ADHIYAMAAN COLLEGE OF ENGINEERING

[An Autonomous Institution Affiliated to Anna University, Chennai]

[Accredited by NAAC]

Dr.M.G.R NAGAR, HOSUR, KRISHNAGIRI (DT) – 635 130, TAMILNADU, INDIA

REGULATIONS 2018

CHOICE BASED CREDIT SYSTEM

B.E- BIOMEDICAL ENGINEERING

Vision

To produce competent and creative biomedical engineers who anticipate change, communicate and work with others effectively in a globally connected society.

Mission

M1: To pursue excellence in Biomedical Engineering by integrating engineering and medicine through education, research and innovation.

M2: To facilitate the students by introducing technologies for uplifting the society with global standards.

M3: To nurture students' skill and leadership qualities by inculcating ethical values.

The Programme defines Programme Educational Objectives, Programme Outcomes and Programme Specific Outcomes as follows:

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 Our graduates will excel in healthcare sectors and/or higher education with the instilling profound knowledge in mathematical, scientific and engineering concepts.

PEO 2 Our graduates will be able to analyze healthcare challenges, design and development of diagnostic, therapeutic strategies with global standards, economically feasible for the welfare of society.

PEO 3 Our graduates will emerge with professionalism, ethical and social responsibilities, communication skills, team spirit and leadership as a holistic personality with life long learning attitude.

2. Program Outcomes (POs)

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

3. PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: An ability to apply advanced technology for measurement and interpretation of data acquired from biological system dealing the problems associated with the interaction between living and non-living materials and systems.

PSO2: An ability to use software tools, mathematics, science and engineering for precise diagnosis and therapeutic applications.

PSO3: An ability to build and expand their undergraduate foundations by engaging in learning opportunities throughout their careers.

4. MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVE WITH PROGRAMME OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES														
	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
I	3	3		1								2	2	2	1
II			3	3	3	3	3				3		3	3	
III						3	3	3	3	3	1	3	1		3

5. MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

		COURSE TITLE	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
YEAR-I	SEMESTER-I	TECHNICAL ENGLISH	2	1	2	1	2	1	2	1	2	2	1	1	2	1	1
		ENGINEERING MATHEMATICS-I	2	1	1	1	2	1	2	1	1	2	1	2	1	2	2
		ENGINEERING PHYSICS	2	1	1	1	2	1	2	1	1	2	1	2	1	2	2
		ENGINEERING CHEMISTRY	2	1	2	1	2	1	2	1	2	2	1	1	1	1	1
		PROBLEM SOLVING AND PYTHON PROGRAMMING	2	1	1	1	2	1	2	2	1	2	1	2	1	2	2
		ELECTIVE (GROUP 1)															
		ENGINEERING PHYSICS LABORATORY	2	1	2	1	2	1	2	1	2	2	1	2	1	2	2
		PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	2	1	1	1	2	1	2	2	1	2	1	2	1	2	2
	SEMESTER-II	COMMUNICATIVE ENGLISH	2	1	1	1	2	1	2	2	1	2	1	2	1	2	2
		ENGINEERING MATHEMATICS-II	2	1	2	1	2	1	2	1	2	2	1	2	1	2	2
		ENVIRONMENTAL SCIENCE AND ENGINEERING	2	1	1	1	2	1	2	1	1	2	1	2	1	2	2
		ENGINEERING GRAPHICS	2	1	1	1	2	1	2	2	1	2	1	2	1	2	2
		ELECTRIC CIRCUITS AND ELECTRON DEVICES	3	0	3	3	0	0	0	0	0	0	0	0	0	2	0
		ELECTIVE (GROUP2)															
		ENGINEERING CHEMISTRY LABORATORY	2	1	1	1	2	1	2	1	1	2	2	2	1	2	2
		ENGINEERING PRACTICE LABORATORY	2	1	2	1	2	1	2	1	2	2	1	1	1	1	1
		CIRCUITS AND DEVICES LABORATORY	3	0	3	3	0	0	0	0	0	0	0	0	0	2	0
YE AR-	SEME STER-	ENGINEERING MATHEMATICS-III	3	3	3	1	1				3			3		3	
		ELECTRICAL MACHINES	2	2	3	2			2	3	3	2	2	2		3	

		HUMAN ANATOMY AND PHYSIOLOGY	2					2		3			3	3	3	2	1
		SENSORS AND MEASUREMENTS	2	2	2	2		3				2		2	3	3	3
		MEDICAL PHYSICS	3		2	1		2				2		2	2	1	2
		FUNDAMENTALS OF DATA STRUCTURES IN C			3	2	3						3			2	1
		HUMAN ANATOMY AND PHYSIOLOGY LABORATORY	3		2	3					1				3	3	1
		SENSORS AND MEASUREMENTS LABORATORY	1	1	1	1									2	3	1
		FUNDAMENTALS OF DATA STRUCTURES IN C LABORATORY			3		3				3					2	1
	SEMESTER-IV	PROBABILITY AND RANDOM PROCESSES			3	3	2	1									
		ANALOG INTEGRATED CIRCUITS	3	2	3	2		2				2	2	2	2	3	1
		DIGITAL LOGIC DESIGN	3	2	3	2										3	1
		PATHOLOGY AND MICROBIOLOGY	3	3	3			1		2	2	2	2	2	3	2	1
		BIOCHEMISTRY	3	2		1		1							3	1	1
		SIGNALS, SYSTEMS AND ANALYSIS	3	3	1	2									1	3	1
		INTEGRATED CIRCUITS LABORATORY	3	3	3	3										3	2
		PATHOLOGY AND MICROBIOLOGY LABORATORY		2	2		2			2	2				2	2	
		BIOCHEMISTRY LABORATORY	3	3	2	3				3					2	2	3
YEAR-III	SEMESTER-V	BIOMEDICAL INSTRUMENTATION	3		3	2	1								2	3	1
		DIGITAL SIGNAL PROCESSING AND BIOMEDICAL APPLICATIONS	3	3		3	2								3	1	
		MICROPROCESSOR AND MICROCONTROLLER SYSTEM DESIGN	1	3	3	3	2								3	2	
		BIO CONTROL SYSTEMS	3	3	3	3	3				3			3	2	3	1
		ANALOG AND DIGITAL COMMUNICATION	3	2	2	2		2	2		3	3	2		2		2
		OPEN ELECTIVE-I															
		BIOMEDICAL INSTRUMENTATION LAB	3	3	3		3				3			3	3	3	
		MICROPROCESSOR AND MICROCONTROLLER LAB	3	1	3	3	2						3		3	2	
		DIGITAL SIGNAL PROCESSING LAB	1	1	2	3	3		2			2	2		3	1	2
	SEMESTER-VI	DIAGNOSTIC EQUIPMENT	3		2		3	2						3	2	1	
		THERAPEUTIC EQUIPMENT	3		2		3	2						3	2	1	

