Heinke, GW, "Environmental Science and Engineering", 2nd Edition, PHI Learning Private limited, New Delhi, 2011. (Unit II)

REFERENCE BOOKS:

1. Masters, GM & Ela, WP, "Introduction to Environmental Engineering and Science", 3rd Edition, PHI Learning Private limited, New Delhi, 2009. (Unit III)
2. Encyclopaedia of environmental ethics and philosophy. Available at www.gmu.ac.ir/download/booklibrary/e-library/Encyclopaedia of Environmental Ethics and philosophy.pdf (Unit IV)

COURSE OUTCOMES:

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

CO1 Interpret the concept, structure and function of an ecosystem.

CO2 Identify the values and conservation methods of biodiversity.

CO3 Demonstrate the environmental impacts of energy development and Categorize the various environmental pollutions and select suitable preventive measures.

CO4 Perceive the environmental effects of human population and the implementation of welfare programs.

CO5 Recall the environmental ethics and legal provisions.

Course outcome	**Mapping CO's with PO's**														
CO's	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	3	3	2	2	-	2	3	-	-	-	-	2	-	-	-
CO2	3	3	2	2	-	2	3	2	-	-	-	2	-	-	-
CO3	3	3	2	2	-	2	3	-	-	-	-	2	-	-	-
CO4	3	3	2	2	-	2	3	-	-	-	-	2	-	-	-
CO5	3	3	2	2	-	2	3	-	-	-	-	2	-	-	-
Average CO	3	3	2	2	-	2	3	2	-	-	-	2	-	-	-

191MA201-ENGINEERING MATHEMATICS II

L	T	P	C
2	2	0	3

COURSE OBJECTIVES

On completion of the course, the students are expected

1. To understand double and triple integrations and enable them to find area and volume using multiple integrals.
2. To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
3. To understand analytic functions of complex variables and conformal mappings.
4. To know the basics of residues, complex integration and contour integration.
5. To understand Laplace transform and use it to represent system dynamic models and evaluates their time responses.

UNIT 1 MULTIPLE INTEGRALS(9 +3) Hours

Double integration – Cartesian and polar coordinates – Change of order of integration –Triple integration in cartesian coordinates.

UNIT 2 VECTOR CALCULUS (9 +3) Hours

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Simple problems on Vector differentiation–Vector integration - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs).

UNIT 3 ANALYTIC FUNCTION(9 +3) Hours

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs)– Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping :$w = z + c$, cz , $1/z$ and bilinear transformation.

UNIT 4 COMPLEX INTEGRATION(9 +3) Hours

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

UNIT 5 LAPLACE TRANSFORM(9 +3) Hours

Laplace transform –Sufficient condition for existence –Transform of elementary functions –Basic properties – Transforms of unit step function and impulse functions –Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem –Initial and final value theorems–Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60 HOURS

TEXT BOOKS

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012.
2. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd., Singapore, 10th Edition

REFERENCES

1. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
2. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
3. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
4. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

COURSE OUTCOMES

CO1: Evaluate multiple integrals using change of variables.
CO2: Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.
CO3: Construct analytic functions of complex variables and transform functions using conformal mappings.
CO4 Estimate the real and complex integrals over suitable closed paths and contours.

CO5 Compute linear differential equations using Laplace transform techniques.

Course outcome	**Mapping CO's with PO's**														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
CO2:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
CO3:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
CO4:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
CO5:	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-
Ave	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-	-

191PH201-MATERIALS SCIENCE FOR ELECTRONIC ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- To introduce the essential principles of materials science for Bio-Medical engineering applications and become proficient in Electrical, Magnetic, Optical and Bio Materials engineering properties of materials

UNIT 1 ELECTRICAL PROPERTIES OF MATERIALS **9**

Classical Free Electron Theory – Drift Velocity -Electrical conductivity - Thermal conductivity-Wiedemann Franz Law- – Fermi- Dirac statistics –Effect of temperature of Fermi function- Density of energy states- Carrier concentration in metals- Energy band diagram-Classification of Semiconducting Materials

UNIT 2 MAGNETIC MATERIALS **9**

Basic Concepts - Origin of magnetic moment – Bohr magneton - Classification of Magnetic Materials – Ferromagnetic Domain Theory – Hysteresis- Soft and Hard Magnetic Materials – antiferromagnetic materials – Ferrites- Applications- Data Storage - MRI Scan

UNIT 3 SOUND IN MEDICINE **9**

Physics of sound, Normal sound levels –Ultrasound fundamentals-Production of ultrasonics by magnetostriction and piezoelectric methods - Acoustic grating-Non Destructive Testing – pulse echo system through Transmission Scanning systems - A,B and C – Scandisplays, Medical applications – Sonogram

UNIT 4 OPTICAL PROPERTIES OF MATERIALS **9**

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode – solar cell - LED – Organic LED – Laser diodes – Optical data storage techniques.

BIO-MATERIALS AND IMPLANT MATERIALS **9**

Bio Compatibility of materials. Classification of Biomaterials -Bio-Polymers-Silicone –Relaxor-Metallic implant materials -Stainless steels, Ni Alloys, Cu Alloys and Ti Alloys, Ceramics, Hydroxyapatite, and its medical applications

Total Periods: 45

TEXT BOOKS

1. Materials Science and Engineering- An Introduction, William D. Callister, 6th Edition, John Wiley, USA, 2004.
2. Solid State Physics, S.O.Pillai, 6th Edition, New Age International Publisher, India, 2009

REFERENCE BOOKS

1.The Science and Engineering of Materials, Donald R. Askland and Pradeep P. Phule, 5th Edition, Cengage Learning Publisher, USA, 2006

COURSE OUTCOME

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

CO1	Assimilate on classical electron theories, and energy band structures
CO2	Analyze the fundamentals of various magnetic materials, their properties and applications in advanced technologies
CO3	Examine the importance of sound properties in engineering fields by projecting the view of applications in medical field
CO4	Describe the significance of optical properties of materials in advanced engineering technologies
CO5	Assimilate recent technological developments, used in creating products from various bio-materials

Course outcome	**Mapping CO's with PO's**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO2	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO3	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO4	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
CO5	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-
AVG	3	3	2	2	-	2	2	2	2	-	-	2	1	-	-

191EC2A-ELECTRONIC DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To understand the concept of semiconductor diode.
2. To learn the operation and characteristics of BJT and FET transistors.
3. To study various types of display and power devices
4. To learn positive and negative feedback circuits

SYLLABUS

UNIT:I–SEMICONDUCTOR DIODES 9

Ideal diode-Current-voltage characteristics, Terminal characteristics of junction diode – Zener diode and applications –Diode logic gates-Clipping and Clamping circuits-Voltage doubler- Schottky-Barrier diode-Varactor –Photo diode-Tunnel diode.

UNIT: II – TRANSISTOR AMPLIFIER 9

BJT- Structure, Operation – Three modes of configuration –Currents in Transistor – Relation between α ,β& γ – load line – Transistor as an amplifier (CE)- h parameter – Av and Ap

UNIT: III – FIELD EFFECT TRANSISTOR 9

JFET-Structure, Operation of N Channel and P Channel - Drain and Transfer characteristics- Applications of JFET-MOSFET types- Characteristics of Enhancement and depletion mode- Comparison of JFET and MOSFET.

UNIT: IV POWER DEVICES AND DISPLAY DEVICES 9

SCR, DIAC, TRIAC, Power BJT, Power MOSFET, IGBT Heat sinks and junction temperature, LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

UNIT: V – FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback - Voltage/current, series/shunt feedback.Positive feedback –Barkhausen criterion for oscillation - Phase shift - Wein Bridge – Hartley – Colpitts and crystal oscillators.

TOTAL PERIODS 45

TEXT BOOKS

1.Sedra and Smith, “Micro Electronic Circuits”; Sixth Edition, Oxford University Press, 2011.
2.Donald A Neaman, “Semiconductor Physics and Devices”, Third Edition, Tata McGrawHillInc. 2007.

REFERENCE BOOKS

1. Robert L. Boylestad and Louis Nasheresky, ―Electronic Devices and Circuit Theory‖,10thEdition, Pearson Education / PHI, 2008
2. Malvino, Electronic Devices and Circuits, PHI, 2007.
3. David A. Bell, ―Electronic Devices and Circuits, Fifth Edition, Oxford UniversityPress, 2008.
4. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, ―Electronic Devices and circuits‖, Third Edition,Tata McGraw- Hill, 2008.

COURSE OUTCOMES

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

CO1	Apply the semiconductor devices in design of electronic devices.
CO2	Explain the fundamentals of transistors and amplifiers
CO3	Analyze the characteristics of different types of transistors.
CO4	Describe the significance of Power devices and display devices.
CO5	Employ the acquired knowledge in design of oscillators and feedback amplifiers.

Course outcome	**Mapping CO's with PO's**														
CO's	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO 3**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-
Average CO	3	3	2	2	-	-	-	-	-	-	-	2	2	1	-

191BM222-FUNDAMENTALS OF BIOCHEMISTRY **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. To get knowledge on prokaryotes, eukaryotes.
2. To learn the concept of classification of carbohydrates.
3. To study the structure of proteins.
4. To understand the role of lipids and classification of lipids.
5. To analyse the structure of nucleic acids.

SYLLABUS

UNIT: I – INTRODUCTION TO ORGANISMS **9**

Introduction to Cell-Prokaryotes, Eukaryotes, Cell function, Cell Differences-Physiological differences and biochemical differences, Metabolisms

UNIT: II CARBOHYDRATES **9**

Classification of carbohydrates -mono, di, oligo and polysaccharides. Structure, physical and chemical properties of carbohydrates Isomerism, racemisation and mutarotation. Digestion and absorption of carbohydrates. Metabolic pathways and bioenergetics –Glycolysis, glycogenesis, glycogenolysis and its hormonal regulation. TCA cycle and electron transport chain. Oxidative phosphorylation. Biochemical aspect of Diabetes mellitus and Glycogen storage Disease.

UNIT: III PROTEINS **9**

Structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Separation, characterization and identification of proteins, Inborn Metabolic error of amino acid metabolism.

UNIT: IV LIPIDS **9**

Classification of lipids-simple, compound and derived lipids. Nomenclature of fatty acid, physical and chemical properties of fat. Metabolic pathways: synthesis and degradation of fattyacid (beta oxidation), hormonal regulation of fatty acid metabolism, ketogenesis, Biosynthesis of Cholesterol. Disorders of lipid metabolism.

UNIT: V NUCLEIC ACIDS 9

DNA, RNA,Structure of Purines and Pyrimidines, Nucleoside, Nucleotide, Chargoffs rule. Watson and crick model of DNA. Structure of RNA and its type. cDNA synthesis, Metabolism and Disorder of Purines and Pyrimidines nucleotide Classification.

TEXT BOOKS

1. Principles of Biochemistry by Albert L. Lehninger, David L. Nelson, Seventh Edition, W. H. Freeman, 2005.
2.RAFI MD ―Text book of biochemistry for Medical Student‖ Second Edition, University Press, 2014.
3.David.W.Martin, Peter.A.Mayes , Victor. W.Rodwell, ―Harper‘s Review of Biochemistry‖, LANGE Medical Publications, 1981.

REFERENCE BOOKS

1.Keith Wilson & John Walker, ―Practical Biochemistry -Principles & Techniques‖, Oxford University Press, 2009.
2.Pamela.C.Champe&Richard.A.Harvey, ―Lippincott Biochemistry Lippincott‘s Illustrated Reviews‖, Raven publishers,1994

COURSE OUTCOMES

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

CO1	Understand the basics of Eukaryotes and Prokaryotes along with their functions
CO2	Describe about classification of carbohydrates and their metabolic pathways
CO3	Understand the properties and classification of proteins with characterization techniques
CO4	Describe about classification of lipids and their metabolic pathways
CO5	Discuss Structure of Purines and Pyrimidines along with metabolism and disorder of nucleotides

Course outcome	**Mapping CO's with PO's**														
CO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**	**-**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**1**	**-**
CO2	3	-	2	2	-	2	-	-	-	-	-	1	3	1	-
CO3	3	-	2	2	-	1	-	-	-	-	-	1	3	1	-
CO4	3	-	2	2	-	2	-	-	-	-	-	1	3	1	-
CO5	3	-	2	1	-	2	-	-	-	-	-	1	3	1	-
Average CO	3	-	2	2	-	2	-	-	-	-	-	1	3	1	-

191BM221- INTRODUCTION TO BIOMEDICAL ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. To understand the concept human anatomy and physiology
2. To learn the concept of metabolism.
3. To study the working principles of various health monitoring devices.
4. To understand the need of biomaterials and biomechanics in health care.
5. To learn the ethical values in health care.

UNIT: I INTRODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY 9

Anatomy: Cell Structure, Organ system-Skin, Bones, Brain and Nervous system, Heart, Kidney and Liver Physiology: Circulatory physiology, Respiratory physiology, Excretory system.

UNIT: II NUTRIENT METOBOLISM 9

Food metabolism - Absorption, Digestion, Availability, Bio-energy and degradation.Synthesis of protein, Nutrient Supply. Fundamentals of vital signs.

UNIT: III INTRODUCTION TO HEALTH MONITORING MEDICAL DEVICES 9

Glucometer, Spectrophotometer, Blood cell counter, Biochemistry Analyzer, Blood infusion pump, Vital signs monitor, Spirometer, Plethysmography.

UNIT: IV BIOMATERIALS AND BIOMECHANICS 9

Introduction to Biomaterials- Sources & Its Requisite Properties-Mechanical Properties,Chemical Properties, Physical Properties. Introduction to Biomechanics- Stress, Strain & Its Relationship, Joint Mechanics, Gait Analysis And Its Parameters, Fluid Mechanics.

UNIT: V ETHICAL ISSUES ON BIOMEDICALENGINEERINGDEVICES 9

Device Manufacturing - Resources, Generalized systems for Measurements & Calibration, Standards. Case studies: Clinical database.

TOTAL PERIODS 45

TEXT BOOKS

1. John D. Enderle and Susan M. Blanchard, ―Introduction to Biomedical Engineering‖, Elsevier International Projects Ltd., Boston, 2005.
2. Laurence J. Street, ―"Introduction to Biomedical Engineering Technology", CRC Press,London, 2008.

REFERENCE BOOKS

1. R.S.Khandpur,- Handbook of Biomedical Instrumentation-3rd Edition .
2. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007.
3. John G. Webster, ―Medical Instrumentation: Application and Design‖, John Wiley and sons, New York, 2007
4. Joseph J. Carr and John M. Brown, ―"Introduction to Biomedical Equipment Technology", John Wiley & Sons, New York, 2008.

COURSE OUTCOMES

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

CO1	Explain the fundamental concepts of different systems in anatomy and physiology
CO2	Demonstrate the metabolism concepts.
CO3	Demonstrate the basic ideas of health monitoring devices used in health care.
CO4	Explain the concepts of biomaterials and idea of biomechanics used in biomedical engineering design concepts
CO5	Understand the ethical issues to be followed while handling Biomedical Engineering devices.

Course outcome	**Mapping CO's with PO's**														
CO's	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO 3**
CO1	3	2	1	1	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	2	1	-	-	-	-	-	-	1	3	2	-
CO4	3	3	3	2	1	-	-	-	-	-	-	1	3	2	-
CO5	3	-	-	1	-	-	-	3	-	-	-	-	2	-	-
Average CO	3	3	3	2	1	-	-	2	-	-	-	1	3	2	-

191EC21A-CIRCUITS AND DEVICES LAB **L T P C**
0 0 2 1

COURSE OBJECTIVES

1. To learn the characteristics of basic electronic devices such as Diode, BJT,FET,SCR
2. To understand the application of PN junction diode
3. To differentiate the operation of oscillators

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode
2. Zener diode Characteristics & Regulator using Zener diode.
3. Common Emitter input-output Characteristics.
4. Common Emitter input-output Characteristics.
5. Common Base input-output Characteristics.
6. FET Characteristics.
7. SCR Characteristics.
8. Positive and negative Clipper.
9. Positive and negative Clamper
10. FWR and ripple factor calculation
11. RC Phase shift oscillator and Wien Bridge Oscillator
12. Hartley Oscillator and Colpitts Oscillator

TOTAL PERIODS 15

COURSE OUTCOMES

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

CO1 Ability to fabricate electrical and electronics circuits.

CO2 Demonstrate wide knowledge on transistors

CO3 Able to understand the working of oscillators.

Course outcome	**Mapping CO's with PO's**														
CO's	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO 3**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-
Average CO	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-

191ME21A-ENGINEERING PRACTICES LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES

- To provide exposure to the students with hands on experience on various basicengineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
-

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings: (a) Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects. Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
© Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
© Demonstration of plumbing requirements of high-rise buildings.
Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise: Wood work, joints by sawing, 44 lanning and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding: (a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding
.(b) Gas welding practice Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice Sheet Metal Work: (a) Forming & Bending: (b) Model making – Trays and funnels.
© Different type of joints. Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner
Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example –
Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
Fitting – Exercises – Preparation of square fitting and V – fitting models

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE **16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.

TOTAL PERIODS 60

COURSE OUTCOMES

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

CO1 Able to demonstrate the fundamental knowledge on civil practices.

CO2 Analyze the fundamentals of various mechanical engineering practices.

CO3 Able to understand the importance of electronic components and equipments.

Course outcome	Mapping CO's with PO's														
CO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	-	2	3	-	-	-	-	2	2	1	-
CO2	3	3	2	2	-	2	3	2	-	-	-	2	2	1	-
CO3	3	3	2	2	-	2	3	-	-	-	-	2	2	1	-
Average CO	3	3	2	2	-	2	3	2	-	-	-	2	2	1	-

191BM22A-BIOCHEMISTRY LAB

L T P C
0 0 2 1

COURSE OBJECTIVES:

To provide practice on:

1. Estimation and quantification of biomolecules.
2. Separation of macromolecules.
3. Estimation and interpretation of biochemical parameter

LIST OF EXPERIMENTS

1. Estimation of starch by Anthrone method
2. Estimation of amino acid by Ninhydrin titration
3. Estimation of protein by Lowry's method from germinating seeds
4. Estimation of cholesterol by Zak's method
5. Preparation of solutions: 1) percentage solutions, 2) molar solutions, 3) normal solutions
6. Standardization of pH meter, preparation of buffers, emulsions.
7. Spectroscopy: Determination of absorption maxima (λmax) of a given solution
8. Estimation of Urea by DAM-TSC method
9. Determination of enzyme activity – AST
10. Determination of enzyme activity – ALT

DEMONSTRATION

11. Identification of proteins by SDS electrophoresis.
12. Identification of amino acids by thin layer chromatography.

TOTAL PERIODS- 15

COURSE OUTCOMES

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

CO1	Understand the Biochemistry laboratory functional components
CO2	Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample
CO3	Have a sound knowledge of separation technology of proteins and amino acids.

Course outcome	**Mapping CO's with PO's**														
CO's	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**	**-**	**2**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**1**	**1**
CO2	3	-	2	3	-	2	-	-	-	-	-	1	3	1	1
CO3	3	-	2	2	-	1	-	-	-	-	-	2	3	1	1
Average CO	3	-	2	2	-	2	-	-	-	-	-	2	3	1	1

SEMESTER – III

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191MA301	Linear Algebra And Numerical Methods	BS	2	2	0	3
2	191CS311	Data Structures In C	ES	3	0	0	3
3	191BM321	Anatomy And Human Physiology	PC	3	0	0	3
4	191BM322	Digital Logic Design	PC	3	0	0	3
5	191BM323	Signals And System	PC	3	0	0	3
6	191BM324	Biosensors & Instrumentation	PC	3	0	0	3
PRACTICAL							
7	191CS31A	Data Structures In C Laboratory	ES	0	0	2	1
8	191BM32A	Anatomy And Human Physiology Laboratory	PC	0	0	2	1
9	191BM32B	Digital Design Laboratory	PC	0	0	2	1
				17	2	6	21

191MA301-LINEAR ALGEBRA AND NUMERICAL METHODS

L T P C
2 2 0 3

COURSE OBJECTIVES

1. To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
2. To understand the concepts of vector space, linear transformations.
3. To apply the concept of inner product spaces in orthogonalization.
4. To provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

UNIT I VECTOR SPACES 9

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT II LINEAR TRANSFORMATION 9

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations

UNIT III INNER PRODUCT SPACES 9

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT-IV SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Iterative method Newton - Raphson method for single variable. Solutions of Linear system by Gaussian Gauss – Jordan, Jacobi and Gauss – Seidel methods, Inverse of a matrix by Gauss –Jordan method. Eigen value of a matrix by power and Jacobi methods.

UNIT-V INTERPOLATION 9

Newton forward and backward difference formulae - Lagrange's Interpolation – Newton's divided difference fomula- Stirling's Bessel's central difference formulae.

TEXT BOOKS

1. Grewal B.S., ―Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Friedberg, A.H., Insel, A.J. and Spence, L., ―Linear Algebra, Prentice Hall of India, New Delhi, 2004.
3. Datta, "Numerical Methods for Linear Control Systems" CBS Publishers. Chennai2005

REFERENCES

1. James, G. ―Advanced Modern Engineering Mathematics‖, Pearson Education, 2007.
2. Kolman, B. Hill, D.R., ―Introductory Linear Algebra‖, Pearson Education, New Delhi, First Reprint, 2009.
3. Lay, D.C., ―Linear Algebra and its Applications‖, 5th Edition, Pearson Education, 2015.
4. O'Neil, P.V., ―Advanced Engineering Mathematics‖, Cengage Learning, 2007.
5. Srinivasan, "Numerical Methods for Engineering" CBS Publishers.Chennai.1994.
6. Yang, "Applied Numerical Methods Using MATLAB" CBS Publishers. Chennai 2005
7. Burden, R.L. and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
8. Balagurusamy: Numerical Methods, Scitech.
9. Baburam: Numerical Methods, Pearson Education.
10. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
11. SoumenGuha& Rajesh Srivastava: Numerical Methods, OUP

COURSE OUTCOME

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

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Have a fundamental knowledge of the basic solutions of equations and eigen value problems.
- Acquire skills in handling situations involving first and second order differentialequations.

	PROGRAM OUTCOMES (POs)														
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	1	1	-	-
CO4	3	-	-	-	3	-	-	-	-	-	-	1	1	-	-
CO5	3	-	-	-	3	-	-	-	-	-	-	-	1	-	-
CO	3	2	-	-	3	-	-	-	-	-	-	1	1	-	-

191CS-311 DATA STRUCTURES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To learn the features of C
2. To learn the Linear and Non Linear Data structures
3. To explore the applications of Linear and Non linear data Structures
4. To Learn to represent data using graph data structures
5. To Learn the basic Sorting and Searching algorithms

UNIT I C PROGRAMMING BASICS **9**

Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays. Strings- String operations – String Arrays. Simple programs – sorting, searching – matrix operations.

UNIT II FUNCTIONS, POINTERS, STRUCTURES AND UNIONS **9**

Functions – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic. Structures and unions - definition – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

UNIT III LINEAR DATA STRUCTURES **9**

Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

UNIT IV NON-LINEAR DATA STRUCTURES **9**

Trees –Binary Trees–Binary tree representation and traversals –Binary Search Trees – Applications of trees. Set representations - Union-Find operations. Graph and its representations – Graph Traversals.