		RADIOLOGICAL EQUIPMENT	**3**	**2**	**2**	**2**	**3**	**2**				**2**	**2**	**3**	**2**	**1**	
		BIOMATERIALS & ARTIFICIAL ORGANS	**3**	**2**	**2**			**1**						**2**	**3**	**1**	
		PROFESSIONAL ELECTIVE – I															
		OPEN ELECTIVE – II															
		DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LAB	**3**		**2**		**3**	**2**			**2**			**3**	**3**	**2**	
		EMPLOYABILITY SKILLS LAB					**1**	**2**			**3**	**3**	**3**			**3**	**3**
		HOSPITAL TRAINING	**3**	**2**		**2**		**3**		**2**	**2**	**2**	**1**	**2**	**2**	**3**	**1**
YEAR-IV	**SEMESTER-VII**	MEDICAL OPTICS	**3**		**2**	**2**	**3**		**2**	**3**		**3**	**3**	**2**	**3**	**1**	**3**
		DIGITAL IMAGE PROCESSING	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**3**		**2**	**2**	**3**	**1**	**2**
		BIOMECHANICS	**3**	**2**	**3**	**3**	**2**	**3**						**2**	**3**	**1**	
		MEDICAL INFORMATICS	**3**		**2**			**2**		**2**		**3**	**3**		**2**	**1**	
		PROFESSIONAL ELECTIVE – II															
		PROFESSIONAL ELECTIVE – III															
		DIGITAL IMAGE PROCESSING LAB	**3**	**3**	**2**	**2**	**3**									**3**	**2**
		MINI PROJECT	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
		INTERPERSONAL SKILLS/LISTENING & SPEAKING					**1**	**2**			**3**	**3**	**3**	**3**			**3**
	SEMESTER-VIII	HOSPITAL ENGINEERING & MANAGEMENT	**1**					**2**		**2**	**2**	**2**	**1**			**2**	**3**
		PROFESSIONAL ELECTIVE – IV															
		PROFESSIONAL ELECTIVE – V															
		PROJECT WORK	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

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CHOICE BASED CREDIT SYSTEM

B.E- BIOMEDICAL ENGINEERING

CURRICULA AND SYLLABI FOR SEMESTER I TO VIII

SEMESTER I

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	118ENT01	TECHNICAL ENGLISH	HSMC	2	0	0	2	2
2.	118MAT02	ENGINEERING MATHEMATICS-I	BSC	3	0	0	3	3
3.	118PHT03	ENGINEERING PHYSICS	BSC	2	0	0	2	2
4.	118CYT04	ENGINEERING CHEMISTRY	BSC	3	0	0	3	3
5.	118PPT05	PROBLEM SOLVING AND PYTHON PROGRAMMING	ESC	3	0	0	3	3
6.	118ESE0X	**ELECTIVE (GROUP1)**	ESC	3	0	0	3	3
PRACTICALS								
7.	118PHP07	ENGINEERING PHYSICS LABORATORY	BSC	0	0	2	2	1
8.	118PPP08	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	ESC	0	0	2	2	1
			TOTAL	**16**	**0**	**4**	**20**	**18**

ELECTIVE (GROUP 1)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	118ESE01	BASIC CIVIL AND MECHANICAL ENGINEERING	ESC	3	0	0	3	3
2.	118ESE05	BASIC MECHANICAL ELECTRICAL AND INSTRUMENTATION ENGINEERING	ESC	3	0	0	3	3
3.	118ESE06	BASIC ELECTRICAL ELECTRONICS AND INSTRUMENTATION ENGINEERING	ESC	3	0	0	3	3
4.	118ESE07	BIOLOGY FOR ENGINEERS	ESC	3	0	0	3	3

SEMESTER II

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	218ENT01	COMMUNICATIVE ENGLISH	HSMC	2	0	2	4	3
2.	218MAT02	ENGINEERING MATHEMATICS-II	BSC	3	1	0	4	4
3.	218GET03	ENVIRONMENTAL SCIENCE AND ENGINEERING	HSMC	2	0	0	2	2
4.	218EGT04	ENGINEERING GRAPHICS	ESC	2	0	4	6	4
5.	218EDT05	ELECTRIC CIRCUITS AND ELECTRON DEVICES	PCC	3	0	0	3	3
6.	218BSE0X	**ELECTIVE (GROUP2)**	BSC	2	0	0	2	2
PRACTICALS								
7.	218CYP07	ENGINEERING CHEMISTRY LABORATORY	BSC	0	0	2	2	1
8.	218EPP08	ENGINEERING PRACTICE LABORATORY	ESC	0	0	2	2	1
9.	218CDP09	CIRCUITS AND DEVICES LABORATORY	PCC	0	0	2	2	1
			TOTAL	**14**	**1**	**12**	**27**	**21**

ELECTIVE (GROUP 2)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	218BSE03	CHEMISTRY FOR TECHNOLOGISTS	BSC	2	0	0	2	2
2.	218BSE04	ENERGY STORAGE DEVICES AND FUEL CELLS	BSC	2	0	0	2	2
3.	218BSE07	PHYSICS OF SEMICONDUCTOR	BSC	2	0	0	2	2
4.	218BSE08	PHYSICS FOR ELECTRONICS ENGINEERING	BSC	2	0	0	2	2

SEMESTER III

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	318MAT01	ENGINEERING MATHEMATICS-III	BSC	3	1	0	4	4
2.	318BMT02	ELECTRICAL MACHINES	ESC	3	0	0	3	3
3.	318BMT03	HUMAN ANATOMY AND PHYSIOLOGY	PCC	3	0	0	3	3
4.	318BMT04	SENSORS AND MEASUREMENTS	PCC	3	0	0	3	3
5.	318BMT05	MEDICAL PHYSICS	PCC	3	0	0	3	3
6.	318BMT06	FUNDAMENTALS OF DATA STRUCTURES IN C	ESC	3	0	0	3	3
PRACTICALS								
7.	318BMP07	HUMAN ANATOMY AND PHYSIOLOGY LABORATORY	PCC	0	0	2	2	1
8.	318BMP08	SENSORS AND MEASUREMENTS LABORATORY	PCC	0	0	2	2	1
9.	318BMP09	FUNDAMENTALS OF DATA STRUCTURES IN C LABORATORY	ESC	0	0	2	2	1
			TOTAL	**18**	**1**	**6**	**25**	**22**

SEMESTER IV

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	418MAT01	PROBABILITY AND RANDOM PROCESSES	BSC	3	1	0	4	4
2.	418BMT02	ANALOG INTEGRATED CIRCUITS	PCC	3	0	0	3	3
3.	418BMT03	DIGITAL LOGIC DESIGN	PCC	3	0	0	3	3
4.	418BMT04	PATHOLOGY AND MICROBIOLOGY	PCC	3	0	0	3	3
5.	418BMT05	BIOCHEMISTRY	PCC	3	0	0	3	3
6.	418BMT06	SIGNALS, SYSTEMS AND ANALYSIS	PCC	3	0	0	3	3

PRACTICALS								
7.	418BMP07	INTEGRATED CIRCUITS LABORATORY	PCC	0	0	2	2	1
8.	418BMP08	PATHOLOGY AND MICROBIOLOGY LABORATORY	PCC	0	0	2	2	1
9.	418BMP09	BIOCHEMISTRY LABORATORY	PCC	0	0	2	2	1
			TOTAL	**18**	**1**	**6**	**25**	**22**

SEMESTER V

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	518BMT01	BIOMEDICAL INSTRUMENTATION	PCC	3	0	0	3	3
2.	518BMT02	DIGITAL SIGNAL PROCESSING AND BIOMEDICAL APPLICATIONS	PCC	3	0	0	3	3
3.	518BMT03	MICROPROCESSOR AND MICROCONTROLLER SYSTEM DESIGN	PCC	3	0	0	3	3
4.	518BMT04	BIO CONTROL SYSTEMS	PCC	3	0	0	3	3
5.	518BMT05	ANALOG AND DIGITAL COMMUNICATION	PCC	3	0	0	3	3
6.		OPEN ELECTIVE – I	OEC	3	0	0	3	3
PRACTICALS								
7.	518BMP07	BIOMEDICAL INSTRUMENTATION LAB	PCC	0	0	2	2	1
8.	518BMP08	MICROPROCESSOR AND MICROCONTROLLER LAB	PCC	0	0	2	2	1
9.	518BMP09	DIGITAL SIGNAL PROCESSING LAB	PCC	0	0	2	2	1
			TOTAL	**18**	**0**	**6**	**24**	21

OPEN ELECTIVE – I

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	518EIO01	VIRTUAL INSTRUMENTATION	OEC	3	0	0	3	3

2.	518CIO05	JAVA PROGRAMMING	OEC	3	0	0	3	3
3.	518BTO11	MEDICAL CODING	OEC	3	0	0	3	3
4.	518ITO05	C# AND .NET FRAMEWORK	OEC	3	0	0	3	3

SEMESTER VI

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	618BMT01	DIAGNOSTIC EQUIPMENT	PCC	3	0	0	3	3
2.	618BMT02	THERAPEUTIC EQUIPMENT	PCC	3	0	0	3	3
3.	618BMT03	RADIOLOGICAL EQUIPMENT	PCC	3	0	0	3	3
4.	618BMT04	BIOMATERIALS AND ARTIFICIAL ORGANS	PCC	3	0	0	3	3
5.	618BMEXX	PROFESSIONAL ELECTIVE – I	PEC	3	0	0	3	3
6.		OPEN ELECTIVE – II	OEC	3	0	0	3	3
PRACTICALS								
7.	618BMP07	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY	PCC	0	0	2	2	1
8.	618BMP08	EMPLOYABILITY SKILLS LABORATORY	EEC	0	0	2	2	1
9.	618BMP09	HOSPITAL TRAINING	EEC	0	0	2	2	1
			TOTAL	**18**	**0**	**6**	**24**	**21**

PROFESSIONAL ELECTIVE – I

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	618BME05	MEDICAL SAFETY AND QUALITY ASSURANCE	PEC	3	0	0	3	3
2.	618BME06	BIO SIGNAL PROCESSING	PEC	3	0	0	3	3
3.	618BME07	CLINICAL ENGINEERING	PEC	3	0	0	3	3
4.	618BME08	PHYSIOLOGICAL MODELLING	PEC	3	0	0	3	3
5.	618BME09	BIOTELEMETRY	PEC	3	0	0	3	3

OPEN ELECTIVE – II

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	418CIT05/ 618BMO01	COMPUTER NETWORKS	OEC	3	0	0	3	3
2.	618CST06/ 618CSO07	BIG DATA ANALYTICS	OEC	3	0	0	3	3
3.	618ECT02/ 618ECO09	VLSI DESIGN	OEC	3	0	0	3	3
4.	718CST03/ 618CSO10	CLOUD COMPUTING	OEC	3	0	0	3	3

SEMESTER VII

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	718BMT01	MEDICAL OPTICS	PCC	3	0	0	3	3
2.	718BMT02	DIGITAL IMAGE PROCESSING	PCC	3	0	0	3	3
3.	718BMT03	BIOMECHANICS	PCC	3	0	0	3	3
4.	718BMT04	MEDICAL INFORMATICS	PCC	3	0	0	3	3
5.	718BMEXX	PROFESSIONAL ELECTIVE – II	PEC	3	0	0	3	3
6.	718BMEXX	PROFESSIONAL ELECTIVE – III	PEC	3	0	0	3	3
PRACTICALS								
7.	718BMP07	DIGITAL IMAGE PROCESSING LABORATORY	PCC	0	0	2	2	1
8.	718BMP08	MINI PROJECT	EEC	0	0	2	2	1
9.	718BMP09	INTERPERSONAL SKILLS/LISTENING & SPEAKING	EEC	0	0	2	2	1
			TOTAL	**18**	**0**	**6**	**24**	**21**

PROFESSIONAL ELECTIVE – II

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	718BME05	BIOSENSORS AND TRANSDUCERS	PEC	3	0	0	3	3
2.	718BME06	PATTERN RECOGNITION AND NEURAL NETWORKS	PEC	3	0	0	3	3
3.	718BME07	EMBEDDED SYSTEMS	PEC	3	0	0	3	3
4.	718BME08	REHABILITATION ENGINEERING	PEC	3	0	0	3	3
5.	718BME09	ICU & OPERATION THEATRE EQUIPMENT	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVE – III

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	718BME10	HOSPITAL WASTE MANAGEMENT	PEC	3	0	0	3	3
2.	718BME11	INTELLECTUAL PROPERTY RIGHTS	PEC	3	0	0	3	3
3.	718BME12	TOTAL QUALITY MANAGEMENT	PEC	3	0	0	3	3
4.	718BME13	DISASTER MANAGEMENT & MITIGATION	PEC	3	0	0	3	3
5.	718BME14	PROFESSIONAL ETHICS AND HUMAN VALUES	PEC	3	0	0	3	3

SEMESTER VIII

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	818BMT01	HOSPITAL ENGINEERING AND MANAGEMENT	PCC	3	0	0	3	3
2.	818BMEXX	PROFESSIONAL ELECTIVE – IV	PEC	3	0	0	3	3