UNIT V SEARCHING AND SORTING ALGORITHMS **9**

Linear Search -Binary Search. Bubble Sort, Insertion sort – Merge sort – Quick sort - Hash tables – Overflow handling.

COURSE OUTCOMES

- Describe the basics of C programming language
- Apply the concepts of functions, pointers, structures and unions for the given application
- Analyze and implement linear data structure operations in C
- Analyze and evaluate non linear data structure for the given application
- Apply the hashing concepts an choose the appropriate sorting algorithm for an application

TEXTBOOKS

1.PradipDey and Manas Ghosh, ―Programming in C, Second Edition, Oxford University Press, 2011.
2. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

REFERENCES

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms, Pearson Education, 1983.
3. Robert Kruse, C.L.Tondo, Bruce Leung, ShashiMogalla, ― Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
4. Jean-Paul Tremblay and Paul G. Sorenson, ―An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.

CO, PO, PSO MAPPING															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	3	3	3	-	-	-	-	-	-	-	3	3	-
CO 2	3	3	2	3	3	-	-	-	-	-	-	-	3	3	-
CO 3	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
CO 4	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
CO 5	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2
CO	3	3	3	3	3	3	-	-	-	-	3	3	3	3	2

191BM321-ANATOMY & HUMAN PHYSIOLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To identify all the organelles of an animal cell and their function.
2. To understand structure and functions of the various types of systems of human body.
3. To demonstrate their knowledge of importance of anatomical features and physiology of human systems

UNIT I: INTRODUCTION TO ANATOMY: CELLS AND TISSUES 9

Structure of cell, cell types, cell components and its functions- Membrane potential- Action Potential, electrical stimulation-Blood cell, composition and origin of RBC- Blood groups, estimation of RBC, WBC and platelet count- Blood groups identification -Tissues and its types

UNITII:RESPIRATORY SYSTEM AND MUSCULO SKELETAL SYSTEM 9

Physiological aspects of respiration-Trachea and lungs, exchange of gases-Regulation of respiration, disturbance of respiration function-Muscles, structure of skeletal muscle-Physiology of muscular contraction-Joints and its classification-Sliding Filament theory.

UNITIII: CARDIOVASCULAR AND NERVOUS SYSTEM 9

Heart, major blood vessels, cardiac cycle, blood pressure-Cardiac output, coronary and peripheral circulation-Structure and function of nervous tissue, neuron , synapse-Brain, spinal cord, reflex action-Peripheral nervous system- Autonomic nervous system.- Identification of nervous system.

UNIT IV: DIGESTIVE AND EXCRETORY SYSTEM 9

Digestive System: Organization of GI system, digestion and absorption-Movements of GI tract, intestine-Liver, pancreas.
Excretory System: Anatomy of Kidney, Ureters, Bladder and Urethra, Structure of nephron- Mechanism of urine formation, urine reflex- Skin and sweat gland, temperature regulation.

UNIT V: SENSORY ORGANS AND ENDOCRINE GLANDS 9

Optics of eye, retina, photochemistry of vision, Accommodation-Neurophysiology of vision-Physiology of internal ear, mechanism of hearing. Auditory pathway-Endocrine glands and its types.

TOTAL PERIODS 45

COURSE OUTCOMES

- Explain basic structure and functions of the cell.
- Outline the physiology of respiration, and the different components of respiratory system, Physiology of muscles and joints
- Summarize the physiology of heart associated with blood pressure and Analyze how the neurons transmit the impulse and the reflex mechanism
- Explain the components involved in digestive and urinary system also the physiology
- Explain the mechanism and physiology involved in vision and hearing and understand the use of endocrine glands

TEXT BOOKS

1. Prabhjot Kaur. Text Book of Anatomy and Physiology. Lotus Publsihers. 2014
2. Elaine.N. Marieb , ―Essential of Human Anatomy and Physiology‖, Eight Edition, Pearson Education, New Delhi, 2007
3. Ross and Wilson, Anatomy and physiology in health and illness,12th edition,2014.

REFERENCES

1. Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew, Fundamentals of Anatomy and Physiology. Pearson Publishers, 2014
2. Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2013
3. William F.Ganong, ―Review of Medical Physiology‖, 22nd Edition, Mc Graw Hill, New Delhi, 2010
4. Eldra Pearl Solomon, ―Introduction to Human Anatomy and Physiology‖, W.B. Saunders Company, 2015
5. Guyton & Hall, ―Medical Physiology‖, 13th Edition, Elsevier Saunders, 2015

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	1	1	-	-	-	-	1	-	1	2	3	1	1
CO 2	3	2	1	1	-	-	-	-	1	-	1	2	3	1	1
CO 3	3	2	1	1	-	-	-	-	1	-	1	2	3	1	1
CO 4	3	2	1	1	-	-	-	-	1	-	1	2	3	1	1
CO 5	3	2	1	1	-	-	-	-	1	-	1	2	3	1	1
CO	3	2	1	1	-	-	-	-	1	-	1	2	3	1	1

191BM322-DIGITAL LOGIC DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The student should be made to:

1. To present the Digital fundamentals, Boolean algebra and its applications in digital systems
2. To familiarize with the design of various combinational digital circuits using logic gates
3. To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
4. To explain the various semiconductor memories and related technology
5. To introduce the electronic circuits involved in the making of logic gates

UNIT I INTRODUCTION TO NUMBER SYSTEM AND DIGITAL LOGIC GATES 9

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

UNIT II COMBINATIONAL CIRCUIT DESIGN 9

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

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV ASYNCHRONOUSSEQUENTIALCIRCUITS 9

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Design of Hazard free circuits, Types of faults-ATPG.

UNIT V MEMORYDEVICESANDDIGITAL INTEGRATED CIRCUITS 9

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL. Introduction to CMOS technology.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course:

- Use digital electronics in the present contemporary world
- Design various combinational digital circuits using logic gates
- Do the analysis and design procedures for synchronous and asynchronous sequential
- circuits
- Use the semiconductor memories and related technology
- Use electronic circuits involved in the design of logic gates

TEXT BOOK

1.M. Morris Mano and Michael D. Ciletti, ―Digital Design‖, 5th Edition, Pearson, 2014.

REFERENCES

1.CharlesH.Roth. ―Fundamentals of Logic Design‖, 6th/7th Edition, Thomson Learning, 2013/2018.
2.Thomas L. Floyd, ―Digital Fundamentals‖, 10th Edition, Pearson Education Inc, 2011
3.S.Salivahanan and S.Arivazhagan―Digital Electronics‖, Ist Edition, Vikas Publishing House pvt Ltd, 2012.
4.AnilK.Maini ―Digital Electronics‖, Wiley, 2014.
5.A.Anand Kumar ―Fundamentals of Digital Circuits‖, 4th Edition, PHI Learning Private Limited, 2016.
6.Soumitra Kumar Mandal ― Digital Electronics‖, McGraw Hill Education Private Limited, 2016.
7. Principles CMOS VLSI Design | Pearson Education India | NHE Weste, K Eshraghian second editions.

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	2	1	-	-	-	-	-	-	-	1	3	2	1
CO 2	3	3	3	1	-	-	-	-	-	-	-	1	3	2	1
CO 3	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1
CO 4	3	2	2	1	-	-	-	-	-	-	-	1	3	2	1
CO 5	3	2	3	1	-	-	-	-	-	-	-	1	3	2	1
CO	3	3	3	1	-	-	-	-	-	-	-	1	3	2	1

191BM323-SIGNALS AND SYSTEM **L T P C**
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To understand the basic properties of signal & systems
2. To know the methods of characterization of LTI systems in time domain
3. To analyze continuous time signals and system in the Fourier and Laplace domain
4. To analyze discrete time signals and system in the Fourier and Z transform domain

UNIT I CLASSIFICATION OF SIGNALS AND SYTEMS **9**

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids - Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic& Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Static & Dynamic ,Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable

UNIT IIANALYSIS OF CONTINUOUS TIME SIGNALS **9**

Fourier series for periodic signals - Fourier Transform and its properties- Laplace transforms and its properties

UNITIII ANALYSIS OF DISCRETE TIME SIGNALS **9**

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

UNIT IV LINEAR **TIME INVARIANT CONTINUOUS TIME SIGNALS** **9**

Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties- Baseband signal Sampling – Sampling and aliasing.

UNIT VLINEAR TIME INVARIANT (LTI) - DISCRETE TIME SIGNALS **9**

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

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course

- To be able to determine if a given system is linear/causal/stable
- Capable of determining the frequency components present in a deterministic signal
- Capable of characterizing LTI systems in the time domain and frequency domain
- To be able to compute the output of an LTI system in the time and frequency domains
- Able to solve engineering problems using Fourier series and Laplace transform

TEXT BOOKS

1. A.V. Oppenheim, A.S.Willsky and S.H.Nawab, Signals & Systems, Prentice Hall of India, New Delhi 2015
2.S. Haykin and B.V.Veen, Signals and Systems, John Wiley & Sons, N. Y, Second edition,2007

REFERENCE BOOKS

1. C.L.Philips, J. M. Parr, E. A Riskin, Signals, Systems and Transforms, 3rd ed., Pearson Education, Delhi, 2014
2. R.E.Zeimer, W. H. Tranter, and D. R. Fannin, Signals and Systems: Continuous and Discrete, Pearson Education, Delhi,2010
3. J.Roberts, Signals and Systems: Analysis using Transform methods and MATLAB, Tata Mc-Graw Hill, New Delhi,2001

CO, PO, PSO MAPPING															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	3	3	2	2	1	-	-	-	-	-	3	3	2	1
CO 2	3	3	3	2	2	1	-	-	-	-	-	3	3	2	1
CO 3	3	3	3	2	2	1	-	-	-	-	-	3	3	2	1
CO 4	3	3	3	2	2	1	-	-	-	-	-	3	3	2	1
CO 5	3	3	3	2	2	1	-	-	-	-	-	3	3	2	1
CO	3	3	3	2	2	1	-	-	-	-	-	3	3	2	1

191BM324-BIOSENSORS & INSTRUMENTATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

- Know the principle of transduction, classifications and the characteristics ofdifferent sensors.
- Know the different types of resistive transducers and signal conditioning amplifiers for resistive transducesrs
- Learn Inductive and pohotoelectric transduction principles and their applications
- Understand the fundamentals of solid-state Image sensing

UNIT I:BASICSONSENSORS& PRINCIPLES 9

Physiological transducers-Resistive sensors- Bridge circuits – inductive sensors – capacitive sensors- piezoelectric sensors- temperature measurements- thermocouples- Thermistors- Radiation thermometry- optical measurements-optical filters- radiation sensors.

UNIT II:RESISTIVETRANSDUCERS 9

Thermo resistors – thermistor– metallic strain gauges – catheter type and catheter tip – potentiometer transducers – magnetostrictive – Hall effect – elastic resistors in biomedical applications Signal conditioning Amplifiers fro voltage dividers-sensor bridge calibration and balance- power supply for Wheatstone's bridge – differential amplifiers – instrumentation amplifier – interference – types and reduction – signal circuit grounding – isolation amplifier Reactance transducers.

UNIT III:INDUCTIVETRANSDUCERS 9

Single Inductor – mutual inductance –LVDT – RVDT – electromagnetic flow meters in biomedical applications. Capacitor transducers: Capacitor configuration – measuring circuits – characteristics – biomedical applications Signal conditioning Carrier amplifier – phase sensitive detectors – applications to LVDT – specific signal conditioning for capacitive sensors.

UNIT IV:PHOTOELECTRICTRANSDUCERS 9

Photo emissive tubes – photo multiplier tubes- scintillation counter – photo devices – colorimetric applications – Thermography – Non – colorimetric applications. Piezoelectric devices – Accelerometer – Pulse – echo – techniques – Application of ultrasound in blood flow meters – pulse echo applications. Signal conditioning Chopper amplifiers – auto zero amplifiers- composite amplifiers- Offsets and drifts Image sensors.

UNIT V:SOLIDSTATEIMAGESENSING 9

Fundamentals of solid photo sensing – Charge coupled devices transportation of photo signals – electronic signal detection –Architectures of image sensors – semiconductor technology for Image sensing the future of image sensing Types –CMOS imaging sensors – Fiber optic sensors – Ultrasound based sensors, Biosensors – types – examples.

TOTAL PERIODS 45

COURSE OUTCOMES

The students would be able to

- To analyze the performance of sensor and evaluate the various types of sensors
- To apply a rigorous engineering design principles and methodology to design the signal conditioning amplifiers for resistive transducesrs
- To demonstrate the various capacitive and Inductive transducers
- To articulate various photoelectric transducers
- To elucidate various detection devices

TEXT BOOKS

1. Principles of Applied Biomedical Instrumentation – LA GEDDES & L.F.BAKER John Wiley and sons Inc, 1989.
2. Sensors and signal conditioning – Raman Pallas-Areny&J.G.Webster, II edition, 2003
3. The measurement, instrumentation and sensors handbook – John G. Webster, John Wiley and sons 2002.

REFERENCES

1. Khandpur, R.S. Handbook of Biomedical Instrumentation, Tata McGraw Hill PublishingCompany, New Delhi 2003.
2. John G. Webster, Medical Instrumentation: Application and Design, Third edition, 1997, John Wiley & Sons

CO, PO, PSO MAPPING															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	3	3	3	2	2	1	-	1	-	1	3	3	1	2
CO 2	3	3	3	3	2	2	1	-	1	-	1	3	3	1	2
CO 3	3	3	3	3	2	2	1	-	1	-	1	3	3	1	2
CO 4	3	3	3	3	2	2	1	-	1	-	1	3	2	1	2
CO 5	3	3	3	3	2	2	1	-	1	-	1	3	3	1	2
CO	3	3	3	3	2	2	1	-	1	-	1	3	3	1	2

191CS32A-DATA STRUCTURES IN C LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

1. To learn linear and non-linear data structures.
2. To understand the different operations of search trees.
3. To implement graph traversal algorithms.
4. To perform sorting and searching algorithms.

LIST OF EXPERIMENTS

1. Basic C Programs – looping, data manipulations, arrays
2. Programs using strings – string function implementation
3. Programs using structures and pointers
4. Programs involving dynamic memory allocations
5. Array implementation of stacks and queues
6. Linked list implementation of stacks and queues
7. Application of Stacks and Queues
8. Implementation of Trees, Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Linear search and binary search
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort
12. Implementation Hash functions, collision resolution technique

TOTAL: 30 PERIODS

COURSE OUTCOMES

- State the functions to implement linear and non-linear data structure operations.
- Identify appropriate linear / non-linear data structure operations for solving a given problem and Construct appropriate sorting and searching functions based on the application
- Analyze appropriate hash functions that result in a collision free scenario for data storage and retrieval.

CO-PO & PSO Mapping

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

191BM32B-DIGITAL DESIGN LABORATORY

L T P C

0 0 2 1

COURSE OBJECTIVES

1. To acquire the basic knowledge of special function IC
2. To understand the usage of multiplexer, encoder, counter
3. To implement the concept of adder, subtracter and logic gates**.**

LIST OF EXPERIMENTS

1. Design and implementation of code converters using logic gates (i) BCD to excess-3 code and **vice** versa (ii) Binary to gray and vice-versa
2. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
3. Design and implementation of Multiplexer and De-multiplexer using logic gates
4. Design and implementation of encoder and decoder using logic gates
5. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counter
6. Design and implementation of 3-bit synchronous up/down counter
7. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.
8. SPICE Simulation studies.

COURSE OUTCOMES

At the end of the course , the students can able to

- Design multiplexer , encoder using logic gates.
- Design shift registers using flip flops
- Acquire knowledge in PSPICE

TOTAL PERIODS 30

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
CO	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2

191BM32A-ANATOMY AND HUMAN PHYSIOLOGY LABORATORY **L T P C**
0 0 2 1

COURSE OBJECTIVES

1. To estimation and quantification of blood cells
2. To learnt methods for identification of blood groups
3. To estimation of haematological parameters
4. To learnt the analysis of visual and hearing test

LIST OF EXPERIMENTS

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

TOTAL: 30 PERIODS

COURSE OUTCOMES

At the end of the course , the students can able to

- Identification and enumeration of blood cells
- Enumeration of haematological parameters
- Analysis of special sensory organs test

CO-PO & PSO Mapping															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	-	1	1	2	-	-	-	-	1	-	2	3	1	1
CO2	3	-	2	1	1	-	-	1	1	-	-	2	3	1	1
CO3	3	2	-	-	-	2	-	-	-	-	-	2	3	1	1
CO	3	2	2	1	2	2	-	1	1	1	-	2	3	1	1

SEMESTER – IV

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191MA401	Probability And Random Process	BS	2	2	0	3
2	191BM421	Biomedical Instrumentation	PC	3	0	0	3
3	191BM422	Biomechanics	PC	3	0	0	3
4	191BM423	Biosignal Processing	PC	3	0	0	3
5	191BM424	Pathology And Microbiology	PC	3	0	0	3
6	191BM425	Bioethics & Intellectual Property Rights (IPRs)	PC	3	0	0	3
PRACTICAL							
7	191HS40A	Reading And Writing Skill Laboratory	HSS	0	0	2	1
8	191BM42B	Biosignal Processing Lab	PC	0	0	2	1
9	191BM42A	Pathology And Microbiology Lab	PC	0	0	2	1
				16	4	6	21

191MA401-PROBABILITY AND RANDOM PROCESSES

L	T	P	C
2	2	0	3

COURSE OBJECTIVES

1. Acquire skills in handling situations involving more than one random variable and functions of random variables.
2. Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
3. Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

UNIT I PROBABILITY AND RANDOM VARIABLES 9

Probability -Axioms of probability – Conditional probability –Baye's theorem - Random variable - Probability mass function - Probability density function - Cumulative distribution function - Moments - Moment generating functions.

UNIT II STANDARD DISTRIBUTIONS 9

Discrete distributions - Binomial, Poisson, Geometric distributions - Continuous distributions- Uniform-Exponential, and Normal distributions

UNIT III TWO DIMENSIONAL RANDOM VARIABLES 9

Random variables-One and two dimensional random variables-Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression.

UNIT IVRANDOM PROCESSES 9

Random process-Classification – definition and examples-Stationary process –first and second order-strict and wide sense process-problems - Ergodic process – Markov process-Poisson process.

UNIT VCORRELATION AND SPECTRAL DENSITIES 9

Auto correlation-Cross correlation-properties-problems-Power spectral density-Cross spectral density-properties-Relationship between cross power spectrum and cross correlation function.

TEXT BOOKS

1. Ibe.O.C., "Fundamentals of Applied Probability and Random Process",Elaevier,1st Indian Reprint,2007.
2. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, New Delhi, 2002.

REFERENCES:

1. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
2. Stark. H., and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition,Pearson Education, Asia, 2002.
3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.

COURSE OUTCOMES (COS):

- Demonstrate and apply the basic probability axioms and concepts in their core areas.
- Apply the concepts of probability distributions in an appropriate place of science andEngineering.
- Calculate the relationship of two dimensional random variables using correlation techniquesand to study the properties of two dimensional random variables.
- Estimate the functions of time when the probability measure is associated through random process.
- Evaluate the concept of spectral density functions.

CO,PO,PSO MAPPING															
Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	1	1	-	-
CO 4	3	-	-	-	3	-	-	-	-	-	-	1	1	-	-
CO 5	3	-	-	-	3	-	-	-	-	-	-	-	1	-	-
CO	3	2	-	-	3	-	-	-	-	-	-	1	1	-	-

191BM421-BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The student should be made to

1. To Illustrate origin of bio potentials and its propagations
2. To understand the different types of electrodes and its placement for various recordings
3. To design bio amplifier for various physiological recordings
4. To learn the different measurement techniques for non-physiological parameters
5. To Summarize different biochemical measurements.

UNIT I BIOPOTENTIAL ELECTRODES 9

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, Contact impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - motion artifacts, measurement with two electrodes.

UNIT II BIOPOTENTIAL MEASUREMENTS 9

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

UNIT III SIGNAL CONDITIONING CIRCUITS 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 BIOCHEMICAL MEASUREMENT AND BIOSENSORS 9

Biochemical sensors - pH, pO2 and pCO2, 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.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Differentiate different bio potentials and its propagations.
- Illustrate different electrode placement for various physiological recordings
- Design bio amplifier for various physiological recordings
- Explain various technique for non-electrical physiogical measurements
- Demonstrate different biochemical measurement techniques.

TEXT BOOK

1. Leslie Cromwell, ―Biomedical Instrumentation and measurement‖, 2nd edition, Prentice hall of India, New Delhi, 2015.
2. Khandpur R.S, ―Handbook of Biomedical Instrumentation‖, 3rd edition, Tata McGraw-Hill New Delhi, 2014.

REFERENCES

1. John G. Webster, ―Medical Instrumentation Application and Design‖, 4th edition, Wiley India Pvt Ltd,New Delhi, 2015.
2. Joseph J. Carr and John M. Brown, ―Introduction to Biomedical Equipment Technology‖, Pearson Education, 2004.
3. Myer Kutz, ―Standard Handbook of Biomedical Engineering and Design‖, McGraw Hill Publisher, 2003.

CO,PO,PSO MAPPING

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

191BM422-BIOMECHANICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The student should be made to

1. To understand the concepts of kinetics and kinematics
2. To understand the stress and strain relationship in bone growth
3. Explain the mechanics of upper extremities in human
4. Discuss the biomechanics of lower extremity and spine
5. Explain the principles of Ergonomics

UNIT I KINEMATIC AND KINETIC CONCEPTS OF HUMAN MOTION 9

Introduction, forms of motion, standard reference terminology, joint movement terminology- Spatial reference systems, qualitative analysis of human movement, tools for measuring kinematic quantities – Basic concepts related to kinetics, mechanical loads on the human body – Effects of loading, tools for measuring kinetic quantities, vector algebra.

UNIT II BIOMECHANICS OF BONE GROWTH AND SKELETAL MUSCLE 9

Composition and structure of bone tissue, bone growth and development, bone response to stress – Osteoporosis – Joint Architecture, joint stability, joint flexibility, techniques for increasing joint flexibility, common joint injuries – Structural organization of skeletal muscle, Soft tissues: Structure, Functions, material properties and modelling of soft tissues.

UNIT III BIOMECHANICS OF THE HUMAN UPPER EXTREMITY 9

Structure of the shoulder, movements of the shoulder, loads on the shoulder, common injuries of the shoulder – Joint-Articulating surface motion of shoulder – Structure of the elbow, movements at the elbow, loads on the elbow, common injuries of the elbow – Joint-articulating surface motion of elbow – Structure of the wrist, movements of the wrist, structure of the joints of the hand, movements of the hand, common injuries of the wrist and hand – Joint-Articulating surface motion of Wrist.

UNIT IV BIOMECHANICS OF THE HUMAN LOWER EXTREMITY AND SPINE 9

Structure of the hip, movements at the hip, loads on the hip, common injuries of the hip-Joint-Articulating surface motion of hip – Structure of the knee and ankle, movements at the knee and ankle loads on the knee and ankle, common injuries of the knee and ankle – Joint-articulating surface motion of knee – Structure of the spine, Biomechanical analysis of spine, muscles of the spine, loads on the spine, Gait Analysis.

UNIT V ERGONOMICS AND APPLICATION OF BIOMECHANICS 9

Finite element analysis of lumbar spine, Ergonomics and principles. Biomechanics in physical education – Biomechanics in strength and conditioning – Gait analysis – biomechanics in sports, medicine and rehabilitation.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Differentiate the concept of kinetics and kinematics.
- Analyse the stress and strain relationship in bone growth.
- Analyse the concepts of motion in joints.
- Perform biomechanical analysis of spine.
- Outline the principles of biomechanics in ergonomics.

TEXT BOOKS

1. Y.C. Fung, ―Bio-Mechanics- Mechanical Properties of Tissues‖, Springer-Verlag, 1998.
2. Subrata Pal, ―Textbook of Biomechanics‖, Viva Books Private Limited, 2009.

REFERENCES

1. Krishna B. Chandran, Ajit P. Yoganathan and Stanley E. Rittgers, ―Biofluid Mechanics: The Human Circulation‖, Taylor and Francis, 2007.
2. Sheraz S. Malik and Shahbaz S. Malik, ―Orthopaedic Biomechanics Made Easy‖, Cambridge University Press, 2015.
3. Jay D. Humphrey, Sherry De Lange, ―An Introduction to Biomechanics: Solids and Fluids, Analysis and Design‖, Springer Science Business Media, 2004.
4. Shrawan Kumar, ―Biomechanics in Ergonomics‖, Second Edition, CRC Press 2007.
5. Neil J. Mansfeild, ―Human Response to Vibration‖, CRC Press, 2005.
6. Carl J. Payton, ―Biomechanical Evaluation of movement in sports and Exercise‖, 2008
7. Susan J.Hall, Basics Bio Mechanics 5th Edition, McGraw-Hill Publishing Co, Newyork,2007.

PO,CO,PSO MAPPING															
Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	1	1	2	1	1	-	-	-	-	2	3	2	-
CO 2	3	2	1	1	3	1	1	1	-	-	-	2	3	2	1
CO 3	3	2	1	1	3	1	1	1	-	-	-	2	3	2	1
CO 4	3	2	1	1	3	1	1	1	-	-	-	2	3	2	1
CO 5	3	2	1	1	3	1	1	2	-	-	-	2	3	2	1
CO	3	2	1	1	3	1	1	2	-	-	-	2	3	2	1

191BM423-BIO-SIGNAL PROCESSING

L	T	P	C
2	2	0	3

COURSE OBJECTIVES

The student should be made to

1. Understand the basics of biosignals.
2. Explain the filtering concepts used in biosignals.
3. Analyse the event detection for better understanding of biosignals.
4. Discuss the frequency domain analysis and its applications
5. Outline the concepts of Signal processing and processors.

UNIT I:INTRODUCTIONTOBIOMEDICALSIGNALS **9**

Origin, nature and acquisition of bio – Signals Examples of biomedical signals-EEG, EMG, ECG, VAG, evoked potentials, etc. Noise processes - Random noise, structured noise, and Physiological interference – Statistical signal processing – Finite time estimation of mean – Variance and correlation.

UNIT II:FILTERING **9**

Time domain filtering – Synchronous averaging, Moving average filters, Frequency domain filters – Design of Butterworth filters- optimal filtering, Adaptive noise cancellation – LMS and RLS algorithms in adaptive filtering – Application of these techniques in removal of artifacts in biosignals.

UNIT III:EVENTDETECTION **9**

Detection of events and waves –Derivative based operators in QRS detection – Pan Tompkins algorithm – Correlation analysis – A CF and CCF in rhythm analysis – Cross-spectral techniques Murmur detection – Homomorphic filtering – Matched filters – Wavelet detection –Spike and wave detection – Extraction of vocal tract response and other applications.

UNIT IV:FREQUENCYDOMAINANALYSIS **9**

Frequency domain representation – Fourier transforms – Fourier spectrum-Discrete FT – FFT Estimation of power spectral density function based of FT – Measures derived from PSDs – Parametric and nonparametric methods in PSD estimation – Parametric system modelling, Autoregressive modelling, Moving average models, Pole-zero modelling – Applications.

UNIT V:INTRODUCTIONTODIGITALSIGNALPROCESSING **9**

Introduction to discrete-time signals and systems – Z-Transform – Filter designing by placement of poles and zeros – Statistical digital signal processing – Multiple digital signal processing, Introduction to DSP processors – Medical applications of digital signal processing.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Analyse the origin and nature of biosignals.
- Apply the concept of filtering in biosignal analysis.
- Detect ORS complex in ECG signals and to perform rhythm analysis.
- Perform Fourier domain analysis using transforms.
- Outline the principles of signal processing.

TEXT BOOKS

1. RangarajM.Rangayyan, Biomedical signal analysis, John Wiley &Sons.Inc. 2002
2. John G. Proakis and Dimitris G. Manolakis, *Digital signal processing: principles, algorithms, and applications*, Pearson Prentice Hall, 2007.

REFERENCE

1. Monson H.Hayes , Statistical Digital signal processing, John Wiley &Sons.Inc. 1996
2. Arnon Cohen, Biomedical Signal Processing Vol I and II, CRC Press Inc., Boca Ralon, Florida, 1988. Mode of Evaluation: Written examination, Assignment and Seminar.

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

191BM424-PATHOLOGY AND MICROBIOLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to

1. Gain a knowledge on the structural and functional aspects of living organisms.
2. Know the etiology and remedy in treating the pathological diseases.
3. Empower the importance of public health.

UNIT I INTRODUCTION TO CELL PATHOLOGY 9

Basic introduction of cell and cell injury – Pathogenesis of cell injury – Morphology of cell injury – Cellular adaptation – Atrophy and hypertrophy – Cellular ageing. Circulatory disturbances – Thrombosis – Embolism –Ischemia – Infarction – Disorders of muscle and nerve: Peripheral nerve injuries, neuropathies, hereditary sensory neuropathy, GuillenBarre syndrome, myopathy.

UNIT II INFLAMMATIONS 9

Inflammation and Healing – Acute Inflammation – Morphology of Acute Inflammation – Chronic Inflammation – General Features of Chronic Inflammation – Types of Chronic Inflammation – Granulomatous Inflammation –Inflammation in Cancer cells.

UNIT III IMMUNOPATHOLOGY 9

Classification – Benign and Malignant tumours – Carcinogenesis – Molecular Pathogenesis of Cancer Immunopathology – Transplant Rejection – Hypersensitivity Reactions – Autoimmune Diseases. Immunological techniques – Immune diffusion – Immuno electrophoresis – RIA and ELISA – Monoclonal antibodies.

UNITIV INTRODUCTION TO MICROBIOLOGY 9

Microbiology – Structure of Bacteria and Virus – Routes of infection and spread – Endogenous and Exogenous infections – Morphological features and structural organization of bacteria and virus – Growth curve – Identification of bacteria – Culture media and its types – Culture techniques and observation of culture – Disease caused by bacteria – Fungi – Protozoal – Virus and helminthes.

UNIT V TECHNIQUES & DIAGNOSTICS OF PATHOPHYSIOLOGY 9

Techniques – Histochemistry – Enzyme Histochemistry – Basic Microscopy – Immunofluorescence – Electron Microscopy – Immunohistochemistry – Cytogenetics – Microscopic analysis of diseases – Peptic ulcer – Nephritis – Nephrosis – Cirrhosis of liver – Coronary artery diseases – Hypertension.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Explain the different pathological conditions in cell.
- Discuss the concepts of inflammation.
- Explain the concepts of tumors and carcinogenesis.
- Describe the different culture techniques.
- Explain the techniques involved in pathophysiology.

TEXTBOOKS

1. Harsha Mohan ―"Text book of pathology", 7th Edition, 2015 Published by Jaypee Brothers Medical Publishers.
2. Vinay Kumar & Abul K. Abbas & Jon C. Aster―"Robbins &Cotran Pathologic Basis of Disease", 9th Edition, 2014 Published by Elsevier Health Publications.
3. Dr. Reba Kanungo ― "Ananthanarayanan&Panicker Textbook of Microbiology", 10th Edition, 2017.

REFERENCES

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000.
2. Dubey RC and Maheswari DK. ―A Text Book of Microbiology‖ Chand & Company Ltd, 2007.
3. Prescott, Harley and Klein, ―Microbiology‖, 10th edition, McGraw Hill, 201

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

191BM425-BIOETHICS & INTELLECTUAL PROPERTY RIGHTS (IPRs)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The student should be made to

1. Understand the need of bioethics
2. Get knowledge of biosafety and genetically modified organisms
3. Explain the concepts of regulatory mechanisms for GMO's
4. Understand the concepts of IPR
5. Discuss about biosafety

UNIT I INTRODUCTION TO BIOETHICS **9**

Bioethics and its scope – Different approaches to ethics – Disease prevention and right to privacy – Biological weapons and their social and ethical implications – morality – Professional conducts and responsibility – Business ethics.

UNIT II INTRODUCTION TO BIOSAFETY AND GENETICALLY MODIFIED ORGANISMS (GMOs) **9**

Overview of biosafety and risk assessment – Cartagena protocol for biosafety – Introduction to GMOs – Transgenic technology – Gene flow – Biosafety of GMO – NGOs for biosafety.

UNIT III REGULATORY MECHANISMS FOR GMOs **9**

Introduction – National regulatory mechanism – International regulatory mechanism – Regulatory measures for biosafety – Biosafety guidelines evolved in India by DBT – Prevention food adulteration act – Food and safety standard bill and seed policy- Rules for manufacture and storage of hazardous GMOs.

UNIT IV INTRODUCTION TO IPRs **9**

Introduction to IPRs – Concept of IPRs – Designs – Trademarks – Trade secrets – Domain names – Geographical indications – Copyrights – Patents – Patent laws – Classification of patents.

UNIT V CASE STUDIES IN IPR AND BIOSAFETY **9**

Diamond Vs Chakraborty case (1980) – Dimminaco A.G. Case (2002) – Neem patient case – Turmeric patent case – Bt Cotton – Bt Brinjal – Golden Rice.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Apply bioethics in health care
- Discuss the nature of genetically modified organisms
- Outline the concepts of regulatory mechanisms for GMO's
- Explain the concepts of Intellectual property rights
- Describe the concept of Biosafety.

TEXT BOOKS

1. Shomini Parashar, Deepa Goel, " IPR, Biosafety and Bioethics", Pearson India, 2013.
2. Flemind OD and Hunt LD. "Biological Safety: Principles and Practices". ASM Press, 2006.

REFERENCE

1.WIPO Academy – Intellectual Property and Bioethics: An overview.

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

191HS40A-READING AND WRITING SKILLS LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

1. It makes the students free of their inferiority complex regarding language
2. It amplifies the student's level of confidence in his/her personal career
3. It elevates the success rate of the students in their professional career
4. It improves the academic standards and the employability skills
5. It helps to overcome the cultural barriers

LIST OF EXPERIMENTS

ACTIVE LISTENING AND RESPONDING
Active listening - Asking questions – Responding to the questions - Listen to the Audio – visual components – Listening Comprehension
PRESENTATION SKILLS
Introduction to Presentation – Building up confidence - Effective Presentation – Body Language - Poster presentations – subject relevant seminars –
SPEAKING SKILLS
General Conversation – Short speech - Role play activities - Question and Answer sessions
WRITING SKILLS
Effective writing - Letter writing – E-mail writing – Paragraph writing – Story writing
GROUP DISCUSSION
Importance of Group Discussion – Understanding the dynamics of GD – Activities to improve the GD Skills – Mock GD – Video samples

COURSE OUTCOMES

Co1: Student will be an active listener so as to respond accurately and effectively and Students becomes confident enough to present anything successfully
Co2: Student becomes free for making queries and answer to queries without hesitation.
Co3: Student learns to write effectively and be able to draft letters, E-mails impressively and Student understands the dynamics of GD and so participates in GDs confidently.

REFERENCE BOOKS

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. Interact English Lab Manual for Undergraduate Students,.OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.
6. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
7. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

WEB SERIES

1.https://learnenglishteens.britishcouncil.org/skills/writing/upper-intermediate-b2-writing/report
2. https://www.ted.com/talks

PO,CO,PSO MAPPING															
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
CO 2	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
CO 3	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-
CO	-	-	-	-	-	-	-	2	3	3	-	3	1	-	-

191BM42A-PATHOLOGY AND MICROBIOLOGY LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES:

The student should be made to:

1. Use Compound microscope
2. Practice on chemical examinations, Cryoprocessing, Histopathological examinations etc

LIST OF EXPERIMENTS:

1. Urine physical and chemical examination (protein, reducing substances, ketones,bilirubin and blood)
2. Study of parts of compound microscope
3. Histopathological slides of benign and malignant tumours.
4. Manual paraffin tissue processing and section cutting (demonstration)
5. Cryo processing of tissue and cryosectioning (demonstration)
6. Basic staining – Hematoxylin and eosin staining.
7. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS
8. Capsule stain
9. Simple stain.
10. Gram stain.
11. AFB stain.
12. Antigen-Antibody reaction Immuno electrophoresis 14. Slides of malarial parasites,micro filaria and leishmania donovani.
13. Haematology slides of anemia and leukemia.
14. Study of bone marrow charts.

TOTAL: 30 PERIODS

COURSE OUTCOMES

- Student can perform practical experiments on tissue processing, cryoprocessing, staining Processes etc
- Student can able to identify blood groups
- Students can perform basic and special stains

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

191BM42B-BIO SIGNAL PROCESSING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES:

- To provide practice on designing and analysis of different Bio potentials
- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB

LIST OF EXPERIMENTS

1) Design of pre amplifiers to acquire bio signals along with impedance matching circuit using suitable IC‘s
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) Measurement of pH and conductivity.
7) Measurement of blood pressure using sphygmomanometer.
8) Measurement of pulse-rate using Photo transducer.
9) Generation of elementary Discrete-Time sequences
10) Auto correlation and Cross Correlation
11) Frequency Analysis using DFT
12) Analysis of Rhythm Detection in EEG
13) Use a Signal Averaging Algorithm in EEG Analysis
14) Smoothening Filters in ECG, QRS detection and R-R interval
15) Design of FIR filters (LPF/HPF) and demonstrates the filtering operation
16) Design of Butterworth and Chebyshev IIR filters (BPF/BSF) and demonstrate the filtering operations

TOTAL : 30 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- The learner is able to design amplifiers for the Bio medical signals.
- Carryout basic signal processing operations
- Demonstrate their abilities towards MATLAB based implementation of various FIR and IIR filters

PO,CO,PSO MAPPING															
Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	2	1	1	-	-	-	-	-	-	1	3	2	-
CO 2	3	2	2	2	2	-	-	-	-	-	-	2	3	2	-
CO 3	3	3	3	2	3	-	-	-	-	-	-	2	3	2	1
CO	3	3	3	2	3	-	-	-	-	-	-	2	3	2	1

SEMESTER – V

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191BM521	Diagnostic And Therapeutic Equipment	PC	3	0	0	3
2	191BM522	Hospital Management	PC	2	2	0	3
3	191BM523	Control Systems in medicine	PC	3	0	0	3
4	191BM524	Biomaterials & Artificial Organs	PC	3	0	0	3
5	191BM525	Microprocessor& Microcontroller	PC	3	0	0	3
6		Program Elective-I	PE	3	0	0	3
PRACTICAL							
7	191BM52B	Diagnostic And Therapeutic Equipments Lab	PC	0	0	2	1
8	191BM52A	Microprocessor & Microcontroller Lab	PC	0	0	2	1
				16	**4**	**4**	**20**

191BM521-DIAGNOSTIC AND THERAPEUTIC EQUIPMENT L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. Understand the devices used in ICU and principles of Telemetry.
2. Describe types of diathermy and its uses
3. Demonstrate applications of ultrasound in medicine
4. Explain extracorporeal devices used in critical care
5. Discuss the importance of patient safety against electrical hazard

UNIT I PATIENT MONITORING AND BIOTELEMETRY 9

Patient monitoring systems, ICU/CCU Equipments, bed side monitors, Infusion pumps, Central consoling controls. Radio Telemetry (single, multi), Portable and Landline Telemetry unit, Applications in ECG and EEG Transmission.

UNIT II DIATHERMY 9

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

UNIT III ULTRASONIC EQUIPMENTS 9

Diagnosis: Tissue Reaction, Basic principles of Echo technique, display techniques A, B and M mode, B Scan, Application of ultrasound as diagnostic tool – Echocardiogram, Echoencephalogram, abdomen, obstetrics and gynaecology, ophthalmology.

UNIT IV EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC TECHNIQUES 9

Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenators, finger pump, roller pump, electronic monitoring of functional parameters. HemoDialyser unit, Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laparoscopy, Otoscopes. Thermography – Recording and clinical application.

UNIT V PATIENT SAFETY 9

Physiological effects of electricity – important susceptibility parameters – Macro shock – Micro shock hazards – Patient‘s electrical environment – Isolated Power system – Conductive surfaces – Electrical safety codes and standards – IEC 60601-1 2005 standard, Basic Approaches to Protection against shock, Protection equipment design, Electrical safety analyzer – Testing the Electric system

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Discuss the various equipment used in ICU and applications of telemetry.
- Explain the types of diathermy and its applications.
- Express the basics of ultrasound and its application in medicine
- Discuss the various extracorporeal and special diagnostic devices used in hospitals
- Outline the importance of patient safety against electrical hazard

TEXT BOOKS

1. John G. Webster, ―Medical Instrumentation Application and Design‖, 4th edition, Wiley India PvtLtd,New Delhi, 2015
2. Joseph J. Carr and John M. Brown, ―Introduction to Biomedical Equipment Technology‖, Pearson education, 2012.

REFERENCES

1. Leslie Cromwell, ―Biomedical Instrumentation and measurement‖, 2nd edition, Prentice hall of India, New Delhi, 2015.
2. Richard Aston ―Principles of Biomedical Instrumentation and Measurement‖, Merril Publishing Company, 1990.
3. L.AGeddas and L.E.Baker ―Principles of Applied Biomedical Instrumentation‖ 2004.
4. Myer Kutz ―Standard Handbook of Biomedical Engineering & Design‖, McGraw-Hill Publisher, 2003.
5. Khandpur R.S, ―Handbook of Biomedical Instrumentation‖, 3rdedition,Tata McGraw-Hill, New Delhi, 2014

CO,PO, PSO MAPPING															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	2	-	2	2	1	-	-	-	3	3	2	2
CO 2	3	3	3	2	-	2	2	-	-	-	-	3	3	3	3
CO 3	3	3	2	2	-	2	2	-	-	-	-	3	3	3	2
CO 4	3	3	3	2	-	2	2	-	-	-	-	3	3	3	3
CO 5	3	2	2	-	-	2	1	1	-	-	-	2	3	2	1
CO	**3**	**2**	**2**	**2**	**-**	**2**	**2**	1	**-**	**-**	**-**	**3**	**3**	**3**	**2**

191BM522- HOSPITAL MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

- To understand the fundamentals of hospital administration and management.
- To know the market related research process
- To explore various information management systems and relative supportive services.
- To learn the quality and safety aspects in hospital.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio-Medical Waste Management.

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL 9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III MARKETING RESEARCH PROCESS 9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets &Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES 9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL 9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Explain the principles of Hospital administration.
- Identify the importance of Human resource management.
- List various marketing research techniques
- Identify Information management systems and its uses
- Explain safety procedures followed in hospitals.

TEXT BOOKS

1. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006.
2. G.D.Kunders, ―Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

REFERENCES

1. Cesar A.Caceres and Albert Zara, ―The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Norman Metzger, ―Handbook of Health Care Human Resources Management‖, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3. Peter Berman ―Health Sector Reform in Developing Countries‖ - Harvard University Press, 1995. 4. William A. Reinke ―Health Planning For Effective Management‖ - Oxford University Press.1988
5. Blane, David, Brunner, ―Health and SOCIAL Organization: Towards a Health Policy for the 21st Century‖, Eric Calrendon Press 2002.
6. Arnold D. Kalcizony& Stephen M. Shortell, ―Health Care Management‖, 6th Edition Cengage Learning, 2011.

CO,PO, PSO MAPPING

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

191BM523-CONTROL SYSTEMS IN MEDICINE

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To understand the concept behind feedback and continuum in various systems and subsystems.
2. To analyse the systems in time and frequency domain and to understand the concept of stability.
3. To apply mathematical modelling principles in understanding the various fundamental biological systems .
4. To analyse biological system models using MATLAB.

UNIT I INTRODUCTION **12**

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

UNIT II TIME RESPONSE ANALYSIS **12**

Step and impulse responses of first order and second order systems, time domain specifications of first and second order systems, steady state error constants, Definition of stability, Routh- Hurwitz criteria of stability, root locus technique, construction of root locus and study of stability.

UNIT III FREQUENCY RESPONSE ANALYSIS **12**

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

UNIT IV BIOLOGICAL SYSTEM MODELS **12**

Distributed parameter versus lumped parameter models, Model development of Cardiovascular system-Heart model-circulatory model, Pulmonary mechanics- Lung tissue visco-elastance-chest wall- airways, Interaction of Pulmonary and Cardiovascular models, Static analysis of physiological systems – Regulation of cardiac output, Regulation of ventilation.

UNIT V BIOLOGICAL CONTROL SYSTEM ANALYSIS **12**

Simple models of muscle stretch reflex action, Study of steady state analysis of muscle stretch reflex action, Study of transient response analysis of neuromuscular reflex model action, Study of frequency response of circulatory control model, Stability analysis of Pupillary light reflex.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of this subject, the student will be able to:

- Explain the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
- Analyze the time response of various systems and discuss the concept of system stability
- Analyze the frequency response characteristics of various systems using different charts
- Explain the concept of modeling basic physiological systems

- Comprehend the application aspects of time and frequency response analysis in physiological control systems.

TEXT BOOKS

1. I.J. Nagarath and M. Gopal ―Control Systems Engineering", Fifth Edition, Anshan Publishers, 2008.
2. Michael C K Khoo, ―Physiological Control Systems‖, IEEE Press, Prentice Hall of India, 2005

REFERENCES

1. Benjamin C. Kuo, ―Automatic Control Systems‖, Prentice Hall of India, 1995.
2. John Enderle Susan Blanchard, Joseph Bronzino ―Introduction to Biomedical Engineering‖, second edition, Academic Press, 2005.
3. Richard C. Dorf, Robert H. Bishop, ―Modern control systems‖, Pearson, 2004.

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

191BM524-BIOMATERIALS & ARTIFICIAL ORGANS

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. Study the evaluation process on artificial organs
2. Know about transplantation procedures for individual organs
3. Understand principle and design parameters for implants
4. Know about blood interfacing implants and implantable medical devices

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS ARTIFICIAL ORGANS: - 9

Introduction, outlook for organ replacements, design consideration, evaluation process.
TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN 9

Principles of implant design, Clinical problems requiring implants for solution, Permanent versus absorbable devices, the missing organ and its replacement, Tissue engineering, scaffolds, cells and regulators criteria for materials selection, Case study of organ regeneration.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION 9

Biocompatibility, local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration.