3.	818BMEXX	PROFESSIONAL ELECTIVE – V	PEC	3	0	0	3	3
PRACTICALS								
4.	818BMP04	PROJECT WORK	EEC	0	0	18	18	9
			TOTAL	**9**	**0**	**18**	**27**	**18**

PROFESSIONAL ELECTIVE – IV

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	818BME02	NANOTECHNOLOGY	PEC	3	0	0	3	3
2.	818BME03	CELL BIOLOGY AND TISSUE ENGINEERING	PEC	3	0	0	3	3
3.	818BME04	ASSIST DEVICES	PEC	3	0	0	3	3
4.	818BME05	BIOMEMS	PEC	3	0	0	3	3
5.	818BME06	INTERNET OF THINGS IN MEDICAL APPLICATIONS	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVE – V

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	818BME07	ADVANCED MEDICAL INSTRUMENTATION	PEC	3	0	0	3	3
2.	818BME08	BRAIN COMPUTER INTERFACE AND APPLICATIONS	PEC	3	0	0	3	3
3.	818BME09	MEDICAL ROBOTICS	PEC	3	0	0	3	3
4.	818BME10	WEARABLE SYSTEMS	PEC	3	0	0	3	3
5.	818BME11	BIOMETRICS	PEC	3	0	0	3	3

B.E. BIOMEDICAL ENGINEERING

HSM COURSES (HSMC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	118ENT01	TECHNICAL ENGLISH	HSMC	2	0	0	2	2
2.	218ENT01	COMMUNICATIVE ENGLISH	HSMC	2	0	2	4	3
3.	218GET03	ENVIRONMENTAL SCIENCE AND ENGINEERING	HSMC	2	0	0	2	2

BASIC SCIENCE COURSES (BSC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	118MAT02	ENGINEERING MATHEMATICS-I	BSC	3	0	0	3	3
2.	118PHT03	ENGINEERING PHYSICS	BSC	2	0	0	2	2
3.	118CYT04	ENGINEERING CHEMISTRY	BSC	3	0	0	3	3
4.	118PHP07	ENGINEERING PHYSICS LABORATORY	BSC	0	0	2	2	1
5.	218MAT02	ENGINEERING MATHEMATICS-II	BSC	3	1	0	4	4
6.	218CYP07	ENGINEERING CHEMISTRY LABORATORY	BSC	0	0	2	2	1
7.	318MAT01	ENGINEERING MATHEMATICS-III	BSC	4	1	0	5	4
8.	418MAT01	PROBABILITY AND RANDOM PROCESSES	BSC	3	1	0	4	4

BASIC SCIENCE COURSES (BSC)-ELECTIVES

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
5.	218BSE03	CHEMISTRY FOR TECHNOLOGISTS	BSC	2	0	0	2	2
6.	218BSE04	ENERGY STORAGE DEVICES AND FUEL CELLS	BSC	2	0	0	2	2

7.	218BSE07	PHYSICS OF SEMICONDUCTOR	BSC	2	0	0	2	2
8.	218BSE08	PHYSICS FOR ELECTRONICS ENGINEERING	BSC	2	0	0	2	2

ENGINEERING SCIENCE COURSES (ESC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	118PPT05	PROBLEM SOLVING AND PYTHON PROGRAMMING	ESC	3	0	0	3	3
2.	118PPP08	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	ESC	0	0	2	2	1
3.	218EGT04	ENGINEERING GRAPHICS	ESC	2	0	4	6	4
4.	218EPP08	ENGINEERING PRACTICE LABORATORY	ESC	0	0	2	2	1
5.	318BMT02	ELECTRICAL MACHINES	ESC	3	0	0	3	3
6.	318BMT06	FUNDAMENTALS OF DATA STRUCTURES IN C	ESC	3	0	0	3	3
7.	318BMP09	FUNDAMENTALS OF DATA STRUCTURES IN C	ESC	0	0	2	2	1

ENGINEERING SCIENCE COURSES (ESC)-ELECTIVES

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
5.	118ESE01	BASIC CIVIL AND MECHANICAL ENGINEERING	ESC	3	0	0	3	3
6.	118ESE05	BASIC MECHANICAL ELECTRICAL AND INSTRUMENTATION ENGINEERING	ESC	3	0	0	3	3
7.	118ESE06	BASIC ELECTRICAL ELECTRONICS AND INSTRUMENTATION ENGINEERING	ESC	3	0	0	3	3
8.	118ESE07	BIOLOGY FOR ENGINEERS	ESC	3	0	0	3	3

PROFESSIONAL CORE COURSES (PCC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
5.	218EDT05	ELECTRIC CIRCUITS AND ELECTRON DEVICES	PCC	3	0	0	3	3
6.	218CDP09	CIRCUITS AND DEVICES LABORATORY	PCC	0	0	2	2	1
7.	318BMT03	HUMAN ANATOMY AND PHYSIOLOGY	PCC	3	0	0	3	3
8.	318BMT04	SENSORS AND MEASUREMENTS	PCC	3	0	0	3	3
9.	318BMT05	MEDICAL PHYSICS	PCC	3	0	0	3	3
10.	318BMP07	HUMAN ANATOMY AND PHYSIOLOGY LABORATORY	PCC	0	0	2	2	1
11.	318BMP08	SENSORS AND MEASUREMENTS	PCC	0	0	2	2	1
12.	418BMT02	ANALOG INTEGRATED CIRCUITS	PCC	3	0	0	3	3
13.	418BMT03	DIGITAL LOGIC DESIGN	PCC	3	0	0	3	3
14.	418BMT04	PATHOLOGY AND MICROBIOLOGY	PCC	3	0	0	3	3
15.	418BMT05	BIOCHEMISTRY	PCC	3	0	0	3	3
16.	418BMT06	SIGNALS, SYSTEMS AND ANALYSIS	PCC	3	0	0	3	3
17.	418BMP07	INTEGRATED CIRCUITS LABORATORY	PCC	0	0	2	2	1
18.	418BMP08	PATHOLOGY AND MICROBIOLOGY	PCC	0	0	2	2	1
19.	418BMP09	BIOCHEMISTRY LABORATORY	PCC	0	0	2	2	1
20.	518BMT01	BIOMEDICAL INSTRUMENTATION	PCC	3	0	0	3	3
21.	518BMT02	DIGITAL SIGNAL PROCESSING AND BIOMEDICAL APPLICATIONS	PCC	3	0	0	3	3
22.	518BMT03	MICROPROCESSOR AND MICROCONTROLLER SYSTEM DESIGN	PCC	3	0	0	3	3
23.	518BMT04	BIO CONTROL SYSTEMS	PCC	3	0	0	3	3
24.	518BMT05	ANALOG AND DIGITAL COMMUNICATION	PCC	3	0	0	3	3