UNIT IV BLOOD INTERFACING IMPLANTS 9

Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS 9

Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation, recent advancement and future directions.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Students will be able to

- To know about artificial organs evaluation process and procedure for transplantation of organs
- To apply a engineering principles for designing an implants
- To design an implantable device based on their various wear and tear properties
- To apply ideas on designing blood interfacing implants
- To design and develop implantable devices and organs on dentistry, maxillofacial and craniofacial

TEXT BOOKS

1. Kopff W.J, Artificial Organs, John Wiley and sons, New York, 1st edition, 1976.
2. Park J.B., ―Biomaterials Science and Engineering‖, Plenum Press, 1984.

REFERENCES

1. J D Bronzino, Biomedical Engineering handbook Volume II, (CRC Press / IEEE Press), 2000.
2. R S Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, 2003
3. Joon B Park, Biomaterials – An Introduction, Plenum press, New York, 1992.
4. Yannas, I. V, ―Tissue and Organ Regeneration in Adults‖, New York, NY: Springer, 2001. ISBN:9780387952147.
5. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, ―Clinical Engineering‖, CRC Press, 1st edition,2010.
6. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw- Hill, 2003.

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

191BM525-MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The student should be made to:

1. To understand the Architecture of 8086 microprocessor.
2. To learn the design aspects of I/O and Memory Interfacing circuits.
3. To interface microprocessors with supporting chips.
4. To study the Architecture of 8051 microcontroller.
5. To design a microcontroller-based system

UNIT I THE 8086 MICROPROCESSOR **9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE **9**

Signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Introduction to advanced processors.

UNIT III I/O INTERFACING **9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT IV MICROCONTROLLER **9**

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

UNIT V INTERFACING MICROCONTROLLER **9**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students should be able to:

- Execute programs based on 8086 microprocessor.
- Explain the bus structures used in microprocessor.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems
- Design Memory Interfacing circuits.

TEXT BOOKS

1. Yu-Cheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007. (UNITI-III)
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C‖, Second Edition, Pearson education, 2011.(UNIT IV-V)

REFERENCES

1. DoughlasV.Hall, ―Microprocessors and Interfacing, Programming and Hardware‖,TMH,2012
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012

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

191BM52B-DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY

L T P C
0 0 2 1

OBJECTIVES

- The student should be made to demonstrate recording and analysis of different Bio potentials
- To examine different therapeutic modalities.

LIST OF EXPERIMENTS:

1. Measurement of visually evoked potential
2. Galvanic skin resistance (GSR) measurement
3. Study of shortwave and ultrasonic diathermy
4. Measurement of various physiological signals using biotelemetry
5. Study of hemodialysis model
6. Electrical safety measurements
7. Measurement of Respiratory parameters using spirometry.
8. Study of medical stimulator
9. Analyze the working of ESU – cutting and coagulation modes
10. Recording of Audiogram
11. Study the working of Defibrillator and pacemakers
12. Analysis of ECG, EEG and EMG signals
13. Study of ventilators
14. Study of Ultrasound Scanners
15. Study of heart lung machine model

OUTCOMES:

At the end of the lab, the student should be able to:

- Measure different bioelectrical signals using various methods
- Assess different non-electrical parameters using various methodologies
- Illustrate various diagnostic and therapeutic techniques

CO,PO, PSO MAPPING															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO7**	**P O 8**	**PO 9**	**PO 10**	**PO 11**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	2	2	-	2	2	2	-	-	-	3	3	2	2
CO 2	3	3	3	2	-	2	2	2	-	-	-	3	3	3	3
CO 3	3	3	2	2	-	2	2	2	-	-	-	3	3	3	2
CO	**3**	**2**	**2**	**2**	**-**	**2**	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**2**

191BM52A-MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L T P C
0 0 2 1

OBJECTIVES

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

LIST OF EXPERIMENTS: 8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

Peripherals and Interfacing Experiments

7. Traffic light controller
8. Stepper motor control
9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation

OUTCOMES:

At the end of the course, the student should be able to:

- Write ALP Programmes for fixed and Floating Point and Arithmetic operations
- Interface different I/Os with processor
- Execute Programs in 8051

CO,PO, PSO MAPPING															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO 2	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO 3	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**
CO	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**

LIST OF ELECTIVES

SEMESTER-V

ELECTIVE-I

	COURSE CODE	COURSE TITLE	L	T	P	C
1	191BM534	VLSI DESIGN	**3**	**0**	**0**	**3**
2	191BM533	TISSUE ENGINEERING	**3**	**0**	**0**	**3**
3	191BM532	BIOMETRIC SYSTEMS	**3**	**0**	**0**	**3**
4	191BM531	BIOMEMS	**3**	**0**	**0**	**3**

191BM533-TISSUE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

6. To understand the use of tissue Engineering concepts in therapy.
7. To learn the properties and components of tissues.
8. To learn the biological properties of scaffolds and role of nanotechnology.

UNIT I : INTRODUCTION **9**

Introduction to tissue engineering: Basic definition; current scope of development; use in therapeutics, cells as therapeutic agents, cell numbers and growth rates, measurement of cell characteristics morphology,number viability, motility and functions. Measurement of tissue characteristics, appearance, cellular component, ECM component, mechanical measurements and physical properties.

UNIT II : TISSUE ARCHITECTURE **9**

Tissue types and Tissue components,Tissue repair,Engineering wound healing and sequence of events.Basic wound healing Applications of growth factors: VEGF/angiogenesis,Basicproperties,Cell-Matrix&Cell-CellInteractions,telomeres and Selfrenewal, Control of cell migration in tissue engineering.

UNIT III : BIOMATERIALS **9**

Biomaterials: Properties of biomaterials ,Surface, bulk, mechanical and biological properties. Scaffolds & tissue engineering, Types of biomaterials, biological and synthetic materials, Biopolymers, Applications of biomaterials,Modifications of Biomaterials, Role of Nanotechnology.

UNIT IV: GENE THERAPY **9**

Bioreactors for Tissue Engineering, Gene therapy and gene transfer techniques, protein and peptide engineering, stem cell programming, controlled release and drug delivery, tissue ablation, material based immunotherapy

UNIT V: APPLICATIONS OF TISSUE ENGINEERING **9**

In vivo cell & tissue engineering case studies: Artificial skin, Artificial blood vessels, Artificial pancreas, Artificial liver, regeneration of bone, muscle, Nerve regeneration.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Measure different cell and tissue characteristics.
- Understand the tissue components and its application in wound healing.
- Apply the concept of biomaterials in the field of nanotechnology.
- Understand the concept of gene therapy in tissue engineering
- Apply the knowledge of tissue engineering in recent trends

TEXT BOOKS:

1. Bernhard O.Palsson,SangeetaN.Bhatia,"Tissue Engineering" Pearson Publishers 2009.
2. Meyer, U.; Meyer, Th.; Handschel, J.; Wiesmann, H.P. Fundamentals of Tissue Engineering and Regenerative Medicine.2009.

REFERENCES:

1. Bernard N. Kennedy (editor). New York : Nova Science Publishers, 2008.Stem cell transplantation, tissue engineering, and cancer applications
2. Raphael Gorodetsky, Richard Schäfer. Cambridge : RSC Publishing, c2011.Stem cell based tissue repair.
3. R. Lanza, I. Weissman, J. Thomson, and R. Pedersen, Handbook of Stem Cells, TwoVolume, Volume 1-2: Volume 1-Embryonic Stem Cells; Volume 2-Adult &Fetal Stem Cells, 2004, Academic Press.
4. R. Lanza, J. Gearhart etal (Eds), Essential of Stem Cell Biology, 2006, ElsevierAcademic press.
5. J. J. Mao, G. Vunjak-Novakovic et al (Eds), Translational Approaches In Tissue Engineering &Regenrative Medicine" 2008, Artech House, INC Publications.
6. Naggy N. Habib, M.Y. Levicar, , L. G. Jiao,.and N. Fisk, Stem Cell Repair and Regeneration, volume-2, 2007, Imperial College Press

CO,PO, PSO MAPPING

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

191BM532- BIOMETRIC SYSTEMS **LTPC**
3 0 0 3

OBJECTIVES:

The student should be made to:

- To understand the technologies of fingerprint, iris, face and speech recognition
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- To recognize personal privacy and security implications of biometrics based identification technology.
- To identify issues in the realistic evaluation of biometrics based systems.

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:

At the end of the course, the student should be able to:

- Demonstrate knowledge engineering principles underlying biometric systems.
- Understand the different technologies involved in fingerprint recognition.
- Design Basic face recognition system
- Understand the concepts and design basic voice recognition system
- Analyze concept of fusion used in biometric applications.

TEXT BOOKS:

1. James Wayman, Anil Jain, DavideMaltoni, Dario Maio, ―Biometric Systems, Technology Design and Performance Evaluation‖, Springer, 2005.
2. David D. Zhang, ―Automated Biometrics: Technologies and Systems‖, Kluwer Academic Publishers, New Delhi, 2000.
3. Arun A. Ross ,KarthikNandakumar, A.K.Jain, ―Handbook of Multibiometrics‖, Springer, New Delhi, 2006.

REFERENCES:

1. Paul Reid, ―Biometrics for Network Security‖, Pearson Education, 2004.
2. Nalini K Ratha, Ruud Bolle, ―Automatic fingerprint Recognition System‖, Springer, 2003
3. L C Jain, I Hayashi, S B Lee, U Halici, ―Intelligent Biometric Techniques in Fingerprint and Face Recognition‖ CRC Press, 1999.
4. John Chirillo, Scott Blaul, ―Implementing Biometric Security‖, John Wiley, 2003.
5. S.Y. Kung, S.H. Lin, M.W.Mak, ―Biometric Authentication: A Machine Learning Approach‖Prentice Hall, 2005

CO, PO, PSO MAPPING

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

191BM534-VLSI DESIGN **L T P C**
3 0 0 3

OBJECTIVES:
1. Study the fundamentals of CMOS circuits and its characteristics.
2.Learn the design and realization of combinational & sequential digital circuits.
3. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
4.Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I MOS TRANSISTOR PRINCIPLE 9
NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II COMBINATIONAL LOGIC CIRCUITS 9
Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS 9
Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture, Synchronous and Asynchronous design

UNIT IV DESIGNING ARITHEMETIC BUILDING BLOCKS 9
Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters

UNIT V IMPLEMENTATION STRATEGIES 9
Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

OUTCOMES:
At the end of the course, the student should be able to:
- Demonstrate knowledge engineering principles underlying CMOS circuits.
- Explain the different combinational logic circuits.
- Design Synchronous and asynchronous sequential circuits.
- Understand the concepts and design of arithmetic building blocks.
- Implement FPGA architectures.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Jan Rabaey, AnanthaChandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective". Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application specific integrated Circuits", Addisson Wesley, 1997
REFERENCES:
1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley,1993.
2. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation",Prentice Hall of India, 2005
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India,2007.

CO, PO, PSO MAPPING

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

191BM531-BIO MEMS **L T P C**
3 0 0 3

OBJECTIVES:
The student should be made to:
- Learn various MEMS fabrication techniques.
- Understand different types of sensors and actuators and their principles of operation at the micro scale level.
- Know the application of MEMS in different field of medicine.

UNIT I MEMS MATERIALS AND FABRICATION **9**
Typical MEMs and Microsystems, materials for MEMS - active substrate materials-Silicon and its compounds, Silicon piezoresistors, Gallium Arsenide, quartz, polymers.Micromachining photolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA.

UNIT II MECHANICAL AND THERMAL SENSORS AND ACTUATORS **9**
Mechanics for MEMs design- static bending of thin plates, mechanical vibration, thermomechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever –microplates, strain, pressure and flow measurements, Thermal sensors and actuators-actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys-Inertia sensor, flow sensor

UNIT III ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATORS
Parallel plate capacitor, pull in effect, Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive. Properties of piezoelectric materials, Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.

UNIT IV MICROFLUIDIC SYSTEMS **9** Fluid dynamics, continuity equation, momentum equation, equation of motion, laminar flow in circular conduits, fluid flow in microconduits, in submicrometer and nanoscale. Microscale fluid, expression for liquid flow in a channel, fluid actuation methods, dielectrophoresis, microfluid dispenser, microneedle, micropumps-continuous flow system, micromixers

UNIT V APPLICATIONS OF BIOMEMS **9** CAD for MEMS, Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR),DNA sensor, MEMS based drug delivery, Biosensors- sensors for glucose, uric acid, urea and triglyceride sensor.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Discuss various MEMS fabrication techniques.
- Explain different types of sensors and actuators and their principles of operation at the micro-Scale level.
- Explain about the micro fluidic systems
- Apply MEMS in different field of medicine.

TEXT BOOKS:
1. Tai Ran Hsu, ―MEMS and Microsystems Design and Manufacture‖, Tata McGraw Hill Publishing Company, New Delhi, 2002. (Unit I, II, III & IV).

2. Wanjun Wang, Stephen A.Soper, ‖BioMEMS: Technologies and Applications‖, CRC Press, New York, 2007.(Unit V). 109

REFERENCES:

1. Marc J. Madou ―Fundamentals of Microfabrication: the Science of Miniaturization‖, CRC Press,2002.
2. NadimMaluf, Kirt Williams. ―An introduction to MicroelectroMechancial Systems Engineering‖, Second Edition, Artech House Inc, MA, 2004.
3. Chang Liu,‘ Foundations of MEMS‘, Pearson Education International, New Jersey, USA,2006
4. NitaigourPremchandMahalik, ―MEMS‖, Tata McGraw Hill Publishing Company, New Delhi, 2007.

CO, PO, PSO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	1	-	1	-	-	-	-	-	1	2	-	-
CO 2	3	3	3	2	-	2	-	-	-	-	-	1	2	1	-
CO 3	3	1	1	1	-	-	-	-	-	-	-	1	2	-	-
CO 4	1	1	1	3	3	3	-	-	-	-	-	1	2	1	-
CO	3	3	3	3	3	3	-	-	-	-	-	1	2	1	-

SEMESTER –VI

S.NO	COURSE CODE	COURSE TITLE	Category	L	T	P	C
		THEORY					
1	191BM621	ADVANCED MICROCONTROLLER AND ITS APPLICATIONS	**PC**	**3**	**0**	**0**	**3**
2	191BM622	COMMUNICATION SYSTEMS	**PC**	**3**	**0**	**0**	**3**
3	191BM623	MEDICAL INFORMATICS	**PC**	**3**	**0**	**0**	**3**
4	191BM624	RADIOLOGICAL EQUIPMENTS	**PC**	**3**	**0**	**0**	**3**
5		PROGRAM ELECTIVE-II	**PE**	**3**	**0**	**0**	**3**
6		OPEN ELECTIVE-I	**OE**	**3**	**0**	**0**	**3**
		PRACTICALS					
1	191HS60A	COMMUNICATION SKILLS LAB	**HSS**	**0**	**0**	**2**	**1**
2	191BM62A	COMMUNICATION SYSTEMS LAB	**PC**	**0**	**0**	**2**	**1**
3	191HS60B	INNOVATION PRACTICES LABORATORY	**PC**	**0**	**0**	**2**	**1**

191BM621-ADVANCED MIVROCONTROLLER AND ITS APPLICATIONS

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to

1. Architecture and programming concepts of PIC Microcontroller.
2. Design of real time system using PIC Microcontroller.
3. Basic concepts of ARM processor.

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx–- Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine - Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.

UNIT III PERIPHERALS AND INTERFACING 9

I2C Bus for Peripherals Chip Access– Bus operation -Bus subroutines– Serial EEPROM—Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing-ADC,DAC,andSensorInterfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

ARM Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy –ARM Assembly Language Programming–Simple Examples

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution-ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

CORSE OUTCOMES

At the end of the course, the student should be able to:

- Explain the architecture ,memory organization and programming of PIC microcontroller
- Develop an embedded C program using the internal functional blocks of PIC microcontroller for the given requirement.
- Explain the peripherals and interfacing of controller.
- Implement assembly language programming by ARM processor.
- Explain the architecture and instruction set of ARM processor

TEXT BOOKS

1. Peatman,J.B., “Design with PIC Micro Controllers”PearsonEducation,3rdEdition, 2004.
2. Furber,S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2000.

REFERENCE

1. Mazidi, M.A.,“PIC Microcontroller” Rollin Mckinlay, Danny causey Printice Hall of India, 2007.

CO-PO and PSO Mapping															
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	1	1	1	1	-	-	-	-	-	-	2	2	1	-
CO 2	3	3	3	2	3	-	-	-	-	-	-	2	3	2	-
CO 3	3	1	1	1	1	-	-	-	-	-	-	2	2	1	-
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	2	-
CO5	3	1	1	1	1	-	-	-	-	-	-	2	2	1	-
CO	3	2	2	2	2	-	-	-	-	-	-	2	2	2	-

191BM622-COMMUNICATION SYSTEMS

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To Know the principles of analog communication
2. To describe different techniques involved in digital communication
3. Be familiarized with source and Error control coding.
4. To learn the principles of multiple access techniques.
5. Gain knowledge on biotelemetry

UNIT I ANALOG COMMUNICATION **9**

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB,DSB/SC, SSB, VSB AM Transmitter & Receiver.

UNIT II DIGITAL COMMUNICATION **9**

Pulse Digital Modulation: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Companding in PCM systems. Differential PCM systems (DPCM). Time Division Multiplexing & Demultiplexing. ASK, FSK,PSK, QPSK

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only) 9

Primary communication – entropy, properties, BSC, BEC, source coding :Shaum, Fao, Huffman coding : noiseless coding theorum, BW – SNR trade off codes: NRZ, RZ, AMI.

UNIT IV MULTIPLE ACCESS TECHNIQUES **9**

SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication :Advantages (merits) :

UNIT V INTRODUCTION TO BIOTELEMETRY **9**

An introduction to telemetry, basic system, Classification, Introduction to biotelemetry ,non-electrical telemetry systems, Voltage and currrent Telemetry Systems, Current Telemetry system, Frequency Telemetring, Local Transmitters and convereters, Power line Carrier Communication (PLCC)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Apply Analog communication techniques in biotelemetry.
- Apply digital communication techniques.
- Analyze source and error control coding.
- Utilize multiple access techniques.
- Explain the techniques involved in Biotelemetry.

TEXT BOOKS

1. Taub &Schiling "Principles of Communication Systems" Tata McGraw Hill 2007.
2. J.Das "Principles of Digital Communication" New Age International, 1986.

REFERENCES

1. Kennedy and Davis "Electronic Communication Systems" Tata McGraw hill, 4th Edition, 1993.
2. Sklar "Digital Communication Fundamentals and Applications" Pearson Education, 2001.
3. Bary le, Memuschmidt, Digital Communication, Kluwer Publication, 2004.
4. B.P.Lathi "Modern Digital and Analog Communication Systems" Oxford University Press, 1998.
5.Khandpur R.S, ―Handbook of Biomedical Instrumentation‖, 3rdedition,Tata McGraw-Hill, New Delhi, 2014.

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	3	1	-	2	-	-	-	-	-	2	2	1	-
CO 2	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-
CO 3	3	1	1	1	-	2	-	-	-	-	-	2	2	1	-
CO4	3	3	3	3	-	2	-	-	-	-	-	2	3	2	-
CO5	3	1	1	1	-	2	-	-	-	-	-	2	2	1	-
CO	3	2	2	2	-	2	-	-	-	-	-	2	2	2	-

191BM623- MEDICAL INFORMATICS

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To understand the concept of bioinformatics.
2. To describe different medical standards used in health care.
3. To know the techniques of medical data storage.
4. To learn the principles of bioinformatics database.
5. To discuss the recent trends in the field of medical informatics.

UNIT I MEDICAL INFORMATICS **9**

Introduction – Medical Informatics – Bioinformatics – Health Informatics - Structure of Medical Informatics –Functional capabilities of Hospital Information System - On-line services and Off – line services - Dialogue with the computer

UNIT II MEDICAL STANDARDS **9**

Evolution of Medical Standards – IEEE 11073 - HL7 – DICOM – IRMA - LOINC – HIPPA –Electronics Patient Records – Healthcare Standard Organizations – JCAHO (Joint Commission on Accreditation of Healthcare Organization) - JCIA (Joint Commission International Accreditation) - Evidence Based Medicine - Bioethics.

UNIT III MEDICAL DATA STORAGE AND AUTOMATION **9**

Representation of Data, Data modeling Techniques, Relational Hierarchical and network Approach,Normalization techniques for Data handling - Plug-in Data Acquisition and Control Boards – Data Acquisition using Serial Interface – Medical Data formats – Signal, Image and Video Formats – Medical Databases - Automation in clinical laboratories - Intelligent Laboratory Information System – PACS.

UNIT IV HEALTH INFORMATICS **9**

Bioinformatics Databases, Bio-information technologies, Semantic web and Bioinformatics, Genome projects, Clinical informatics, Nursing informatics, Public health informatics, Education and Training

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS **9**

Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment – Surgical simulation - Radiation therapy and planning – Telemedicine – virtual Hospitals Smart Medical Homes – Personalized e-health services – Biometrics - GRID and Cloud Computing in Medicine.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Discuss about health informatics and different ICT applications in medicine.
- Explain the function of Hospital Information Systems
- Analyze medical standards
- Explain about the bioinformatics database
- Discuss the recent trends and virtual reality concepts in informatics.

TEXT BOOKS

1.R.D.Lele, "Computers in medicine progress in medical informatics", Tata McGraw Hill Publishing Ltd, 2005 (Units I, III & IV).
2. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Ltd, 2003 (Units II, IV & V).

REFERENCES

1. OrpitaBosu and Simminder Kaur Thukral, "Bioinformatics Databases, Tools and Algorithms", Oxford University press, 2007.
2. Yi Ping Phoebe Chen, "Bioinformatics Technologies", Springer International Edition, New Delhi, 2007.

CO-PO and PSO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
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CO 3	3	-	-	-	-	1	-	-	-	-	-	-	1	-	-
CO 4	3	-	-	-	-	1	-	-	-	-	-	-	1	-	-
CO 5	3	-	-	-	-	1	-	-	-	-	-	-	1	-	-
CO	3	-	-	-	2	1	1	1	-	-	-	-	1	1	1

191BM624-RADIOLOGICAL EQUIPMENTS L T P C

3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To understand the generation of X-ray and its uses in imaging
2. To describe the principle of Computed Tomography.
3. To know the techniques used for visualizing various sections of the body.
4. To learn the principles of different radio diagnostic equipment in Imaging
5. To discuss the radiation therapy techniques and radiation safety.

UNIT I MEDICAL X-RAY EQUIPMENT 9

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Cathode and filament currents, Focusing cup, Thermionic emission, Electromagnetic induction, Line focus principle and the heel effect, Causes of x-ray tube failure: Electron arcing/filament burn out, Failure to warm up tube, High temp due to over exposure, x-ray tube rating charts.X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, Cine Angiography, Digital subtraction Angiography. Mammography and Dental x-ray unit.

UNIT II COMPUTED TOMOGRAPHY 9

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors-Viewing systems- spiral CT scanning – Ultra fast CT scanners. Advantages of computed radiography over film screen radiography: Time, Image quality, Lower patient dose, Differences between conventional imaging equipment and digital imaging equipment: Image plate, Plate readers, Image characteristics, Image reconstruction techniques- back projection and iterative method. 3D Imaging and its application.

UNIT III MAGNETIC RESONANCE IMAGING 9

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system- system magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), and shim coils, Electronic components, fMRI.

UNIT IV NUCLEAR MEDICINE TECHNIQUES 9

Nuclear imaging – Anger scintillation camera –Nuclear tomography – single photon emission computer tomography, positron emission tomography – Recent advances. Radionuclide imaging- Bone imaging, dynamic renal function, myocardial perfusion. Non imaging techniques- hematological measurements, Glomerular filtration rate, volume measurements, clearance measurement, whole -body counting, surface counting

UNIT V RADIATION THERAPY AND RADIATION SAFETY 9

Radiation therapy – linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of this course, the student should be ablto

1. Describe the working principle of X ray machine and its application.
2. Illustrate the principle computed tomography.
3. Interpret the technique used for visualizing various sections of the body using magnetic resonance imaging
4. Demonstrate the applications of radio nuclide imaging.
5. Outline the methods of radiation safety.

TEXT BOOKS

1. Steve Webb, ―The Physics of Medical Imaging‖, Adam Hilger, Philadelpia, 1988 (Units I, II, III & IV).
2. R.Hendee and Russell Ritenour ―Medical Imaging Physics‖, Fourth Edition William, Wiley-Liss, 2002.

REFERENCES

1. Gopal B. Saha ―Physics and Radiobiology of Nuclear Medicine‖- Third edition Springer, 2006.
2. B.H.Brown, PV Lawford, R H Small wood, D R Hose, D C Barber, ―Medical physics and Biomedical Engineering‖, - CRC Press, 1999.
3. Myer Kutz, ―Standard handbook of Biomedical Engineering and design‖, McGraw Hill, 2003.
4. P.Ragunathan, ―Magnetic Resonance Imaging and Spectroscopy in Medicine Concepts and Techniques‖,Paperback – Import, 2007
5. Khandpur R.S, ―Handbook of Biomedical Instrumentation‖, 3rdedition,Tata McGraw-Hill, New Delhi, 2014.

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	-	-	-	-	-	-	-	-	-	1	2	-	-
CO 2	3	3	1	3	-	-	-	-	-	-	-	1	2	-	-
CO 3	3	3	2	1	-	-	-	-	-	-	-	1	2	1	-
CO 4	3	3	-	2	-	-	-	-	-	-	-	1	2	-	-
CO 5	3	2	-	-	-	1	-	1	-	-	-	1	2	-	1
CO	3	3	2	3	-	1	-	1	-	-	-	1	2	1	1

191HS60A-COMMUNICATION SKILLS LABORATORY

L T P C
0 0 3 2

COURSE OBJECTIVES

The student should be made to:

1. To equip students of engineering and technology with effective speaking and listening skills in English.
2. To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
3. To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises

I. PC based session (Weightage 40%)

A. English Language Lab

1. Listening Comprehension:

6Listening and typing – Listening and sequencing of sentences – Filling in the blanks -Listening and answering questions.

2. Reading Comprehension: **6**

Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3.Speaking: **6**

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English. Conversations: Face to Face Conversation – Telephone conversation – Role play activities

B. Viewing and discussing audio-visual materials

(Samples are available to learn and practice)

1. Resume / Report Preparation / Letter Writing **1**

Structuring the resume / report - Letter writing / Email Communication - Samples.

2. Presentation skills: **1**

Elements of effective presentation – Structure of presentation - Presentation tools – Voice

Modulation – Audience analysis - Body language – Video samples

3. Soft Skills: **2**

Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. Group Discussion: **1**

Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. Interview Skills: **1**

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.

II. Practice Session (Weightage – 60%)

1. Resume / Report Preparation / Letter writing: Students prepare their own resume and report.

2.Presentation Skills: Students make presentations on given topics. 8

3.Group Discussion: Students participate in group discussions. 6

4.Interview Skills: Students participate in Mock Interviews 8

COURSE OUTCOME

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

CO1: To be totally learner-centric with minimum teacher intervention as the course revolves around practice and Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.

CO3: Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.

CO4:GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.

REFERENCE

1. Anderson, P.V, Technical Communication, Thomson Wadsworth , Sixth Edition, New Delhi, 2007.
2. Prakash, P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, 2004.
4. Evans, D, Decisionmaker, Cambridge University Press, 1997.
5. Thorpe, E, and Thorpe, S, Objective English, Pearson Education, Second Edition, New Delhi, 2007.
6. Turton, N.D and Heaton, J.B, Dictionary of Common Errors, Addision Wesley Longman Ltd., Indian reprint 1998

LAB REQUIREMENTS

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

CO-PO and PSO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	1	3	3	-	-	-	-
CO	-	-	-	-	-	-	-	-	1	3	3	-	-	-	-

191BM62A-COMMUNICATION SYSTEMS LAB

L T P C
0 0 2 1

COURSE OBJECTIVES

The student should be made to:

1. To Know the principles of modulation and demodulation.
2. To understand different techniques involved in digital communication
3. Be familiarized with line coding.

LIST OF EXPERIMENTS:

1. Sampling theorem
2. Time Division Multiplexing
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation
7. FSK modulation and demodulation.
8. PSK modulation and demodulation.

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Apply modulation and demodulation techniques in biotelemetry.
- Apply digital communication techniques.
- Analyze Line coding schemes.

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	3	1	-	2	-	-	-	-	-	2	2	1	-
CO 2	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-
CO 3	3	1	1	1	-	2	-	-	-	-	-	2	2	1	-
CO	3	2	2	2	-	2	-	-	-	-	-	2	2	2	-

SEMESTER-VI

PROGRAM ELECTIVE-II

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM631	Medical Optics	3	0	0	3
2	191BM632	Nanotechnology And Applications	3	0	0	3
3	191BM633	Telehealth Technology	3	0	0	3
4	191BM634	Virtual Reality	3	0	0	3

191BM631-MEDICAL OPTICS

L T P C

3 0 0 3

COURSE OBJECTIVES

To Study about:

1. The optical properties of the tissues and the interactions of light with tissues.
2. The instrumentation and components in Medical Optics.
3. The Medical Lasers and their applications
4. The optical diagnostic applications
5. The emerging optical diagnostic and therapeutic techniques

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

Fundamental Properties of light - Refraction, Reflection, Laws (Snell's law and Fresnel law) Scattering, Absorption, Light transport inside the tissue, Tissue properties, Laser Characteristics as applied to medicine and biology, Laser tissue Interactions – Photo chemical, Photo thermal and Photo mechanical interactions, Fluorescence, Speckles, Photo ablative processes.

UNIT II INSTRUMENTATION IN PHOTONICS **9**

Instrumentation for absorption, Scattering and emission measurements, Excitation light sources – high pressure arc lamps, LEDs, Lasers, Optical filters – Prism and Monochromators, Polarizers, Optical detectors – Single Channel and Multichannel detectors, Time resolved and phase resolved detection methods, Optical fibers – Total Internal Reflection.

UNIT III SURGICAL THERAPEUTIC APPLICATIONS OF LASERS **9**

Lasers in ophthalmology, Dermatology, Dentistry, Urology, Otolaryngology, Tissue welding and Soldering.

UNIT IV NON THERMAL DIAGNOSTIC APPLICATIONS **9**

Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM Raman Spectroscopy and Imaging, FLIM – Holographic and Speckle applications of lasers in biology and medicine.

UNIT V DIAGNOSTIC AND THERAPEUTIC TECHNIQUES **9** Near field imaging of biological structures, In vitro clinical diagnostics, Phototherapy, Photodynamic therapy (PDT) - Principles and mechanisms - Oncological and non-oncological applications of PDT - Biostimulation effect – applications - Laser Safety Procedures.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students should be able to:

- Demonstrate knowledge of the fundamentals of optical properties of tissues
- Analyze the components of instrumentation in Medical Photonics and Configurations

- Describe surgical applications of lasers.
- Describe photonics and its diagnostic applications.
- Investigate emerging techniques in medical optics

TEXT BOOKS

1. Tuan Vo Dirh, ―Biomedical Photonics – Handbook‖, CRC Press, Bocaraton, 2014.
2. Paras N. Prasad, ―Introduction to Biophotonics‖, A. John Wiley and Sons, Inc. Publications, 2003

REFERENCES

1. MarkolfH.Niemz, ―Laser-Tissue Interaction Fundamentals and Applications‖, Springer, 2007 2. G.David Baxter ―Therapeutic Lasers – Theory and practice‖, Churchill Livingstone publications Edition- 2001. 3. Leon Goldman, M.D., &R.James Rockwell, Jr., ―Lasers in Medicine‖, Gordon and Breach, Science Publishers Inc., 1975.

CO-PO and PSO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
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CO 2	3	3	3	3	3	2	2	1	2	2	2	2	3	2	2
CO 3	2	2	2	2	2	2	3	1	2	2	3	2	2	3	3
CO4	3	2	2	2	3	2	2	1	2	3	3	2	3	2	2
CO5	2	3	2	3	2	2	3	3	2	3	3	2	2	3	3
CO	3	2	2	3	3	2	3	1	2	2	3	2	3	3	3

191BM632-NANOTECHNOLOGY AND APPLICATIONS L T P C

3 0 0 3

COURSE OBJECTIVES

1. To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
2. To explore the basics of nanomaterial synthesis and characterization.
3. To introduce the applications of nanotechnology

UINT I INTRODUCTION TO NANOTECHNOLOGY 9

Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures- clusters of metals and semiconductors, bionano-particles.

UNIT II FABRICATION AND CHARACTERIZATION OF NANOMATERIALS 9

Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electro spinning. Bio-synthesis of nanomaterials.

UNIT III PROPERTIES AND MEASUREMENT OF NANOMATERIALS 9

Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

UNIT IV NANO STRUCTURES 9

Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response to Nanostructures.

UNIT V APPLICATIONS OF NANOTECHNOLOGY 9

Nano electronics, Nanosensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Interpret the creation, characterization, and manipulation of nanoscale materials.
- Discuss the exciting applications of nanotechnology at the leading edge of scientific research
- Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.
- To demonstrate an understanding of approaches to engineering nanomaterials and nanostructures.
- To demonstrate an understanding of the challenges on safe nanotechnology.

TEXT BOOKS

1. Springer Handbook of Nanotechnology by Bharat Bhushan 2004.(Unit I – V)
2. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004. (Unit I – V)

REFERENCES

1. Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and ArchitectsD. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009.
2. Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y.Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003.
3. Handbook of Nanoceramics and their Based Nanodevices (Vol. 2) Edited by Tseung-Yuen Tseng and Hari Singh Nalwa, American Scientific Publishers.

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	2	3	3	2	3	2	3	1	3	3	2	3	2
CO 2	2	2	2	3	2	2	2	2	2	3	2	3	2	3	2
CO 3	2	3	3	2	2	3	3	3	2	3	1	2	2	2	2
CO4	3	3	3	2	3	3	1	1	2	3	2	2	2	3	2
CO 5	2	2	1	2	3	3	2	3	2	3	3	3	2	2	2
CO	2.4	2.4	2.2	2.4	2.6	2.6	2.2	2.2	2.2	2.6	2.2	2.6	2	2.6	2

191BM633-TELEHEALTH TECHNOLOGY

L T P C

3 0 0 3

COURSE OBJECTIVES

The students should be made to
1. Learn the key principles for telemedicine and health
2. Understand telemedical technology.
3. Know telemedical standards, mobile telemedicine and it applications.

UNIT I FUNDAMENTALS OF TELEMEDICINE **9**

History of telemedicine, definition of telemedicine, tele-health, tele-care, scope,Telemedicine Systems, benefits & limitations of telemedicine.

UNIT II TYPE OF INFORMATION & COMMUNICATION INFRASTRUCTURE FOR TELEMEDICINE **9**

Audio, video, still images, text and data, fax-type of communications and network: PSTN, POTS, ANT, ISDN, internet, air/ wireless communications, GSM satellite, micro wave, Mobile health and ubiquitous healthcare.

UNIT III ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE **9**

Confidentiality, patient rights and consent: confidentiality and the law, the patient-doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues, intellectual property rights.

UNIT IV PICTURE ARCHIVING AND COMMUNICATION SYSTEM **9**

Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

UNIT V APPLICATIONS OF TELEMEDICINE **9**

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e Health and Cyber Medicine.

TOTAL: 45 PERIODS

COURSE OUTCOMES

The students will be able to

- Apply multimedia technologies in telemedicine
- Explain protocols behind encryption techniques for secure transmission of data
- Apply telehealth in healthcare.
- Use telehealth technology to provide more efficient access and appropriate systems for patients when referring to specialists and allied health professionals
- Implement an efficient and cost-effective telehealth service within your practice workflow

TEXTBOOKS

1. Norris A C, ―Essentials of Telemedicine and Telecare‖, John Wiley, New York, 2002.
2. H K Huang, ―PACS and Imaging Informatics: Basic Principles and Applications‖ Wiley, New Jersey, 2010.

REFERENCES

1. Olga Ferrer Roca, Marcelo Sosa Iudicissa, ―Handbook of Telemedicine‖, IOS Press, Netherland, 2002.
2. Khandpur R S, ―Handbook of Biomedical Instrumentation‖, Tata McGraw Hill, New Delhi, 2003.
3. Keith J Dreyer, Amit Mehta, James H Thrall, ―Pacs: A Guide to the Digital Revolution‖, Springer, New York, 2002.
4. Khandpur R S, ―TELEMEDICINE – Technology and Applications‖, PHI Learning Pvt Ltd., New Delhi, 2017.

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	2	3	3	2	3	2	3	1	3	3	2	3	2
CO 2	2	2	2	3	2	2	2	2	2	3	2	3	2	3	2
CO 3	2	3	3	2	2	3	3	3	2	3	1	2	2	2	2
CO 4	3	3	3	2	3	3	1	1	2	3	2	2	2	3	2
CO 5	2	2	1	2	3	3	2	3	2	3	3	3	2	2	2
CO	2	2	2	2	2	2	2	2	2	3	2	3	2	3	2

191BM634-VIRTUAL REALITY

L T P C

3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
2. To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
3. To know the intricacies of these platform to develop PDA applications with better optimality

UNIT I INTRODUCTION **10**

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 MODELING **9**

Geometric modeling - kinematics modeling- physical modeling - behavior modeling - model management.

UNIT III HUMAN FACTORS **8**

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 PROGRAMMING **10**

Introducing Java 3D-loading and manipulating external models-using a lathe to make shapes. 3D Sprites-animated 3D sprites-particle systems.

UNIT V APPLICATIONS **8**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Analyse &Design a system or process to meet given specifications with realistic engineering constraints.
- Identify problem statements and function as a member of an engineering design team.
- Utilize technical resources
- Exploring towards the utilization of information technology trends
- Propose technical documents and give technical oral presentations related to design mini project results

TEXT BOOKS

1. C. Burdea& Philippe Coiffet, “Virtual Reality Technology”, Second Edition, Gregory, John Wiley & Sons, Inc., 2008
2. Andrew Davison, “Killer Game Programming in Java”, Oreilly SPD, 2005.

REFERENCES

1. William R.Sherman, Alan Craig, “Understanding Virtual Reality, interface, Application and Design”, Elsevier, Morgan Kaufmann, 2002.
2. Bill Fleming,”3D Modeling and surfacing”, Elsevier, Morgan Kauffman, 1999
3. David H.Eberly, “3D Game Engine Design Practical Approach to Real-Time Computer Graphics”, Elsevier, 2007.
4. John Vince, “Virtual Reality Systems”, Pearson Education, 2007

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	1	2	2	1	3	3	1	3	2	2	2
CO 2	3	2	2	3	1	3	1	1	3	3	1	3	3	3	3
CO 3	2	2	1	1	3	3	1	2	3	2	1	3	3	3	3
CO4	3	3	3	2	3	2	1	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	-	3	3	3	3	1	3	3	3
CO	3	3	3	3	2	2	2	2	3	3	2	3	3	3	3

SEMESTER – VII

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1	191BM721	Medical Device Design	PC	3	0	0	3
2	191BM722	Medical Imaging Processing	PC	2	2	0	3
3	191BM723	Medical Robotics	PC	3	0	0	3
4		Elective-III	PE	3	0	0	3
5		Elective-IV	PE	3	0	0	3
6		Open Elective-II	OE	3	0	0	3
PRACTICAL							
7	191BM72A	Medical Devices Laboratory	PC	0	0	2	1
8	191BM72B	Medical Image Processing Lab	PC	0	0	2	1
9	191BM72C	Project Work Phase-I	PROJ	0	0	2	1
				17	2	8	22

191BM721-MEDICAL DEVICE DESIGN

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. Understand the devices for measurement of parameters related to cardiology.
2. Illustrate the recording and measurement of EEG
3. Demonstrate EMG recording unit and its uses.
4. Explain diagnostic and therapeutic devices related to respiratory parameters.
5. Understand the various sensory measurements that hold clinical importance.

UNIT I CARDIAC EQUIPMENT 9

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, ECG machine maintenance and troubleshooting, Cardiac Pacemaker- Internal and External Pacemaker– Batteries, AC and DC Defibrillator- Internal and External,Defibrillator Protection Circuit, Cardiac ablation catheter.- Testing and maintenance of Heart lung machine- Troubleshooting of ECG recorders.

UNIT II NEUROLOGICAL EQUIPMENT 9

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

UNIT III MUSCULAR AND BIOMECHANICAL MEASUREMENTS 9

Recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation. Static Measurement – Load Cell, Pedobarograph. Dynamic Measurement – Velocity, Acceleration, GAIT, Limb position.

UNIT IV RESPIRATORY MEASUREMENT SYSTEM 9

Instrumentation for measuring the mechanics of breathing – Spirometer -Lung Volume and vital capacity, measurements of residual volume, Pneumotachometer – Airway resistance measurement, Whole body Plethysmograph, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor. Types of Ventilators – Pressure, Volume, and Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

UNIT V SENSORY MEASUREMENT 9

Psychophysiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Speech, Eye Tonometer, Applanation Tonometer, slit lamp, auto refractometer.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course , the students can able to

1. Describe the working and recording setup of all basic cardiac equipment.
2. Explain the working and recording of all basic neurological equipment's.
3. Discuss the recording of diagnostic and therapeutic equipment's related to EMG.
4. Explain about measurements of parameters related to respiratory system.
5. Describe the measurement techniques of sensory responses.

TEXT BOOKS

1. John G. Webster, ―Medical Instrumentation Application and Design‖, 4th edition, Wiley India PvtLtd,New Delhi, 2015
2. Joseph J. Carr and John M. Brown, ―Introduction to Biomedical Equipment Technology‖, Pearson education, 2012.

REFERENCES

1. Leslie Cromwell, ―Biomedical Instrumentation and measurement‖, 2nd edition, Prentice hall of India, New Delhi, 2015.
2. Richard Aston ―Principles of Biomedical Instrumentation and Measurement‖, Merril Publishing Company, 1990.
3. L.A Geddas and L.E.Baker ―Principles of Applied Biomedical Instrumentation‖ 2004.
4. Myer Kutz ―Standard Handbook of Biomedical Engineering & Design‖, McGraw-Hill Publisher, 2003.
5. Khandpur R.S, ―Handbook of Biomedical Instrumentation‖, 3rdedition,Tata McGraw-Hill, New Delhi, 2014.

CO-PO and PSO Mapping

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

191BM722-MEDICAL IMAGE PROCESSING

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To become familiar with digital image fundamentals
2. To get exposed to simple image enhancement techniques in Spatial and Frequency
3. domain.
4. To learn concepts of degradation function and restoration techniques.
5. To study the image segmentation and representation techniques.
6. To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT.

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, ,Color image enhancement.

UNIT III IMAGE RESTORATION 9

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV IMAGE SEGMENTATION 9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological operators, Feature Extraction, biomedical applications.

UNIT V IMAGE COMPRESSION ANDRECOGNITION 9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL PERIODS:45

COURSE OUTCOMES

At the end of the course , the students can able to

1. Know and Explain the basics and fundamentals of digital image processing, such asdigitization, sampling, quantization, and 2D-transforms.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Explain the restoration concepts and filtering techniques.
4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models.
5. Explain the concepts of compression.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, _Digital Image Processing‘, Pearson, Third Edition, 2010.
2. Anil K. Jain, _Fundamentals of Digital Image Processing‘, Pearson, 2002.

REFERENCES

1.Kenneth R. Castleman, _Digital Image Processing‘, Pearson, 2006.

2.Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, _Digital Image Processing using MATLAB‘, Pearson Education, Inc., 2011.
3.D,E. Dudgeon and RM. Mersereau, _Multidimensional Digital Signal Processing‘, Prentice Hall Professional Technical Reference, 1990.
4.William K. Pratt, _Digital Image Processing‘, John Wiley, New York, 2002
Milan Sonka et al _Image processing, analysis and machine vision‘, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	1	2	1	1	-	-	-	-	-	-	1	3	-	-
CO 2	3	3	2	2	2	-	-	-	-	-	-	1	3	1	-
CO 3	3	3	2	2	2	-	-	-	-	-	-	1	3	1	-
CO 4	3	3	3	2	2	-	-	-	-	-	-	1	3	1	-
CO 5	3	3	3	2	2	-	-	-	-	-	-	1	3	1	-
CO	3	3	3	2	2	-	-	-	-	-	-	1	3	1	-

191BM723-MEDICAL ROBOTICS

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. Understand the basics of Robotics, Kinematics.
2. Understand the basics of Inverse Kinematics.
3. Explore various kinematic motion planning solutions for various Robotic configurations.
4. Explore various applications of Robots in Medicine

UNITI INTRODUCTION **9**

Introduction Automation and Robots, Classification, Application, Specification, Notations, Direct Kinematics Dot and cross products, Coordinate frames, Rotations, Homogeneous coordinates Link coordination arm equation – Five-axis robot, Four-axis robot, Six-axis robot.

UNIT II KINEMATICS **9**

Inverse Kinematics – General properties of solutions tool configuration, Five axis robots, Three-Four axis, Six axis Robot, Workspace analysis and trajectory planning work envelope.

UNIT III ROBOT VISION **9**

Robot Vision Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation – Thresholding, region labeling, Shrink operators, Swell operators, Structured illumination, Camera calibration.

UNIT IV PLANNING **9**

Task Planning Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp Planning, Fine-motion planning, Simulation of planar motion.

UNIT V APPLICATIONS **9**

Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Bionic Arm, Clinical and Surgical – Gynaecology, Orthopaedics, Neurosurgery.

TOTAL: 45 PERIODS

CORSE OUTCOMES

At the end of the course , the students can able to

- Explain the basics of robotic systems.
- Design basic Robotics system and formulate Kinematics.
- Construct Inverse Kinematic motion planning solutions for various Robotic configurations.
- Design Robotic systems for Medical application.
- Implement the concept of robotics in health care

TEXT BOOKS

1. Robert Schilling, ―Fundamentals of Robotics-Analysis and control‖, Prentice Hall, 2003.
2. J.J.Craig, ―Introduction to Robotics‖, Pearson Education, 2005.