25.	518BMP07	BIOMEDICAL INSTRUMENTATION LABORATORY	PCC	0	0	2	2	1
26.	518BMP08	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	PCC	0	0	2	2	1
27.	518BMP09	DIGITAL SIGNAL PROCESSING LABORATORY	PCC	0	0	2	2	1
28.	618BMT01	DIAGNOSTIC EQUIPMENT	PCC	3	0	0	3	3
29.	618BMT02	THERAPEUTIC EQUIPMENT	PCC	3	0	0	3	3
30.	618BMT03	RADIOLOGICAL EQUIPMENT	PCC	3	0	0	3	3
31.	618BMT04	BIOMATERIALS & ARTIFICIAL ORGANS	PCC	3	0	0	3	3
32.	618BMP07	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY	PCC	0	0	2	2	1
33.	718BMT01	MEDICAL OPTICS	PCC	3	0	0	3	3
34.	718BMT02	DIGITAL IMAGE PROCESSING	PCC	3	0	0	3	3
35.	718BMT03	BIOMECHANICS	PCC	3	0	0	3	3
36.	718BMT04	MEDICAL INFORMATICS	PCC	3	0	0	3	3
37.	718BMP07	DIGITAL IMAGE PROCESSING LABORATORY	PCC	0	0	2	2	1
38.	818BMT01	HOSPITAL ENGINEERING & MANAGEMENT	PCC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES (PEC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
39.	618BME05	MEDICAL SAFETY & QUALITY ASSURANCE	PEC	3	0	0	3	3
40.	618BME06	BIO SIGNAL PROCESSING	PEC	3	0	0	3	3
41.	618BME07	CLINICAL ENGINEERING	PEC	3	0	0	3	3

42.	618BME08	PHYSIOLOGICAL MODELLING	PEC	3	0	0	3	3
43.	618BME09	BIOTELEMETRY	PEC	3	0	0	3	3
44.	718BME05	BIOSENSORS AND TRANSDUCERS	PEC	3	0	0	3	3
45.	718BME06	PATTERN RECOGNITION AND NEURAL NETWORKS	PEC	3	0	0	3	3
46.	718BME07	EMBEDDED SYSTEMS	PEC	3	0	0	3	3
47.	718BME08	REHABILITATION ENGINEERING	PEC	3	0	0	3	3
48.	718BME09	ICU & OPERATION THEATRE EQUIPMENT	PEC	3	0	0	3	3
49.	718BME10	HOSPITAL WASTE MANAGEMENT	PEC	3	0	0	3	3
50.	718BME11	INTELLECTUAL PROPERTY RIGHTS	PEC	3	0	0	3	3
51.	718BME12	TOTAL QUALITY MANAGEMENT	PEC	3	0	0	3	3
52.	718BME13	DISASTER MANAGEMENT & MITIGATION	PEC	3	0	0	3	3
53.	718BME14	PROFESSIONAL ETHICS AND HUMAN VALUES	PEC	3	0	0	3	3
54.	818BME02	NANOTECHNOLOGY	PEC	3	0	0	3	3
55.	818BME03	CELL BIOLOGY AND TISSUE ENGINEERING	PEC	3	0	0	3	3
56.	818BME04	ASSIST DEVICES	PEC	3	0	0	3	3
57.	818BME05	BIOMEMS	PEC	3	0	0	3	3
58.	818BME06	INTERNET OF THINGS IN MEDICAL APPLICATIONS	PEC	3	0	0	3	3
59.	818BME07	ADVANCED MEDICAL INSTRUMENTATION	PEC	3	0	0	3	3
60.	818BME08	BRAIN COMPUTER INTERFACE AND APPLICATIONS	PEC	3	0	0	3	3
61.	818BME09	MEDICAL ROBOTICS	PEC	3	0	0	3	3
62.	818BME10	WEARABLE SYSTEMS	PEC	3	0	0	3	3
63.	818BME11	BIOMETRICS	PEC	3	0	0	3	3

OPEN ELECTIVE COURSES (OEC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
5.	518EIO01	VIRTUAL INSTRUMENTATION	OEC	3	0	0	3	3
6.	518CIO05	JAVA PROGRAMMING	OEC	3	0	0	3	3
7.	518BTO11	MEDICAL CODING	OEC	3	0	0	3	3
8.	518ITO05	C# AND .NET FRAMEWORK	OEC	3	0	0	3	3
9.	418CIT05/ 618CIO06	COMPUTER NETWORKS	OEC	3	0	0	3	3
10.	618CST06/ 618CSO07	BIG DATA ANALYTIC	OEC	3	0	0	3	3
11.	618ECT02/ 618ECO09	VLSI DESIGN	OEC	3	0	0	3	3
12.	718CST03/ 618CSO10	CLOUD COMPUTING	OEC	3	0	0	3	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	618BMP08	EMPLOYABILITY SKILLS LAB	EEC	0	0	2	2	1
2.	618BMP09	HOSPITAL TRAINING	EEC	0	0	2	2	1
3.	718BMP08	MINI PROJECT	EEC	0	0	2	2	1
4.	718BMP09	INTERPERSONAL SKILLS/LISTENING & SPEAKING	EEC	0	0	2	2	1
5.	818BMP04	PROJECT WORK	EEC	0	0	18	18	9

SUMMARY

Name of the Programme: B.E. Biomedical Engineering										
S.No	**SUBJECT AREA**	**CREDITS PER SEMESTER**								**TOTAL CREDITS**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	
1	HSMC	2	5							7
2	BSC	9	7	4	4					24
3	ESC	7	5	7						19
4	PCC		4	11	18	18	13	13	3	80
5	PEC						3	6	6	15
6	OEC					3	3			6
7	EEC						2	2	9	13
Total		**18**	**21**	**22**	**22**	**21**	**21**	**21**	**18**	**164**

118ENT01	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- Develop strategies and skills to enhance their ability to read and comprehend engineeringand technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in groupdiscussions.
- Strengthen their listening skill which will help them comprehend lectures and talks intheir areas of specialization.

UNIT I **9**

Listening - Ink talks and gap exercises - Speaking – Asking for and giving directions - Reading – short technical texts from journals and newspapers - Writing - definitions – instructions – checklists – recommendations - Vocabulary Development - technical vocabulary - Language Development – parts of speech – articles – word formation.

UNIT II **9**

Listening - longer technical talks - Speaking – process description - Reading – longer technical texts – Writing – graphical representation - Vocabulary Development - vocabulary used in formal letters/emails and reports - Language Development – tenses - voices - numerical adjectives – question tags.