REFERENCES

1. Staugaard, Andrew C,―Robotics and Artificial Intelligence: An Introduction to Applied Machine Learning‖, Prentice Hall Of India, 1987
2. Grover, Wiess, Nagel, Oderey, ―Industrial Robotics: Technology, Programming and Applications‖, McGraw Hill, 1986.
3. Wolfram Stadler, ―Analytical Robotics and Mechatronics‖, McGraw Hill, 1995.
4. Saeed B. Niku, ―Introduction to Robotics: Analysis, Systems, Applications‖, Prentice Hall, 2001.
5. K. S. Fu, R. C. Gonzales and C. S. G. Lee, ―Robotics‖, McGraw Hill, 2008.

CO-PO and PSO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	1	1	-	-
CO 2	3	3	3	2	1	1	-	-	1	-	-	-	2	1	-
CO 3	3	3	3	1	1	1	-	-	-	-	-	-	2	1	-
CO 4	3	3	3	3	2	3	-	-	3	-	-	2	3	2	1
CO5	3	3	3	3	2	3	-	-	3	-	-	2	3	2	1
CO	3	3	3	3	2	3	-	-	2	-	-	2	3	2	1

191BM7A-MEDICAL DEVICES LAB

L T P C
0 0 2 1

COURSE OBJECTIVES

The student should be made to:

1. Perform the recording and measurement of EEG
2. Demonstrate EMG recording unit and its uses.
3. Explain diagnostic and therapeutic devices related to respiratory parameters.
4. Understand the various sensory measurements that hold clinical importance.

LIST OF EXPERIMENTS

1. Analysis of EEG signal
2. Analysis of ECG signal
3.Analysis of EMG signal
4. Analyse the respiratory flow with detector and analyser
5. Breath analysis using E-nose kit
6. Analysis of speech signals
7. CPR Manikin with Ambu bag and AED Trainer with Simulator (Study experiment)
8.Detection of Non-invasive Blood Glucose (Relative Measurements),Pulse Rate, Non-Invasive Blood Pressure ,Temperature by Telemedicine based Unit with IOT Connectivity .

COURSE OUTCOMES

- Analysis of ECG, EMG and EEG signal
- Discuss the recording of diagnostic and therapeutic equipment's related to EMG
- Explain about measurements of parameters related to respiratory system

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
CO 2	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
CO 3	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-
CO	3	3	2	2	2	1	-	-	-	-	-	2	3	1	-

191BM72B-MEDICAL IMAGE PROCESSING LAB

L T P C
0 0 2 1

COURSE OBJECTIVES

1. To practice the basic image processing techniques.
2. To compute magnitude and phasor representation of images.
3. To understand the concepts of image restoration and segmentation.
4. To explore the applications of image processing techniques.

LIST OF EXPERIMENTS

Simulation using MATLAB

1. Image sampling and quantization
2. Analysis of spatial and intensity resolution in MRI images
3. Intensity transformation of images.
4. DFT analysis of images
5. Transforms (Walsh, Hadamard, DCT, Haar)
6. Histogram Processing and Basic Thresholding functions
7.Image enhancement for CT images using spatial filtering
8. Image Enhancement- Filtering in frequency domain
9. Image segmentation – Edge detection, line detection and point detection.
10. Basic Morphological operations.
11. Region based Segmentation
12. Segmentation using watershed transformation
13. Analysis of images with different color models.
14. Study of DICOM standards
15. Image compression techniques
16. Image restoration
17. A mini project based on medical image processing

COURSE OUTCOMES

At the end of the course, the student should be able to:

Perform enhancing operations on the image using spatial filters and frequency domain

- Use transforms and analyse the characteristics of the image.
- Perform segmentation operations in the images.
- Apply image processing technique to solve real health care problems.

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	1	2	3	3	-	-	-	-	-	-	1	3	-	-
CO 2	3	3	2	3	3	-	-	-	-	-	-	1	3	1	-
CO 3	3	3	2	3	3	-	-	-	-	-	-	1	3	1	-
CO 4	3	3	3	3	3	-	-	-	-	-	-	1	3	1	-
CO 5	3	3	3	3	3										
CO	3	3	3	3	3	-	-	-	-	-	-	1	3	1	-

SEMESTER-VII

PROGRAM ELECTIVE-III

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM731	Brain Computer Interface And Its Applications	3	0	0	3
2	191BM732	Drug Delivery System	3	0	0	3
3	191BM733	Lasers In Medicine	3	0	0	3
4	191BM734	Physiological Modelling	3	0	0	3

191BM731-BRAIN COMPUTER INTERFACE AND ITS APPLICATIONS

L T PC
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

- Understand the basic concepts of brain computer interface
- Study the various signal acquisition methods
- Learn about the signal processing methods used in BCI
- Understand the various machine learning methods of BCI.
- Learn the various applications of BCI

UNIT I INTRODUCTION TO BCI **9**

Introduction - Brain structure and function, Brain Computer Interface Types - Synchronous and Asynchronous -Invasive BCI -Partially Invasive BCI - Non Invasive BCI, Structure of BCI System, BCI Monitoring Hardware, EEG, ECoG, MEG, fMRI.

UNIT II BRAIN ACTIVATION **9**

Brain activation patterns - Spikes, Oscillatory potential and ERD, Slow cortical potentials, Movement related potentials-Mu rhythms, motor imagery, Stimulus related potentials - Visual Evoked Potentials – P300 and Auditory Evoked Potentials, Potentials related to cognitivetasks.

UNIT III FEATURE EXTRACTION METHODS **9**

Data Processing – Spike sorting, Frequency domain analysis, Wavelet analysis, Time domain analysis, Spatial filtering -Principal Component Analysis (PCA), Independent Component Analysis (ICA), Artefacts reduction, Feature Extraction - Phase synchronization and coherence

UNIT IV MACHINE LEARNING METHODSFORBCI **9**

Classification techniques –Binary classification, Ensemble classification, Multiclass Classification, Evaluation of classification performance, Regression - Linear, Polynomial, RBF‘s, Perceptron‘s, Multilayer neural networks, Support vector machine, Graph theoretical functional connectivity analysis

UNIT V APPLICATIONS OF BCI **9**

Case Studies - Invasive BCIs: decoding and tracking arm (hand) position, controlling prosthetic devices such as orthotic hands, Cursor and robotic control using multi electrode array implant, Cortical control of muscles via functional electrical stimulation. Noninvasive BCIs:P300 Mind Speller, Visual cognitive BCI, Emotion detection. Ethics of Brain Computer Interfacing.

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course , the students can able to

- Explain the significance and role of this course in the presentContemporary world.
- Evaluate concept of BCI.
- Assign functions appropriately to the human and to the machine.
- Use machine learning algorithms for translation.
- Develop high fidelity BCI.

TEXT BOOKS

1. Rajesh.P.N.Rao,-BrainComputerInterfacing:AnIntroduction‖,CambridgeUniversityPress,First edition,2013.
2. Jonathan Wolpaw, Elizabeth Winter Wolpaw, -Brain Computer Interfaces: Principles and practice‖, Oxford University Press, USA, Edition 1, January2012.

REFERENCES

1. Ella Hassianien, A &Azar.A.T(Editors), -Brain-Computer Interfaces Current Trends and Applications‖, Springer,2015.
2. Bernhard Graimann, Brendan Allison, GertPfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer,2010
3. Ali Bashashati, MehrdadFatourechi, Rabab K Ward, Gary E Birch,‖ A survey of signal Processing algorithms in brain–computer interfaces based on electrical brain signals‖ Journal of Neural Engineering, Vol.4, 2007,PP.32-57
4. ArnonKohen, -Biomedical Signal Processing‖, Vol I andII, CRC Press Inc, Boca Rato, Florida.
5. BishopC.M.,-NeuralnetworksforPatternRecognition‖,Oxford,ClarendonPress,1995.
6. Andrew Webb, -Statistical Pattern Recognition‖, Wiley International, Second Edition, 2002

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	2	2	-	-	-	-	3	-	-	-	-	1	1	-	-
CO 2	2	2	-	1	1	1	-	-	-	-	-	-	1	1	-
CO 3	3	2	2	1	2	2	-	-	-	-	-	-	2	2	-
CO 4	3	2	2	2	2	1	1	-	-	-	-	-	2	2	-
CO 5	3	2	2	2	2	2	-	1	1	1	-	-	2	2	-
CO	3	2	2	2	2	1	2	1	1	1	-	-	2	2	-

191BM732- DRUG DELIVERY SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES:

The student should be made to:

1. Gain knowledge on controlled drug delivery.
2. Understand the concepts of polymers in drug delivery.
3. Learn the transdermal and implantable drug delivery system
4. Study the various site specific drug delivery system.

UNIT 1 SUSTAINED AND CONTROLLEDDRUGDELIVERY **9**

Introduction, properties of drugs, Pharmacokinetic properties of drugs, sustained release formulations – concept, physicochemical biological properties of drugs, advantages and disadvantages.

UNIT 2 POLYMERS & TARGETTED DRUGDELIVERYSYSTEMS **9**

Polymers used in drug delivery systems – modules, classification, characterization, advantages and disadvantages of polymer.

UNIT 3 TRANSDERMAL DRUGDELIVERYSYSTEMS **9**

Transdermal penetration of drugs – formulation – addition – polymers in transdermaldrug delivery system – iontophoresis – transdermal controlled release products and devices

UNIT 4 IMPLANTABLE DRUGDELIVERYSYSTEMS **9**

Implantable micro – pump systems – peristaltic micro pump – osmotic micro pump - diaphragm micro pump – Fluorocarbon propellent driven micro pump – solenoid driver reciprocate micro pump – programmable implanted drug administrative device (DAD)

UNIT 5 SITE SPECIFIC DRUGDELIVERYSYSTEMS **9**

Development in insulin therapy using biomedical controlled drug delivery systems – drug delivery using monoclonal antibodies – role of biosensors and transducers in diagnostic

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course , the students can able to

- Analyse the properties of drugs.
- Apply polymers in drug delivery system.
- Apply polymers in transdrmal drug delivery system.
- Design implantable micro drug delivery systems.
- Impliment the concepts of biosensors in drug delivery system

TEXT / REFERENCE BOOKS

1. Vyas S. P. Khar R K Targetted and controlled drug delivery Novel Carrier System CBSPD,2006.
2. Anya M Hilleryet al Drug delivery and targeting CRC press,2000
3. Robinson R Robinson Conventional drug delivery systems CRC press,2004.

CO-PO and PSO Mapping															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	2	-	1	-	-	-	-	-	2	3	-	-
CO 2	3	2	3	2	-	1	-	-	-	-	-	2	3	2	-
CO 3	3	2	3	2	-	1	-	-	-	-	-	2	3	2	-
CO 4	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-
CO 5	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-
CO	3	3	3	2	-	2	-	-	-	-	-	2	3	2	-

191BM733-LASER IN MEDICINE

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. The optical properties of the tissues and the interactions of light with tissues.
2. The instrumentation and components in Medical Optics.
3. The Medical Lasers and their applications
4. The optical diagnostic applications
5. The emerging optical diagnostic and therapeutic techniques

UNIT 1 OPTICAL PROPERTIES OF THE TISSUES9

Refraction, Scattering, Absorption, Light transport inside the tissue, Tissue properties,Laser Characteristics as applied to medicine and biology-Laser tissue Interaction-Chemical-Thermal Electromechanical – Photoabalative processes.

UNIT 2 INSTRUMENTATION IN PHOTONICS9

Instrumentation for absorption, Scattering and emission measurements, excitation light sources – high pressure arc lamp, LEDs, Lasers, Optical filters, - optical detectors – Time resolved and phase resolved detectors.

UNIT 3 SURGICAL APPLICATIONS OF LASERS9

Lasers in ophthalmology- Dermatology – Types of lasers used in dermatology – Dentistry- Types of Dental lasers - Urology – Surgical therapy in urology - Otolaryngology - Tissue welding – Specifications

UNIT 4 NON THERMALDIAGNOSTIC APPLICATIONS9

Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM RamanSpectroscopy and Imaging, FLIM – Holographic and speckle application of lasers in biology and medicine.

UNIT 5 THERAPEUTIC APPLICATION9

Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and nononcological applications of PDT - Biostimulation effect – applications-Laser Safety Procedures.

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course , the students can able to

1. Demonstrate knowledge of the fundamentals of optical properties of tissues
2. Analyze the components of instrumentation in Medical Photonics and Configurations
3. Describe surgical applications of lasers.
4. Describe photonics and its diagnostic applications.
5. Investigate emerging techniques in medical optics

TEXT / REFERENCE BOOKS:

1. Leon Goldman, M.D., &R.James Rockwell, Jr., Lasers in Medicine, Gordon and Breach Science Publishers Inc., 1975.
2. Abraham Katzir, Lasers and Optical Fibers in Medicine, Academic PressEdition,1998.
3. Tuan Vo Dirh, Biomedical Photonics – Handbook, CRC Press, Bocaraton,2003.

4. Glasser, O., Medical Physics -- Vol 1, 2, 3 Adam HilgarBrustol Inc,1987.
5. G.David Baxter, Therapeutic Lasers – Theory and practice, Churchill Livingstone Publications Edition-2001.

CO-PO and PSO Mapping															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	-	-	1	-	1	-	-	-	-	-	1	2	-	-
CO 2	3	2	1	1	-	1	-	-	-	-	-	1	2	1	-
CO 3	3	2	2	2	-	2	-	1	-	-	-	1	2	1	-
CO 4	3	1	1	1	-	1	-	-	-	-	-	1	2	1	-
CO 5	3	2	1	1	-	2	-	1	-	-	-	1	2	1	-
CO	3	2	2	2	-	2	-	1	-	-	-	1	2	1	-

191BM734- PHYSIOLOGICAL MODELING L T P C

3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. To explain the application of Physiological models and vital organs.
2. To Formulate the methods and techniques for analysis and synthesis of dynamicmodels
3. To describe the dynamic models, simulate and visualize, dynamic responses ofphysiological models using software.
4. To describe nonlinear models of physiological systems
5. To compute the Simulation of physiological systems

UNIT I INTRODUCTION TO PHYSIOLOGICAL MODELING 9

Approaches to modeling: The technique of mathematical modeling, classification of models, characteristics of models. Time invariant and time varying systems for physiological modeling.Introduction to physiology (homeostasis, cell biology) Modeling physicalsystems, linearmodels of physiological systems.

UNIT II MODELING OF DYNAMIC PHYSIOLOGICAL SYSTEM 9

Dynamic systems and their control, modeling and block diagrams, the pupil control systems(Human Eye), general structure of control systems, the dynamic response characteristics of the pupil control system, open &close loop systems instability, automatic aperture control.

UNIT III NONLINEAR MODELS OF PHYSIOLOGICAL SYSTEM 9

Nonparametric Modeling-Volterra Models.Wiener Models. Efficient Volterra Kernel Estimation.Parametric Modeling- Basic Parametric Model Forms and Estimation Procedures- Volterra Kernels of Nonlinear Differential Equations. Discrete-Time Volterra Kernels of NARMAX Models.

UNIT IV COMPARTMENTENTALPHYSIOLOGICALMODEL 9

Modeling the body as compartments, behaviour in simple compartmental system, pharmacokinetic model, and multi compartmental system. Physiological modeling: Electrical analogy of blood vessels, model of systematic blood flow and model of coronary circulation.Mathematical modeling of the system: Thermo regulation,.

UNIT V SIMULATION OF PHYSIOLOGICAL SYSTEM 9

Simulation of physiologicalsystemsusing Open CV / MATLAB software. Biological receptors: - Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity. Neuromuscular model, Renal System, Drug Delivery Model.

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course , the students can able to

- Explain the application of Physiological models
- Describe the methods and techniques for analysis and synthesis of Linear anddynamicsystem
- Develop differential equations to describe the compartmental physiological model
- Describe Nonlinear models of physiological systems
- Illustrate the Simulation of physiological systems.

TEXT BOOKS

1. MichelCKhoo,-PhysiologicalControlSystemsAnalysis,simulationandestimation‖,PrenticeHallof India,2001.
2. Marmarelis,-NonlinearDynamic ModelingofPhysiologicalSystems‖, Wiley-IEEEPress,2004.

REFERENCES

1. BenjaminCKuo,-Automatic controlsystems‖, TenthEdition,McGraw-HillEducation,2017.
2. DavidTWestwick, Robert E. Kearney, Identification of Nonlinear PhysiologicalSystems, Wiley-IEEE Press,2003.
3. V.Z.Marmarelis,-Advancedmethodsofphysiologicalmodeling‖,*Springer*, 1989
4. L.Stark,‖ Neurological Control System, PlenumPress‖,1968.
5. JohnHMilsum,-Biologicalcontrolsystems‖,McGrawHill1966
6. MinruiFei,ShiweiMa,XinLi,XinSun,LiJiaandZhouSu,-AdvancedComputationalMethodsin Life System Modeling and Simulation‖,*Springer*,2017

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	-	-	-	2	1	-	-	-	-	-	-	3	-	-
CO 2	3	2	2	1	2	-	-	-	-	-	-	-	3	2	-
CO 3	3	2	3	2	3	1	-	-	-	-	-	-	3	2	-
CO 4	3	2	3	3	3	1	-	-	-	-	-	-	3	2	-
CO 5	3	3	3	3	2	1	-	-	-	-	-	-	3	2	-
CO	3	3	3	3	3	1	-	-	-	-	-	-	3	2	-

SEMESTER-VII

PROGRAM ELECTIVE-IV

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM735	Biofluids And Dynamics	3	0	0	3
2	191BM736	Bioinformatics	3	0	0	3
3	191BM737	Computer Networks	3	0	0	3
4	191BM738	Pattern Recognition And Neural Networks	3	0	0	3

191BM735- BIOFLUIDS AND DYNAMICS

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

- To understand the basics of fluid mechanics,
- To analyze cellular, ocular, cardiovascular and respiratory fluid mechanics
- To learn mathematical modeling of fluid biological systems.
- To learn about the cardio respiratory mechanics

UNIT I - BIOFLUID MECHANICS

Intrinsic fluid properties - Density, Viscosity, Compressibility, Surface tension, Hydrostatics Fluid characteristics and viscosity – Displacement and velocity, Sheer stress and viscosity Bernoulli equation, Introduction to pipe flow – Reynolds number, Poiseuille's law, Flow Rate, Womersley number, Constitutive equations – Newtonian fluid, Non-Newtonian viscous fluid, Diameter, velocity and pressure of blood flow relationship, Resistance against flow, Viscoelasticity – Viscoelastic models, Response to Harmonic variation, Use of viscoelastic models, Bio-Viscoelastic fluids – Protoplasm, Mucus, Saliva, Synovial fluids.

UNIT II - CELLULAR AND OCCULAR MECHANICS

Cellular Biomechanics – Eukaryotic cell architecture, Cytoskeleton, Cell-matrix interactions, Mechanical property measurement – Atomic Force microscopy, Optical Trapping, Magnetic bead microrheometry, Micropipette aspiration, Models of cellular biomechanical behavior, Computational model of a chondrocyte in its matrix, Mechanotransduction, Techniques for mechanical stimulation of the cells, Tissue cell mechanobiology – Endothelial, smooth muscle cells, Chondrocytes, Osteoblasts, Ocular Biomechanics – Occular anatomy, Biomechanics of Glaucoma, Ocular blood flow.

UNIT III - BLOOD RHEOLOGY AND BLOOD VESSEL MECHANICS

Viscometry, Elements of Blood, Blood characteristics – Viscosity of blood, Einstein's equation, Biomechanics of red cell membrane, Apparent and relative viscosity, Blood viscosity variation,Casson's equation, Rheology of Blood In Micro vessels – Fahraeus-Lindquist effect and its inversion, Anatomy and physiology of blood vessels, Arterial wall as membrane – Uniaxial loading, Biaxial loading, Torsion, Hemodynamics of Large arteries – Ventricular outflow and the aorta, Pressure-flow relations and Vascular Impedance, Wave propagation and reflection.

UNIT IV - CARDIO RESPIRATORY MECHANICS AND SPACE MEDICINE

Cardiac cycle – Pressure volume diagrams, Changes in contractility, Ventricular performance, Congestive heart failure, Pulsality index, Physics of valvular diseases, Prosthetic heart valves and replacements, Respiratory System – Alveolar ventilation-lung volumes and capacities, Mechanics of breathing, Work of breathing – Lung compliance, Airway resistance, Gas exchange and transport, Oxygen dissociation curve, Lung surfactant, Pulmonary pathologies, Space Medicine – Hypoxia, Physiology of decompressive sickness, Human response to acceleration, Thermal Stress.

UNIT V - COMPUTATIONAL FLUID DYNAMICS

Computational fluid dynamics – CFD Code, Problem solving with CFD, Conservation Laws of Fluid Motion and Boundary Conditions, Turbulence and its modelling, The Finite Volume Method for Diffusion Problems and Convection-Diffusion Problems, Solution Algorithms for Pressure-Velocity Coupling in steady flows, Solution of Discretized Equations, The Finite Volume Method for Unsteady flows, Implementation of Boundary Conditions Application – Multiphysics computational models for cardiac flow and virtual cardiography.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the students can able to

- Discuss the basics of Fluid Mechanics
- Construct the intracellular fluid mechanics and ocular mechanics.
- Describe the rheology of blood and mechanics of blood vessels.
- Elucidate on cardio respiratory mechanics and space medicine.
- Develop mathematical models of biological systems with fluids

TEXT BOOKS

1. Krishnan B. Chandran, Ajit P. Yoganathan, Stanley E. Rittgers, "Biofluid Mechanics- The human circulation", CRC Taylor and Francis, 2007.
2. Y.C Fung, "Biomechanics- Mechanical properties of living tissues", 2nd Edition, Springer-Verlag, 1993.
3. Jeffery R. Davis et. Al., "Fundamentals of Aerospace Medicine", Wolter Kluwer Health, Lippincott Williams and Wilkins, 2008

REFERENCES

1. Jung HeeSeo, Vijay Vedula, Theodore Abraham and Rajat Mittal, "Multiphysics computational models for cardiac flow and virtual cardiography", Int. J. Numer. Meth. Biomed. Engng. (2013) Published online in Wiley Online Library
2. Lee Waite, Jerry Fine, "Applied Biofluid Mechanics", McGraw Hill, 2007
3. John K-J Li, "Dynamics of Vascular System", World Scientific, 2004
4. C. Ross Ethier, Craig A Simmons, "Introduction to Biomechanics- From Cells to Organisms", Cambridge Texts in Biomedical Engineering, 2007
5. H K Versteeg, W Malalasekera, "An Introduction to Computational Fluid Dynamics The Finite Volume Method", Longman Scientific and Technical, 1995

CO-PO and PSO Mapping

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	1	-	1	1	-	-	-	-	-	-	-	2	-	-
CO 2	3	2	2	2	2	-	-	-	-	-	-	-	2	1	-
CO 3	3	2	2	2	2	-	-	-	-	-	-	-	3	1	-
CO 4	3	2	2	2	2	-	-	-	-	-	-	-	3	1	-
CO 5	3	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO	3	2	2.2	2	2	-	-	-	-	-	-	-	2.6	1.2	-

191BM736- BIOINFORMATICS

L T P C
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. Expose to the need for Bioinformatics tools. Be familiar with the modeling techniques
2. Learn microarray analysis
3. Expose to Pattern Matching and Visualization

UNIT I - INTRODUCTION

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics - Biological Data Integration System.

UNIT II - DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics

UNIT III - MODELING FOR BIOINFORMATICS

Hidden markov modeling for biological data analysis – Sequence identification –Sequence classification – multiple alignment generation – Comparative modeling –Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.

UNIT IV - PATTERN MATCHING AND VISUALIZATION

Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acidsequences.

UNIT V - MICROARRAY ANALYSIS

Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the students can able to

- Develop models for biological data
- Apply pattern matching techniques to bioinformatics data – protein data genomic data
- Apply micro array technology for genomic expression study
- Explain about Pattern matching
- Apply microarray technology.

TEXT BOOK

1. Yi-Ping Phoebe Chen Edition, “BioInformatics Technologies”, First Indian Reprint, Springer Verlag, 2007.

REFERENCES

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003. 2. Arthur M Lesk, “Introduction to Bioinformatics”, Second Edition, Oxford University Press, 2005

CO, PO, PSO MAPPING

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	3	1	2	-	-	-	-	-	-	2	3	1	-
CO 2	3	3	3	2	2	1	-	-	-	-	-	2	3	2	-
CO 3	3	3	3	2	2	1	-	-	-	-	-	2	3	2	-
CO 4	3	3	3	2	2	1	-	-	-	-	-	2	3	2	-
CO 5	3	3	3	2	2	1	-	-	-	-	-	2	3	2	-
CO	3	3	3	1.6	2	1	-	-	-	-	-	2	3	2	-

191BM737-COMPUTER NETWORKS

L T PC
3 0 0 3

COURSE OBJECTIVES

The student should be made to:

1. Understand the division of network functionalities into layers.
2. Be familiar with the components required to build different types of networks
3. Be exposed to the required functionality at each layer
4. Learn the flow control and congestion control algorithms

UNIT I - FUNDAMENTALS & LINK LAYER

Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

UNIT II - MEDIA ACCESS & INTERNETWORKING

Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)

UNIT III - ROUTING

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

UNIT IV - TRANSPORT LAYER

Overview of Transport layer - UDP - Reliable byte stream (TCP) – Connection management – Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT V - APPLICATION LAYER

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS - SNMP

TOTAL PERIODS: 45

COURSE OUTCOMES:

At the end of the course , the students can able to

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network
- Explain about the application layer

TEXT BOOK

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A systems approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.

REFERENCES

1. James F. Kurose, Keith W. Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill Publisher, 2011. 4. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw – Hill, 2011.

CO, PO, PSO MAPPING

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	2	1	1	1	1	-	-	-	-		1	3	-	-
CO 2	3	2	1	1	1	1	-	-	-	-	-	1	3	-	-
CO 3	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-
CO 4	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-
CO 5	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-
CO	3	2	2	2	2	2	-	-	-	-	-	1	3	2	-

191BM738-PATTERN RECOGNITION AND NEURAL NETWORKS

L T PC
3 00 3

COURSE OBJECTIVES

1. The course will introduce the student to the fundamentals of pattern recognition and its application. The course will discuss several supervised and unsupervised algorithms suitable for pattern classification.
2. Particular emphasis will be given to computational methods such as linear discriminant functions and nearest neighbor rule.
3. The course also covers basic neural network architectures and learning algorithms, for applications in pattern recognition, image processing, and computer vision.
4. The major focus of this course will be on the use of Pattern and Neural Classifiers for classification applications.

UNIT I - INTRODUCTION AND SIMPLE NEURAL NET
Elementary neurophysiology and biological neural network-Artificial neural network –Architecture, biases and thresholds, Hebb net, Perceptron, Adaline and Madaline.

UNIT II - BACK PROPOGATION AND ASSOCIATIVE MEMORY
Back propogation network, generalized delta rule, Bidirectional Associative memory, Hopefield network

UNIT III - NEURAL NETWORKS BASED ON COMPETITION
Kohonen Self organising map, Learning Vector Quantisation, counter propogationnetwork.

UNIT IV - UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS
Patterns and features, training and learning in pattern recognition, discriminant functions, different types of pattern recognition. Unsupervised learning- hierarchical clustering,partitional clustering. Neural pattern recognition approach – perceptron model

UNIT V - SUPERVISED LEARNING USING PARAMETRIC AND NON PARAMETRIC APPROACH
Bayesian classifier, non-parametric density estimation, histograms, kernels, window estimators, k-nearest neighbor classifier, estimation of error rates.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Explain the fundamentals of pattern recognition and neural networks.
- Design and apply different pattern recognition techniques to the applications of interest.
- Analyze the concept of neural networks
- Explain about clustering technique
- Analyze supervised and unsupervised neural networks.

TEXT BOOKS

1. Duda R.O. Hart P.G, "Pattern Classification and scene analysis", Wiley Edition 2000 (Units I & II).
2. Hagan, Demuth and Beale, "Neural network design", Vikas Publishing House Pvt Ltd., New Delhi, 2002 (Units III, IV & V).

REFERENCES

1. Freeman J.A., and Skapura B.M, "Neural Networks, Algorithms, Applications and Programming Techniques", Addison - Wesley, 2003.
2. Earl Gose, Richard Johnsonbaugh Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India Pvt Ltd., New Delhi, 1999.
3. Robert Schalkoff, "Pattern recognition, Statistical, Structural and neural approaches" John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2005.
4. Laurene Fausett, "Fundamentals of neural networks- Architectures, algorithms and applications", Prentice Hall, 1994.

CO, PO, PSO MAPPING

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	3	1	1	1	1	-	-	-	-	-	-	2	3	-	-
CO 2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	-
CO 3	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-
CO 4	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-
CO 5	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-
CO	3	2	2	2	2	-	-	-	-	-	-	3	3	3	-

SEMESTER – VIII

Sl. No	Course Code	Name of the Course	Category	No. of Periods / Week			Credits
				L	T	P	
THEORY							
1		Program Elective-V	PE	3	0	0	3
2		Program Elective-VI	PE	3	0	0	3
PRACTICAL							
3	191BM82A	Project Work Phase-II	PROJ	0	0	20	10
				6	0	20	16

SEMESTER-VIII

PROGRAM ELECTIVE-V

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM831	Assist Devices	3	0	0	3
2	191BM832	Neural Engineering	3	0	0	3
3	191BM833	Principles Of Management	3	0	0	3
4	191BM834	Soft Computing Techniques	3	0	0	3

191BM831-ASSIST DEVICES

L T P C

3 0 0 3

COURSE OBJECTIVES:

1. Study various mechanical techniques that will help failing heart.
2. Learn the functioning of the unit which does the clearance of urea from the blood
3. Explain the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
4. Know the various orthodic devices and prosthetic devices to overcome orthopedic problems.
5. Explain electrical stimulation techniques used in clinical applications.

UNIT I CARDIAC ASSIST DEVICES **9**

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

UNIT II HEMODIALYSERS **9**

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

UNIT III HEARING AIDS **9**

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

UNIT IV PROSTHETIC AND ORTHODIC DEVICES **9**

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

UNIT V RECENT TRENDS **9**

Transcutaneous electrical nerve stimulator, bio-feedback.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Students would be able to

- Describe the circulatory mechanics associated with prosthetic heart valves.
- Describe the functions of dialyser
- Apply DSP in hearing aids
- Develop aids for hand, standing and walking function
- Explain new challenges in assist devices

TEXT BOOKS

1. Levine S.N. (ed), "Advances in Bio-medical Engineering and Medical physics", Vol. I, II, IV, inter university publications, New York, 1968 (Unit I, IV, V).
2. Kolff W.J, "Artificial Organs", John Wiley and sons, New York, 1976. (Unit II).
3. Albert M.Cook and Webster J.G, "Therapeutic Medical Devices", Prentice Hall Inc., New Jersey,1982 (Unit III).

REFERENCE

1.D.S. Sunder, "Rehabilitation Medicine", 3rd Edition, Jaypee Medical Publication, 2010.

CO, PO, PSO MAPPING															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	3	2	2	2	1	-	-	-	3	3	3	3
CO 2	3	3	3	3	2	2	2	1	-	-	-	3	3	2	2
CO 3	3	2	3	2	2	2	3	1	-	-	-	3	3	1	3
CO 4	3	2	2	2	2	1	2	1	-	-	-	3	2	2	2
CO 5	3	2	2	2	2	1	3	1	-	-	-	3	3	2	3
CO	3	2	2	2	2	2	2	1	-	-	-	3	3	2	3

191BM832-NEURAL ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES

1. To discuss the various physiological aspects of nerve impulse generation and Electromyography
2. To discuss about the various applications of EEG
3. To introduce various methods to study central and peripheral nerve function

UNIT I BASICS OF NEURON STRUCTURE AND FUNCTIONS 9

Nervous system development. Trophic factors, extra cellular matrix components in nervous system development. Neuron: structure – function – classification. Glial cells – myelination – Neurotransmitter – types and functions. Synapses

UNIT II ELECTROENCEPHALOGRAPHY 9

Electroencephalography (EEG): General Principles and Clinical Applications, Neonatal and Paediatric EEG, EEG Artefacts and Benign Variants, Video EEG monitoring for epilepsy, Invasive Clinical Neurophysiology in Epilepsy and movement disorders, Topographic mapping, Frequency analysis and other quantitative techniques in EEG,

UNIT III NERVE EXCITABILITY 9

Nerve Excitability: Functional insights derived from axonal structures, Nerve excitability findings in Neurologic diseases: Chemotherapy induced neurotoxicity, Porphyric Neuropathy, Inflammatory Neuropathy and its Treatment, Spinal Cord Injury;

UNIT IV FUNCTIONAL NEUROIMAGING AND COGNITION 9

Historical and physiological perspective, Functional neuroimaging methods: PET and fMRI, Network analyses, Functional neuroimaging of: Attention, Visual recognition, Semantic memory, Language, Episodic memory, Working memory, Cognitive aging, Neuro-psychologically impaired patients

UNIT V NEURONAL DISEASES AND DISORDERS 9

Neuro degeneration: Degenerative, Demyelinated and injury related disorders associated with nervous system. Wallerian Degeneration. Neuronal plasticity –CNS acting drugs and their pharmacokinetics.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Students would be able to

- Revise anatomy and physiology of nervous system
- Identify various techniques for evaluating the function of central and peripheral nervous system.
- Apply nerve excitability in neurological disorders.
- Distinguish between a normal and abnormal signal coming from a healthy and a diseased nervous system respectively.
- Apply different electrophysiological evaluation in neuronal disorders.

TEXT BOOKS

1. Michael J. Aminoff, et. al., ―Aminoff‘s electrodiagnosis in Clinical Neurology‖, Sixth Edition, Elsevier Saunders, 2012.
2. Kim E. Baretteet. al., ―Ganong‘s review of Medical Physiology‖, 23rd Edition, McGraw Hill Medical, 2010.
3.Mathews G.G. “Neurobiology”, 2nd edition, Blackwell Science, UK, 2000.
4. Malcom Carpenter, “Neuroanatomy”, Mc Graw Hill 4th Edition.1991

REFERENCES

1.Eric R. Kandelet. al., ―Principles of Neural Science‖ ,McGraw-Hill, New York, 2012.
2. R. Cooper, et. al, ―Techniques in Clinical Neurophysiology: A Practical Manual , Elsevier, Amsterdam, The Netherlands, 2005.
3. W. Mark Saltzman Tissue Engineering
– Engineering principles for design of replacement
organs and tissue –- Oxford University Press Inc New York 2004.

CO, PO, PSO MAPPING															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	2	1	2	1	-	1	1	1	3	3	3	3
CO 2	3	2	2	3	2	2	1	-	1	1	1	3	3	3	2
CO 3	3	2	2	2	2	2	1	-	1	1	1	3	3	3	3
CO 4	3	2	2	2	2	2	1	-	1	1	1	3	2	2	2
CO 5	3	2	2	2	2	2	1	-	1	1	1	3	3	3	3
CO	3	2	2	2	2	2	1	-	1	1	1	3	3	3	3

191BM833-PRINCIPLES OF MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Students would be able to

- Elucidate basics of organization and management
- Gain knowledge on managerial function planning
- Gain basic knowledge on organizing skills
- Acquire knowledge on leadership qualities
- Gain knowledge on managerial function controlling

TEXTBOOKS

1. Stephen P. Robbins & Mary Coulter, ―Management‖, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert ―Management‖, Pearson Education, 6th Edition, 2004.

REFERENCES

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, ―Fundamentals of Management‖ Pearson Education, 7th Edition, 2011.
2. Robert Kreitner&MamataMohapatra, ― Management‖, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich ―Essentials of management‖ Tata McGraw Hill,1998. 4. Tripathy PC & Reddy PN, ―Principles of Management‖, Tata McGraw Hill, 1999.

CO, PO, PSO MAPPING															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO 2	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO 3	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO 4	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO 5	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-
CO	3	-	-	-	-	3	3	3	3	2	2	2	-	-	-

191BM834-SOFT COMPUTING TECHNIQUES L T P C

3 0 0 3

COURSE OBJECTIVES

1. To understand the basic principles of fuzzy sets.
2. To understand the principles of fuzzy logic, various fuzzy systems and their functions.
3. To understand the various machine learning and genetic algorithms

UNIT I INTRODUCTION 9

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.

UNITIIGENETIC ALGORITHM 9

Genetic Algorithms: Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators methods of selection, crossover and mutation, simple GA (SGA), other types of GA, generation gap, steady state GA.

UNIT III HYBRID AND ADVANCED MODEL IN SOFT COMPUTING 9

Genetic Algorithm based Back propagation Network, Fuzzy Logic Controlled Genetic Algorithms, Neuro-fuzzy hybrid systems, Support Vector Machine, Extreme Learning Machine (ELM), Extended ELM, Random Forest Algorithm.

UNIT IV FUZZY LOGIC 9

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic -extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base.

UNIT V FROM BIOLOGY TO ARTIFICIAL NEURAL NETWORKS 9

Biological Neural Networks, Components of Artificial Neural Networks – Connections, Propagation function and Network Inputs, Common Activation Functions, Threshold, Network Topologies, Learning - Supervised, Unsupervised, Reinforcement. Backpropagation, Radial Basis Function, Self-Organizing Maps, Counter Propagation Networks, Adaptive Resonant Theory (ART).

TOTAL: 45 PERIODS

COURSE OUTCOMES

Students would be able

- To use various types of neural network algorithms for training a system
- To elucidate the significance of various genetic algorithms
- To explain the principle of machine learning
- To elucidate various fuzzy measure algorithms for driving a system.
- To apply soft computing techniques in real time applications

TEXT BOOKS

1. J.S.R.Jang, C.T.Sun and E.Mizutani, ―Neuro-Fuzzy and Soft Computing‖, PHI, 2004, Pearson Education 2004.
2. James A Freeman and David M.Skapra, ―Neural Networks: Algorithms, Applications, and Programming Techniques‖, Addison-Wesley, 1991, Digital Version 2007.
3. Davis E.Goldberg, ―Genetic Algorithms: Search, Optimization and MachineLearning‖, Addison Wesley, N.Y., 1989.
4. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
5.S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCES

1. LaureneFausett, ―Fundamentals of neural networks- Architectures, algorithms and applications‖, Prentice Hall, 1994.
2. Simon O. Haykins,‖Neural Networks: A Comprehensive Foundation‖, 2nd Edition, Pearson 1994
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. S.Rajasekaran and G.A.VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
5. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.

CO, PO, PSO MAPPING

Cos	PO1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO 1	2	-	2	2	2	-	-	1	-	-	-	3	3	1	3
CO 2	2	-	1	2	1	-	-	3	-	-	2	3	3	1	2
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CO 4	2	-	2	-	2	-	-	2	-	-	-	3	2	1	2
CO 5	2	-	1	-	-	-	-	-	3	-	-	3	3	1	3
CO	2	-	1	2	2	-	-	2	2	-	1	3	3	1	3

SEMESTER-VIII

PROGRAM ELECTIVE-VI

S.NO	Course Code	Course Title	Category	L	T	P
1	191BM835	Electrical Safety And Quality Assurance	3	0	0	3
2	191BM836	Embedded and Real Time System	3	0	0	3
3	191BM837	Rehabilitation Engineering	3	0	0	3
4	191BM838	Wearable Systems	3	0	0	3

191BM835-ELECTRICAL SAFETY AND QUALITY ASSURANCE

L T P C
3 0 0 3

COURSE OBJECTIVES

- To provide electrical protection and maintenance in working environment and ensure that electrical safety.

UNITIELECTRICAL HAZARDS **12**

Review of Electrical concept, Electrostatic – Electro magnetism – Electrical Hazards – Energy leakage – Clearance and insulation– Current surges – Electrical causes of fire and explosion – Human interface with electricity – Human resistance to electricity

UNITIISTANDARDSANDREQUIREMENTS **12**

National electrical Safety code - Standards and statutory requirements – Indian electricity acts and rules – statutory requirements from Electrical inspectorate. Hazardous area classification and classification of electrical equipments for hazardous areas (IS, NFPA, API and OSHA standards).

UNITIIIELECTRICAL PROTECTIONAND MAINTENANCE **9**

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance. First aid-cardio pulmonary resuscitation(CPR).

UNITIVSTANDARDIZATION OF QUALITY MEDICAL CAREINHOSPITALS **6**

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 equipment.

UNITVREGULATORY REQUIREMENT FORHEALTHCARE **6**

CE and FDA regulations, Accreditation for hospitals - JCI, NABH and NABL.

TOTAL :45 PERIODS

COURSE OUTCOMES

Students would be able to

- Demonstrate various techniques to shield patient from electrical hazardous
- Develop knowledge on medical safety standards
- Gain knowledge on safety measures to be followed in hospitals
- Insight into the procedures used in quality control
- Implement the various methods to monitor and assess quality in healthcare

TEXT BOOKS

1. B.M.Sakharkar, Principles of Hospital administration and Planning, JAYPEE Brothers,Medical Publishers (P) Ltd.24
2. K.Shridhara Bhat, Quality Management, Himalaya Publishing House Cesar A.Cacere&Albert Zana, The Practice of Clinical Engg. Academic press, New York,1977.

REFERENCES

1. Webster J.G and Albert M.Cook, Clinical Engg, Principles & Practices, Prentice Hall Inc., Engle wood Cliffs, New Jersy,1979.
2. KarenParsley,KarenParsleyPhilomenaCorrigan|QualityimprovementinHealthcare, 2nd edition ,Nelson Thrones Pub,2002
3. SharonMyers-PatientSafety&Hospital Accreditation-A Modelfor EnsuringSuccess| Springer Publishers2012
4. JosephFDyro-Clinical Engineering Handbook–Elsevier Publishers,2004

CO, PO, PSO MAPPING															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	3	3	3	3	2	3	1	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	2	2	1	1	1	3	3	3	3	2
CO 3	3	2	3	3	2	2	3	1	1	1	2	3	3	3	3
CO 4	3	2	2	3	2	1	2	1	2	2	2	3	2	2	2
CO 5	3	3	3	3	2	1	3	2	2	2	3	3	3	3	3
CO	3	3	3	3	2	2	3	1	2	2	3	3	3	3	3

191BM836- EMBEDDED AND REAL TIME SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To discuss about embedded systems, Architecture of ARM processor and peripherals
- To apply embedded systems in real time applications

UNIT I INTRODUCTION TO EMBEDDED SYSTEM DESIGN **9**

Complex systems and microprocessors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performanceanalysis.

UNIT II ARM PROCESSOR AND PERIPHERALS **9**

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3MCU.

UNIT III EMBEDDED PROGRAMMING **9**

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT IV REAL TIME SYSTEMS **9**

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation.

UNIT V PROCESSES AND OPERATING SYSTEMS **9**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real- time operating systems- Priority based scheduling- Interprocesscommunicationmechanisms- Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE. - Distributed embeddedsystems-MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Videoaccelerator.

TOTAL:45 PERIODS

COURSE OUTCOMES

Students would be able to

- Acquire Knowledge about embedded systems and design analysis
- Develop new architectures of ARM processor and its peripheral devices
- Demonstrate sound knowledge on embedded software tool
- Develop advanced real time techniques in embedded systems.
- Demonstrate multiple tasks and multiprocessor

TEXT BOOKS

1. Marilyn Wolf,-ComputersasComponents-PrinciplesofEmbeddedComputingSystemDesign‖, ThirdEdition-MorganKaufmannPublisher(AnimprintfromElsevier), 2012.

2. Jane W.S.Liu,‖RealTimeSystems‖, Pearson Education, Third Indian Reprint, 2003

REFERENCES

1. Lyla B.Das,-Embedded Systems:AnIntegratedApproach‖PearsonEducation,2013.
2. JonathanW.Valvano,-EmbeddedMicrocomputerSystemsRealTimeInterfacing‖,Third Edition Cengage Learning,2012.
3. David.E.Simon,-An Embedded SoftwarePrimer‖, 1stEdition,FifthImpression,Addison- Wesley Professional,2007.
4. Raymond J.A.Buhr,DonaldL.Bailey,-AnIntroduction to Real-TimeSystems-From Design to Networking with C/C++‖, Prentice Hall,1999.
5. C.M.Krishna,KangG.Shin,-Real-Time Systems‖,InternationalEditions,McGrawHill 1997
6. K.V.K.K.Prasad,-Embedded Real-Time Systems:Concepts,Design&Programming‖, Dream Tech Press,2005.
7. SriramVIyer,PankajGupta,-EmbeddedRealTimeSystemsProgramming‖,TataMcGraw Hill,2004.

CO-PO and PSO Mapping															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	3	2	2	2	2	1	1	1	1	3	3	3	3
CO 2	3	2	2	2	3	2	2	1	1	1	1	3	3	3	2
CO 3	3	2	2	2	3	2	2	1	1	1	1	3	3	3	3
CO 4	3	2	2	2	3	2	2	1	1	1	1	3	2	2	2
CO 5	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3
CO	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3

191BM837- REHABILITATION ENGINEERING

L P T C

3 0 0 3

COURSE OBJECTIVES

1. To interactively and effectively introduce students to the field of rehabilitation and discuss the principles of rehabilitation.
2. To provide insight into the orthopaedic prosthetics and orthotics in rehabilitation.
3. To learn therapeutic Exercise Techniques
4. To gain knowledge on assist devices for management of communicational impairments.
5. To describe the essential principles, methods, and strategies of assessment of individuals with disabilities in VR settings and to gain knowledge of the robotic developments in the field of rehabilitation engineering.

UNITIINTRODUCTION TOREHABILITATION **9**

What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Rehabilitation team Classification of members, The Role of Psychiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist - Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist &Biomedicalengineer.

UNITIIPRINCIPLES OF REHABILITATION **9**

Introduction, The Human Component, Principles of Assistive Technology Assessment,Principles of Rehabilitation Engineering- Key Engineering Principles, Key ErgonomicPrinciples - Practice of Rehabilitation and AssistiveTechnology.