UNIT III **9**

Listening - listening to classroom lectures - Speaking – introduction to technical presentations - Reading – longer texts both general and technical and practice in speed reading – Writing – process description using sequence words and sentences - Vocabulary Development - Misspelled words – one-word substitution - Language Development - embedded sentences – singular and plural nouns compound nouns - editing

UNIT IV **9**

Listening - Listening to documentaries and making notes - Speaking – mechanics of presentations-Reading – reading comprehension – Writing - email etiquettes - job application – cover letter – Résumé preparation - essay writing - Vocabulary Development – synonyms and antonyms – paraphrasing - Language Development – modals – conditionals.

UNIT V **9**

Listening - TED talks - Speaking – brainstorming and debate – Reading – reading and understanding technical articles – Writing – reports - minutes of a meeting - Vocabulary

Development- verbal analogies - phrasal verbs - Language Development - concord - reported speech.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Read technical texts and write area- specific texts effortlessly.

CO2: Listen and comprehend lectures and talks in their area of specialization successfully.

CO3: Speak appropriately and effectively in varied formal and informal contexts.

CO4: Understand the basic grammatical structures and its applications.

CO5: Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.
2. Sudharshana. N. P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.
3. Uttham Kumar. N. Technical English I (with work book). Sahana Publications, Coimbatore, 2016.

REFERENCE BOOKS:

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015.
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.

Students can be asked to read Tagore and Chetan Bhagat for supplementary reading.

COURSE OUTCOMES		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	Read technical texts and write area- specific texts effortlessly	2		1		2		2		1		1	2	1	2	2
CO2	Listen and comprehend lectures and talks in their area of specialization successfully		1	2	1		1	3	1	2	2		1		1	1
CO3	Speak appropriately and effectively in varied formal and informal contexts		1	2	1		1		1	2	2		1	3	1	1

CO4	Understand the basic grammatical structures and its applications	2		1		2		2		1		1	2	1	2	2
CO5	Write reports and winning job applications		1	2	1		1		1	2	2		1	3	1	1

118MAT02 ENGINEERING MATHEMATICS-I

L	T	P	C
3	1	0	3

COURSE OBJECTIVES:

- To understand the eigen value problems.
- To solve differential equations of certain types, including systems of differential equations that they might encounter in the same or higher semesters.
- To understand the concepts of curvatures, evolutes and envelopes and to study the maxima and minima of any function.
- To learn the partial derivatives and apply the same to find maxima and minima.
- To solve certain linear differential equations using the Laplace transform technique which has applications in control theory and circuit theory.

UNIT I MATRICES **9**

Eigenvalues and eigenvectors of a real symmetric matrix –Properties – Cayley - Hamilton theorem (Statement only) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form –Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS **9**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolutes as envelope of normals.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Jacobians – Taylor's expansion– Maxima and Minima – Method of Lagrangian multipliers.

UNIT I VORDINARY DIFFERENTIAL EQUATIONS **9**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients-Applications to Engineering problems-Electric Circuits, Simple Harmonic Motions and bending of beams.

UNIT V LAPLACE TRANSFORM **9**

Laplace transforms – Conditions for existence –Basic properties (without proof) – Laplace

Transform of elementary functions, derivatives and integrals, unit step function and impulse functions, periodic functions. Definition of Inverse Laplace transform – Convolution theorem (Statement and applications only) – Initial and final value theorems (Statement and applications only) – Solution of linear ordinary differential equations of second order with constant coefficients using Laplace transform techniques.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop the knowledge of basic linear algebraic concepts.

CO2: Determine the solutions of ordinary differential equations by various methods which have an application in their core subjects.

CO3: Acquire the basic knowledge of ordinary differential calculus.

CO4: Compute maxima and minima of a function.

CO5: Apply Laplace transform techniques to solve ordinary differential equations which have an application in many engineering fields.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th edition New Delhi 2016.
2. Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.

REFERENCE BOOKS:

1. T.Veerarajan, "Engineering Mathematics " Tata McGraw-Hill Publishing company, New Delhi, 2014.
2. Kandasamy.P, Thilagavathy,K., &Gunavathi.K., "Engineering Mathematics for first year "., S.Chand & Company Ltd., New Delhi,2014.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.

COURSE OUTCOMES		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	Develop the knowledge of basic linear algebraic concepts	2		1		2		2		1		1	2	1	2	2
CO2	Determine the solutions of ordinary differential equations by various methods which have an application in their core subjects.		1	2	1		1		1	2	2		1		1	1
CO3	Acquire the basic		1	2	1		1		1	2	2		1		1	1

	knowledge of ordinary differential calculus.															
CO4	Compute maxima and minima of a function.	2		1		2		2		1		1	2	1	2	2
CO5	Apply Laplace transform techniques to solve ordinary differential equations which have an application in many engineering fields.	2		1		2		2		1		1	2	1	2	2

118PHT03 **ENGINEERING PHYSICS** **L T P C**

2 0 0 2

COURSE OBJECTIVES:

- To understand the concept of properties of matter.
- To understand the properties of sound and principles of quantization of energy.
- To understand the properties of coherent light and its importance.

UNIT-I PROPERTIES OF MATTER **9**

Elasticity – Stress – Strain diagram – Factors affecting elasticity – Twisting couple on a wire – Torsion pendulum – Young's modulus - cantilever – Uniform and Non uniform bending (theory and experiment)–Viscosity-Poiseuille's method for Coefficient of Viscosity (Qualitative).

UNIT-II ACOUSTICS AND ULTRASONICS **9**

Classification of sound, loudness, intensity – Decibel – Weber Fechner Law – Reverberation and Reverberation time – derivation of Sabine's formula for Reverberation time (Growth and Decay)– Absorption coefficient and its determination. Introduction of Ultrasonics – Production – magnetostriction effect – magnetostriction generator– piezoelectric effect – piezoelectric generator – Detection of ultrasonic waves, properties – Cavitation – Applications – Depth of sea – Non Destructive Testing.

UNIT-III QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh–jeans' Law from Planck's theory – Compton Effect–derivation– Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box – Degeneracy and Non-degeneracy.

UNIT-IV LASER **9**

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion – pumping – Einstein's A and B coefficients – derivation – Types of lasers – He-Ne, CO_2, Nd-YAG, Semiconductor lasers – homojunction – Applications of Laser.

UNIT-V WAVE OPTICS & FIBRE OPTICS 9

Interference – Air wedge (theory & experiment) – Polarization– Methods of polarizing light- Theory of plane circularly and elliptically polarized light. Principle and propagation of light in optical fibers – Numerical aperture and Acceptance angle– Types of optical fibers (material, refractive index, and mode) – Fiber optical communication system (Block diagram) – Fiber optic sensors – Temperature & Displacement sensors (Qualitative).