UNITIIITHERAPEUTIC EXERCISE TECHNIQUE **9**

Co-ordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

UNITIVMANAGEMENT OF COMMUNICATION &VIRTUALREALITY **9**

Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids. Introduction to virtual reality, Virtual reality-based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in MobilityRehabilitation.

UNIT V ORTHOTIC, PROSTHETIC DEVICES &RESTORATIONTECHNIQUES **9**

General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Calipers-FO, AFO, KAFO, HKAFO. Prosthetic devices: Hand and arm replacement, Body powered prosthetics, Myoelectric controlled prosthetics and Externally powered limb prosthetics. Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

TOTAL : 45 PERIODS

COURSE OUTCOMES

Students would be able to

- Explain the roles of rehabilitation team and decide quality and safety standards in design of devices for user needs.

- Interpret the techniques and aids for impairments related in rehabilitation.
- Compare and know the different therapeutic exercises to improve person's health
- Explore the use of Robots and Virtual Reality tool in rehabilitative curative care.
- Describe the applications of different orthosis and prosthesis for various disabilities.

TEXT BOOKS

- Sunder 'Textbook of Rehabilitation', Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi, 2nd Edition, Reprint 2007
- Joseph D.Bronzino, The Biomedical Engineering Handbook, Third edition-3 volume set, Taylor & Francis,2006

REFERENCES

- Horia- NocholaiTeodorecu, L.C.Jain ,Intelligent systems and technologies inrehabilitation Engineering; CRC; December2000.
- Keswick. J., What is Rehabilitation Engineering, Annual Reviews of Rehabilitation- Springer-Verlag, New York,1982.
- Warren E. Finn,Peter G. LoPresti; Handbook of Neuroprosthetic Methods CRC; edition2002.
- Rory A Cooper (Editor), HisaichiOhnabe (Editor), Douglas A. Hobson (Editor), 'An Introduction to Rehabilitation Engineering (Series in Medical Physics and Biomedical Engineering' CRC Press,2006.

CO-PO and PSO Mapping															
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CO 1	1	1	2	1	-	2	1	1	1	1	3	3	3	-	2
CO 2	3	3	3	2	2	2	2	1	1	1	3	3	3	-	2
CO 3	3	3	3	2	2	2	3	1	1	1	2	3	3	-	2
CO 4	3	3	3	3	2	1	2	1	2	2	2	3	2	-	2
CO 5	2	2	2	2	3	1	3	2	2	2	3	3	3	-	2
CO	2	2	3	2	2	2	3	1	2	2	3	3	3	-	2

191BM838-WEARABLESYSTEMS

L T P C
3 0 0 3

COURSE OBJECTIVES

1. Study about sensors and its application in wearable systems
2. Learn about wireless health system and BAN architecture and its technical challenges.
3. Gain knowledge on real time wearable systems on the basis of different case studies.

UNIT I SENSORS **9**

Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, CMOS – Based Biosensors, E-Textiles, Bio compatibility

UNIT II SIGNAL PROCESSING **9**

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information, Data mining

UNIT III ENERGY HARVESTING FOR WEARABLE DEVICES **9**

Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT IV WIRELESS HEALTH SYSTEMS **9**

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication techniques.

UNIT VAPPLICATIONS OF WEARABLE SYSTEMS **9**

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording, Gait analysis, Sports Medicine, Smart Fabrics.

COURSE OUTCOMES

Students would be able to

- Use smart sensors to monitor vital parameters
- Demonstrate knowledge on the basic principles of signal conditioning in wearable system
- Explain sources of energy for wearable devices
- Develop advanced techniques of BAN architecture for more medical applications.
- Design various safe and user friendly wearable devices for patients.

TEXT BOOKS

- Annalisa Bonfiglio,DaniloDeRossi ,"Wearable Monitoring Systems", Springer,2011.
- Sandeep K.S. Gupta,TridibMukherjee,Krishna Kumar Venkatasubramanian, "Body Area Networks Safety,Security, and Sustainability," Cambridge University Press,2013.

REFERENCES

- Hang,Yuan-Ting,"wearable medical sensors andsystems",Springer-2013
- Mehmet R. Yuce,JamilY.Khan, "Wireless Body Area Networks Technology, Implementation and

Applications",Pan Stanford Publishing Pvt.Ltd, Singapore,2012
- Guang-Zhong Yang(Ed.), "Body Sensor Networks, "Springer,2006
- Andreas Lymberis, Danilo de Rossi ,'Wearable eHealth systems forPersonalised Health Management - State of the art and future challenges ' IOS press, The Netherlands,2004.

CO-PO and PSO Mapping															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO 3**
CO 1	3	3	3	2	3	-	1	1	1	1	-	2	3	3	3
CO 2	3	3	3	2	2	-	1	1	1	1	-	2	2	3	3
CO 3	3	3	3	2	2	-	1	1	1	1	-	2	2	3	3
CO 4	3	3	3	2	2	1	1	1	1	1	-	2	3	1	1
CO 5	3	3	3	2	2	1	1	1	1	1	-	2	3	1	1
CO	3	3	3	2	2	1	1	1	1	1	-	2	3	3	3

OPEN ELECTIVE OFFERED TO OTHER DEPARTMENTS

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	19BM541	Basic Of Bioinformatics	3	0	0	3
2	19BM542	Electronics In Medicine	3	0	0	3
3	19BM543	Introduction To Biomedical Devices	3	0	0	3
4	19BM544	Introduction To Human Anatomy Systems	3	0	0	3
5	19BM545	Principles Of Telemedicine	3	0	0	3

19BM541- BASICS OF BIOINFORMATICS

3 0 0 3

UNIT I INTRODUCTION

Introduction to bioinformatics, biological information, the Central Dogma, Bioinformatics: Definition and overview Bioinformatics, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics. Genome projects, human genome project- Databases and human chromosomes, role of Bioinformatics in biological sequences. Biological data- DNA sequence protein sequence, macromolecular structure. Challenges in bioinformatics.

UNIT II DATABASES

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary sequence databases, protein sequence and structure databases, Organism specific databases

UNIT III DATAPROCESSING

Data–Access, Retrieval and Submission: Standards each engines; Data retrieval tools–Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local versus global. Distance metrics. Similarity and homology. Scoring matrices.

UNIT IV METHODS OF ANALYSIS

Dynamic programming algorithms, Needleman-wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA, and PSIBLAST. Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment;

UNIT V APPLICATIONS AND SOFTWARES

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis: Comparative genomics, orthologs, paralogs. Genome analysis – Genome annotation Basic software tools used in bioinformatics - Sequence analysis- GCG, Emboss - Cn3D viewer- Rasmol, Swiss pdb viewer, Pymol, Jmol.Modeling-Discoverystudio2.0,Docking -Autodock, HEX.

COURSE OUTCOMES

Students would be able to

- Elucidate the genesis of bioinformatics, comparison with its allied disciplines.
- Explain primary sequence databases, Protein sequence and structure databases, Organism specific databases
- Elucidate the processing of acquired data
- Describe various Methods of sequence alignment
- Explain applications of bio informatics in the area of biological and biomedical sciences

TEXT/REFERENCEBOOKS

1. Introduction to Bioinformatics byArthurK.Lesk, Oxford University Press.
2. Algorithms on Strings,Trees and Sequences by DanGus field,Cambridge University Press.
3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by Durbin, S.Eddy,A.Krogh,G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O'ReilleyMedia

CO-PO and PSO Mapping														
Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO 3**
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CO 2	3	3	3	2	2	-	1	1	1	1	-	2	2	3	3
CO 3	3	3	3	2	2	-	1	1	1	1	-	2	2	3	3
CO 4	3	3	3	2	2	1	1	1	1	1	-	2	3	1	1
CO 5	3	3	3	2	2	1	1	1	1	1	-	2	3	1	1
CO	3	3	3	2	2	1	1	1	1	1	-	2	3	3	3

19BM542-ELECTRONICS IN MEDICINE

L T P C

3 0 0 3

COURSE OBJECTIVE

- At the end of the course the students will have clear knowledge of electronics in medicine inmedicalfield

UNIT 1 BASICS OF ELECTRONICS IN MEDICINE 9

Fields of Application - Designing Electronics in Medicine-Medical ElectronicsSpecificRequirements-ElectronicSensing-HealthConditionMonitoring-BiosignalsandTransducers

UNIT 2 ELECTRONICS FOR WIRELESS HEALTH MONITORING 9

Requirements for Wireless Devices -Data Acquisition-System Integration-Wireless Communications

UNIT 3 POWER SUPPLY 9

Battery Power Budget Considerations- Wireless Power- Wireless Power Link Analysis-WirelessPower Charger-EnergyHarvesting

UNIT 4 WEARABLE MEDICAL ELECTRONICS 9

Wearable Systems- Categories of Wearable Systems-Design Requirements- Sensors forWearableSystems-SensingMethodologies

UNIT 5 ELECTRONICS IN MEDICINEATWORK 9

WirelessandWearableLow-Power-HealthMonitoringSystems-Sensors-WirelessLink-Optical Biopotential Recording- Optical Electrodes -Optical Signal Acquisition –LocalizationSolutions-AmbientAssistedLivingApplications-WirelessLinkDesignforBiomedicalApplications

COURSE OUTCOMES

Students would be able to

- Describe the basics of electronics in medicine.
- Describe the wireless electronics used in healthcare
- Explain the power supplies of electronics in medicine
- Explain the basis of wearable devices
- Use smart systems to monitor vital parameters

TEXT BOOKS

1 J.C.Schuh:Medicaldeviceregulationsandtestingfortoxicologicpathologists,Toxicol.Pathol.**36**,63–69(2008)

REFERENCE BOOKS:

1.D.Lapedes:*McGraw-HillDictionaryofScientificandTechnicalTerms*(McGraw-Hill,NewYork2000)

CO-PO and PSO Mapping															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO 3**
CO 1	3	2	3	2	2	2	2	1	1	1	1	3	3	3	3
CO 2	3	2	2	2	3	2	2	1	1	1	1	3	3	3	2
CO 3	3	2	2	2	3	2	2	1	1	1	1	3	3	3	3
CO 4	3	2	2	2	3	2	2	1	1	1	1	3	2	2	2
CO 5	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3
CO	3	2	3	2	3	2	2	1	1	1	1	3	3	3	3

19BM543-INTRODUCTION TO BIOMEDICAL DEVICES **L T P C**

3 0 0 3

COURSE OBJECTIVES:

1. To study the basic characteristics of measurement system.
2. To study the basic characteristics of measurement system.
3. The students will be exposed to electrical and non-electrical physiological measurements and bio-amplifiers.

UNIT I TRANSDUCERS **9**

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

UNIT II ELECTRODES & AMPLIFIERS **9**

Types of electrodes Half cell potential, Reference electrodes, polarization effects, Polarisable and nonpolarisable electrodes, Micro electrodes, Equivalent Circuits, Signal Conditioning circuits- Characteristics of Amplifiers , Differential Amplifiers, Filters, Bridge circuits, A/D Converters. surface, needle and micro electrodes and their equivalent circuits.

UNIT III CHEMICAL AND OPTICAL TRANSDUCERS **9**

Biochemical sensors - PH, PO2 electrodes, Ion sensor, An-ion and Cat-ion sensor, Liquid and solid ion exchange membrane electrode, Enzyme electrode, Principle of fiber optic cable, fiber optic sensors.

UNIT IV BIO-CHEMICAL MEASUREMENT **9**

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

UNIT V RECORDERS AND DISPLAY **9**

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

Total Hours:45

COURSE OUTCOMES:

- Measure various electrical parameters with accuracy, precision, resolution.
- Elucidate the origin of bio potentials and various bio electrodes.
- Select appropriate light sensors for measurement of physical phenomenon.
- Develop measurement systems for non-electrical parameter measurements.
- Employ CRO and different types of recorders for appropriate measurement.

TEXT BOOKS

1.Khandpur R.S, "Handbook of Biomedical Instrumentation", 3rd edition, Tata McGraw-Hill New Delhi, 2014

2.Leslie Cromwell, "Biomedical Instrumentation and measurement", 2nd edition, Prentice hall of India, New Delhi, 2015.

3. Jacob Kline., Handbook of Bio Medical Engineering, Academic press Inc., Sandiego, 1988.
4. J.B.Gupta, A course in electronic and electrical measurement and instrumentation, S.K.Kataria & Sons, 1999.
5. Tatsuo Togawa, Toshiyo Tamura, P.Ake Oberg, Biomedical Transducers and Instruments,CRC Press, New York, 1997.
6. Joseph J.Carr and John M Brown, Introduction To Biomedical Equipment Technology, 4/E,pearson education India.2001.

CO-PO and PSO Mapping															
Cos	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO 12**	**PSO1**	**PSO2**	**PSO 3**
CO 1	3	2	2	3	2	2	2	1	-	-	-	3	3	3	3
CO 2	3	3	3	3	2	2	2	1	-	-	-	3	3	2	2
CO 3	3	2	3	2	2	2	3	1	-	-	-	3	3	1	3
CO 4	3	2	2	2	2	1	2	1	-	-	-	3	2	2	2
CO 5	3	2	2	2	2	1	3	1	-	-	-	3	3	2	3
CO	3	2	2	2	2	2	2	1	-	-	-	3	3	2	3

19BM544-INTRODUCTION TO HUMAN ANATOMY SYSTEMS

L T P C
3 0 0 3

COURSE OBJECTIVES

- Students will have clear knowledge of anatomy and physiology of every vital organ.

UNIT 1 CELL

Structure and organelles - Functions of each component in the cell. Different types of cells. Cell membrane – transport across membrane – origin of cell membrane potential – Action potentialcomponents.StructureofaNeuron.Classificationofneurons.Partsofbraincorticallocalization of functions. Conduction of action potential in neuron - synaptic transmission. Parts of spinal cord, simple reflex, with drawl reflex and autonomic nervous system.

UNIT 2 BLOOD

Composition –functions of blood –RBC structure-production of BC.WBC types–productions of WBC cells and their functions. Blood groups –importance of blood groups –identification of blood groups. Platelet production and its functions.

UNIT 3 DIGESTIVE SYSTEM

Digestive system parts (oral cavity, stomach, intestine, large intestine and accessory glands).Digestion and absorption of carbohydrates,lipids And proteins. Structureof Kidney and nephron. Blood supply to Kidney. Mechanism of urine formation. Structure of eye and ear, auditory and visual pathways.

UNIT 4 BONES AND MUSCLE

Orientation of body planes. Classification of bones and types of joints. Types of muscles :skeletal, cardiac and smooth muscle structure and their differences. Motor unit - Structure of neuro muscular junction. Excitation motor neuron and skeletal muscle contraction(change in potential - mechanical – energy changes- thermal – pH changes.) Effect of second stimulus-fasciculation– fibrillation-EMG

UNIT 5 RESPIRATORY SYSTEM

Parts of respiratory system (Trachea, Bronchi, muscle of respiration, thoracic cage, pleural membranes). Mechanics of respiration - Volumes and capacities of lung. Carbon dioxide and oxygen transport. Types of hypoxia.Regulation of respiration.Structure of heart-Cardiac cycle
–ECG-Heart sound-volume and pressure changes

TOTAL PERIODS- 45

COURSE OUTCOMES

Students would be able to

- Explain basic structure and functions of cell
- Summarize the functioning and components of blood and identification of systems
- Explain interconnect of various systems
- Describe skeletal and muscular system
- Describe about anatomy and physiology of various systems of human body

TEXTBOOK

1.Elaine.N. Marieb, 'Essentials of Human Anatomy and Physiology', 8th edition, PearsonEducation,NewDelhi ,2007.

REFERENCE BOOKS

1.WilliamF.Ganong,'ReviewofMedicalPhysiology',22nd edition,McGrawHill,NewDelhi,2005.
2.A.K. Jain, 'Text book of Physiology', volume I and II, Third edition, Avichal Publishingcompany,NewDelhi, 2005.

CO-PO and PSO Mapping															
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CO 2	1	1	-	2	2	2	3	2	1	2	-	3	-	-	-
CO 3	1	1	-	1	-	2	3	2	-	2	-	3	-	-	-
CO 4	1	1	1	1	3	2	3	2	-	2	1	3	3	-	1
CO 5	1	1	-	1	3	2	3	2	-	2	1	3	3	-	1
CO	1	1	1	1	3	2	3	2	1	2	1	3	3	-	1

19BM545-PRINCIPLES OF TELEMEDICINE

L T P C

3 0 0 3

COURSE OBJECTIVES

1. Know Scope, Benefits and Limitations of Telemedicine.
2. Know Security and Standards and their use in Telemedicine Applications

UNIT I HISTORY AND FUNDAMENTALS OF TELEMEDICINE

9

History and Evolution of telemedicine, definition of telemedicine, Functional diagram of telemedicine system, Telemedicine, Tele health, Tele care, benefits & limitations of telemedicine, Introduction of Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues.

UNIT II TYPES OF COMMUNICATION

9

Types of Communication and Network: PSTN, POTS, ATN, ISDN, Internet, Wireless Communications:GSM, satellite and Micro Wave. Types of information: Audio, Video, still Images, text and data, Fax.

UNIT III DATA EXCHANGES

9

Network Configuration, Circuit and packet switching, H.320 series (Video phone based ISBN) T.120, h.324 (Video phone based PSTN), Video Conferencing.

UNIT IV DATA SECURITY AND STANDARD

9

Encryption, Cryptography, Mechanisms of encryption, Phases of Encryption. Photocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7. Ethical and legal aspects of Telemedicine: Confidentiality and Law, patient rights and consent, access to medical Records, Consent treatment.

UNIT V APPLICATIONS OF TELEMEDICINE

9

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e Health care.

Total Hours: 45

COURSE OUTCOMES

Students would be able to

- Describe the growth and fundamentals of tele medicine
- Apply multimedia technologies in telemedicine
- Elucidate various network configurations
- Explain protocols behind encryption techniques for secure transmission of data
- Apply telehealth in healthcare.

TEXT BOOKS

1. A.C.Norris, Essentials of Telemedicine and Telecare, John Wiley & Sons, 2002.

REFERENCES

1. Olga Ferrer-Roca, M.Sosa Ludicissa, Handbook of Telemedicine, IOS press 2002.

CO-PO and PSO Mapping														
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CO 4	3	3	3	3	3	3	1	1	1	1	1	3	2	2	2
CO 5	3	3	3	3	3	3	1	1	1	1	1	3	3	3	3
CO	3	3	3	3	3	3	1	1	1	1	1	3	3	3	3

OPEN ELECTIVE OFFERED BY OTHER DEPARTMENTS

S.No	Name of the Course	Category	L	T	P	Credits	DEPT
1.	Problem Solving and Python Programming	OE	3	0	0	3	CSE
2.	Big Data Analytics	OE	3	0	0	3	CSE
3.	Software Testing	OE	3	0	0	3	CSE
4.	Internet-of-Things	OE	3	0	0	3	CSE
5.	Machine Learning Techniques	OE	3	0	0	3	CSE
6.	Software Project Management	OE	3	0	0	3	CSE
7.	Data Warehousing and Data Mining	OE	3	0	0	3	CSE
8.	Human Computer Interaction	OE	3	0	0	3	CSE
9.	Grid and Cloud Computing	OE	3	0	0	3	CSE
10.	Information Security	OE	3	0	0	3	CSE
11.	Soft Computing	OE	3	0	0	3	CSE
12.	Information Theory and Coding	OE	3	0	0	3	CSE
13.	Multi-Core Architectures and Programming	OE	3	0	0	3	IT
14.	Information Theory & Coding	OE	3	0	0	3	IT
15.	Embedded Systems	OE	3	0	0	3	IT
16.	C# & .Net Programming	OE	3	0	0	3	IT
17.	Advance Database Technologies	OE	3	0	0	3	IT
18.	Information Security	OE	3	0	0	3	IT
19.	Data Analytic	OE	3	0	0	3	IT
20.	Digital Image Processing	OE	3	0	0	3	IT
21.	Advanced Java Programming	OE	3	0	0	3	IT
22.	Wireless Networks	OE	3	0	0	3	IT
23.	Mobile Computing	OE	3	0	0	3	IT
24.	Information Retrieval Systems	OE	3	0	0	3	IT
25.	Multimedia Databases	OE	3	0	0	3	IT
26.	Medical Electronics	OE	3	0	0	3	ECE
27.	Robotics and Automation	OE	3	0	0	3	ECE
28.	MEMS and NEMS	OE	3	0	0	3	ECE
29.	Wireless Communication	OE	3	0	0	3	ECE
30.	Speech Signal Processing	OE	3	0	0	3	ECE

31.	Wireless Networks	OE	3	0	0	3	ECE
32.	Sensors and Transducers	OE	3	0	0	3	ECE
33.	Telecommunication Network Management	OE	3	0	0	3	ECE
34.	Digital Image Processing	OE	3	0	0	3	ECE
35.	Cognitive Radio	OE	3	0	0	3	ECE
36.	Computer Networks	OE	3	0	0	3	ECE
37.	Satellite Communication	OE	3	0	0	3	ECE
38.	Air Pollution And Control Engineering	OE	3	0	0	3	CIVIL
39.	Environmental And Social Impact Assessment	OE	3	0	0	3	CIVIL
40.	Geographic Information System	OE	3	0	0	3	CIVIL
41.	Participatory Water Resources Management	OE	3	0	0	3	CIVIL
42.	Integrated Water Resources Management	OE	3	0	0	3	CIVIL
43.	Coastal Engineering	OE	3	0	0	3	CIVIL
44.	Geographic Information System	OE	3	0	0	3	CIVIL
45.	Vibration And Noise Control	OE	3	0	0	3	CIVIL
46.	Industrial Safety Engineering	OE	3	0	0	3	CIVIL
47.	Supply Chain Management	OE	3	0	0	3	CIVIL
48.	Systems Engineering	OE	3	0	0	3	CIVIL
49.	Selection Of Materials	OE	3	0	0	3	CIVIL
50.	Product Design And Development	OE	3	0	0	3	CIVIL
51.	Energy Conservation And Management	OE	3	0	0	3	MECH
52.	Testing Of Materials	OE	3	0	0	3	MECH
53.	Lean Six Sigma	OE	3	0	0	3	MECH
54.	Advanced Materials	OE	3	0	0	3	MECH
55.	Design Thinking	OE	3	0	0	3	MECH
56.	Material Science and technology	OE	3	0	0	3	MECH
57.	Renewable energy sources	OE	3	0	0	3	MECH
58.	Basics of electric power generation	OE	3	0	0	3	EEE
59.	Design,Estimation and costing of electrical systems	OE	3	0	0	3	EEE
60.	Electrical machines and appliactions	OE	3	0	0	3	EEE
61.	Energy management and audit	OE	3	0	0	3	EEE
62.	Electrical power utilization and safety	OE	3	0	0	3	EEE
63.	Introduction to smart grid	OE	3	0	0	3	EEE
64.	Non- conventional energy sources	OE	3	0	0	3	EEE
65.	Power Electronics and applications	OE	3	0	0	3	EEE