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: To understand properties of solids with different types of moduli and to gain knowledgeabout absorption coefficients of solids and different surfaces.

CO2: To understand basic concepts of high frequency sound waves and its applications.

CO3: To understand basic concepts of quantum mechanical behavior of wave and particlealong with applications.

CO4: To understand the concepts of production of laser and its behavior with diffraction principle of interference.

CO5: To apply the concept of polarization phenomenon and thereby its applications in fiber optic communication.

TEXT BOOKS:

1. R.K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi(2003)
2. Jayaprakash R.N, 'Engineering Physics - I', Dhanam Publications, Chennai, (2007).

REFRENCE BOOKS:

1. Dr.M.N.Avadhanulu, Introduction to Lasers: theory and applications S.Chand publications 2012, New Delhi.

COURSE OUTCOMES		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	To understand properties of solids with different types of moduli and to gain knowledgeabout absorption coefficients of solids and different surfaces.	2		1		2		2		1		1	2	1	2	2
CO2	To understand basic concepts of high frequency sound waves and its applications		1	2	1		1		1	2	2		1		1	1
CO3	To understand basic concepts of quantum mechanical behavior of wave and particlealong	2		1		2		2		1		1	2	1	2	2

	with applications.															
CO4	To understand the concepts of production of laser and its behavior with diffractionprinciple of interference.	2		1		2		2		1		1	2	1	2	2
CO5	To apply the concept of polarization phenomenon and thereby its applications in fiberoptic communication.	2		1		2		2		1		1	2	1	2	2

118CYT04 **ENGINEERING CHEMISTRY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To recall the terminologies of electrochemistry and explain the function of batteries andfuel cells with its electrochemical reactions.
- To understand the fundamentals of corrosion, its types and polymers with its applications.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water - types - expression of hardness - units - estimation of hardness of water by EDTA - numerical problems -Alkalinity-types of alkalinity-determination of alkaninity-boiler troubles (scale and sludge) - treatment of boiler feed water - Internal treatment (carbonate, colloidal, phosphate and calgon conditioning) external treatment Ion exchange process, zeolite process - desalination of brackish water - Reverse Osmosis.

UNIT II ELECTROCHEMISTRY AND ENERGY STORAGE DEVICES 9

Electrochemical cell-single electrode potential-standard electrode potential-electrochemical series and its significance-EMF of a cell- Nernst equation -Electrodes-Reference electrodes-hydrogen, calomel, quinhydrone and glass electrodes. Determination of pH of a solution using a glass electrode. Batteries - primary and secondary cells, dry cell, alkaline, lead acid storage cell, Ni-Cd battery and lithium nano battery. Clean energy fuel cells - H2-O2 fuel cell.

UNIT III CORROSION SCIENCE 9

Corrosion: definition - types of corrosion: chemical and electrochemical corrosion – Pilling Bedworth ratio - types of oxide layer (stable, unstable, volatile, porous) - hydrogen evolution and oxygen absorption mechanism for electrochemical corrosion - mechanism for rusting of iron. Types of electrochemical corrosion: Galvanic corrosion - differential aeration corrosion

(pitting, waterline and pipeline). Galvanic series - applications. Factors influencing corrosion: nature of metal and environment. Corrosion control methods: sacrificial anode method - impressed current Cathodic protection method - electroplating - electroless plating.

UNIT IV POLYMERS AND ITS PROCESSING 9

Monomers - polymers - polymerization - functionality – degree of polymerization - classification of polymers based on source and applications - Molecular weight determination. Types of polymerization: addition, condensation and copolymerization - mechanism of free radical polymerization. Preparation, properties and applications of PE, PVC, Teflon, terylene, Nylon and Bakelite. Rubber-drawbacks of natural rubber-Vulcanization-Compounding of plastics - injection and blow moulding methods.

UNIT V FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. **Combustion of fuels:** Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Attribute the internal and external treatment methods for the removal of hardness in water for domestic and industrial applications.

CO2: Construct an electrochemical cell and Identify the components and processes in batteries and infer the selection criteria for commercial battery systems with respect to different applications.

CO3: Utilize electrochemical data to formulate an electrochemical half-cell and cell reactions for corrosion control processes.

CO4: Differentiate the polymers used in day to day life based on its source, properties and applications.

CO5: Analyse the three types of fuels based on calorific value for selected application.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, “A Textbook of Engineering Chemistry”, S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, “Engineering Chemistry” Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India PVT, LTD, New Delhi, 2013.

REFERENCE BOOKS:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi,2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

COURSE OUTCOMES		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	Attribute the internal and external treatment methods for the removal of hardness in water for domestic and industrial applications.		1	2	1		1		1	2	2		1		1	1
CO2	Construct an electrochemical cell and Identify the components and processes in batteries and infer the selection criteria for commercial battery systems with respect to different applications.		1	2	1		1		1	2	2		1		1	1
CO3	Utilize electrochemical data to formulate an electrochemical half-cell and cell reactions for corrosion control processes.	2		1		2		2		1		1	2	1	2	2
CO4	Differentiate the polymers used in day to day life based on its source, properties and applications.	2		1		2		2		1		1	2	1	2	2
CO5	Analyse the three types of fuels based on calorific value for selected application.		1	2	1		1		1	2	2		1		1	1

118PPT05 PROBLEM SOLVING AND PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS **9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS **9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Arrays. Illustrative programs: squareroot, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES **9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, date and time, errors and exceptions, handling exceptions, debugging, modules, packages; Illustrative programs: word count, copy file.

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems
CO2: Read, write, execute by hand simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.

CO5: Represent compound data using Python lists, tuples, and dictionaries.

TOTAL HOURS: 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS:

1. John V Guttag, —Introduction to Computation and Programming Using Python'', Revisedand expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-Disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, —Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs‖, CENGAGE Learning,2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A ComputationalProblem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

COURSE OUTCOMES		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	Develop algorithmic solutions to simple computational problems	2		1		2		2		1		1	2	1	2	2
CO2	Read, write, execute by hand simple Python programs.		1	2	1		1		1	2	2		1		1	1
CO3	Structure simple Python programs for solving problems.		1	2	1		1		1	2	2		1		1	1
CO4	Decompose a Python program into functions.	2		1		2		2		1		1	2	1	2	2
CO5	Represent compound data using Python lists, tuples, dictionaries.	2		1		2		2	3	1		1	2	1	2	2

118ESE01	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To gain the knowledge on civil works like masonry, roofing, flooring and plastering.
To gain the knowledge on stress, strain of various building and foundations.
The students should familiar with foundry, welding and forging processes.
The students should familiar working principle of IC engines and its types.
To gain the knowledge about various energy recourses and refrigeration air condition systems.

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying: Objects, types, classification, principles, measurements of distances, angles, leveling, determination of areas, illustrative examples. **Civil Engineering Materials:** Bricks, stones, sand,cement, concrete, steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 10

Foundations: Types, Bearing capacity, Requirement of good foundations. **Superstructure:** Brick masonry, stone masonry, beams, columns, lintels, roofing, flooring, plastering, Mechanics, Internal and external forces, Stress, Strain, Elasticity, Types of Bridges and Dams, Basics of Interior Designand Landscaping.

B – MECHANICAL ENGINEERING

UNIT III FOUNDRY WELDING AND FORGING 10

Foundry: Introduction - Patterns –materials. Types of pattern and pattern allowances. Molding sand, types and properties, Molding procedure. **Welding:** Definition and Classification, Gas welding, Oxy Acetylene welding, Types of flames, advantages and disadvantages of gas welding. Resistance welding - Classification, Spot welding and Seam welding. Soldering, Definition and Classification. Brazing – Definition and Classification. **Forging:** Types of Forging, Differences between Hot working and Cold working processes.

UNIT IV IC ENGINES& BOILERS 8

Internal combustion engines, Working principle of Petrol and Diesel Engines, Four stroke and Two stroke cycles, Comparison of four stroke and two stroke engines, Boilers: Introduction of boilers, classification, Lancashire boiler, Babcock and Wilcox boiler, list of boiler mountings and accessories and applications (no sketches).

UNIT V SOURCE OF ENERGY&REFRIGERATION 8

Sources of energy: Introduction, conventional and non-conventional sources of energy, examples, solar energy, hydro power plant. Introduction to refrigeration and air-conditioning, COP, properties of refrigerants and types of refrigerants, working principle of

vapour compression & vapour absorption refrigeration system, Layout of typical domestic refrigerator, Window and Split type room Air conditioner.

TOTAL HOURS: 45 HOURS

COURSE OUTCOMES:

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

CO1: The usage of surveying and properties of construction materials.

CO2: The stress strain of various building and material such as substructure, road transport and bridge.

CO3: The concept of manufacturing methods encountered in engineering practice such as foundry, welding and forging processes.

CO4: The working of internal combustion engines and its types.

CO5: The concept of energy conservation in practical, power plant refrigeration air condition andits types.

TEXT BOOKS:

1. Ranganath G and Channankaiah, "Basic Engineering Civil & Mechanical", S.S.Publishers,2014.
2. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 3rd Edition, 2012.

REFERENCE BOOKS:

1. Venugopal.K and PrabhuRaja.V, "Basic Mechanical Engineering", Anuradha Publishers,Kumbakonam, 2015.
2. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd, 3rd Edition reprint, 2013.
3. Shanmugasundaram. S and Mylsamy. K, "Basics of Civil and Mechanical Engineering",Cenage Learning India Pvt.Ltd, NewDelhi, 2012.
4. Khanna O.P, Foundry Technology, Dhanpat Rai Publishing Co. (P) Ltd, 2011.
5. Shanmugam G., "Basic Mechanical Engineering", Tata McGraw Hill Publishing Co., NewDelhi, 2010.
6. Gopalakrishna K R, "Elements of Mechanical Engineering", Subhas Publications, Bangalore,2008.
7. Shantha Kumar S R J, "Basic Mechanical Engineering", Hi-Tech Publications,Mayiladuthurai, 2001.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	The usage of surveying and properties of construction materials.		1	2	1		1		1	2	2		1		1	1
CO2	The stress strain of various building and	2		1		2		2		1		1	2	1	2	2

	material such as substructure, road transportand bridge.															
CO3	The concept of manufacturing methods encountered in engineering practice such asfoundry, elding and forging processes.	2		1		2		2		1		1	2	1	2	2
CO4	The working of internal combustion engines and its types.		1	2	1		1		1	2	2		1		1	1
CO5	The concept of energy conservation in practical, power plant refrigeration air condition andits types.	2		1		2		2		1		1	2	1	2	2

118ESE07 **BIOLOGY FOR ENGINEERS** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To familiarize the basic organization of organisms and subsequent building to a living being
- To provide knowledge about biological problems that require engineering expertise to solvethem
- To understand the concepts of enzymes and its industrial applications
- To impart an understanding about the machinery of the cell functions that is ultimatelyresponsible for various daily activities.
- To know about the nervous system, immune system and cell signaling

UNIT I BASIC CELL BIOLOGY 9

Introduction: Methods of Science-Living Organisms: Cells and Cell theory Cell Structure and Function, Genetic information, protein synthesis, and protein structure, transcription, translation,Cell metabolism-Homoeostasis-Cell growth, reproduction, and differentiation

UNIT II BIOCHEMISTRY AND MOLECULAR ASPECTS OF LIFE 9

Biological Diversity --Chemistry of life: chemical bonds--Biochemistry and Human biology--Protein synthesis- Protein Folding- Bioinformatics- Disease detection – PCR and electrophoresis-clone and DNA sequencing -Stem cells and Tissue engineering

UNIT III ENZYMES AND INDUSTRIAL APPLICATIONS 9

Enzymes: Biological catalysts, Proteases, Carbonic anhydrase, Restriction enzymes, and Nucleoside monophosphate kinases – Photosynthesis, DNA replication, protein synthesis

UNIT IV MECHANOCHEMISTRY 9

Molecular Machines/Motors – Cytoskeleton – Bioremediation- phytoremediation,

mycoremediation–Biosensors-Principle, Immobilization of biological components, Molecular recognition –Biological recognition agents, Application of Biosensors-Biosensors for Clinical Chemistry

UNIT V NERVOUS SYSTEM, IMMUNE SYSTEM AND CELL SIGNALING 9

Nervous system- central Nervous system, Peripheral, Nervous system. Immune system-innate immune system, Adaptive immune system, Neuroimmune system - General principles of cell signaling- classification, Signal Pathway

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: To familiarize the basic organization of organisms and subsequent building to a living being

CO2: To provide knowledge about biological problems that require engineering expertise to solvethem

CO3: To understand the concepts of enzymes and its industrial applications

CO4: To impart an understanding about the machinery of the cell functions that is ultimatelyresponsible for various daily activities.

CO5: To know about the nervous system, immune system and cell signaling

TEXT BOOK:

1. ThyagaRajan S, Selvamurugan N, Rajesh M. P, Nazeer, Richard Thilagaraj R.A, Barathi.W.S and. Jaganthan. M. K "Biology for Engineers," Tata McGraw-Hill, New Delhi, 2012.

REFERENCE BOOKS:

1. Jeremy M, Berg John.L, Tymoczko and Lubert Stryer, "Biochemistry," W.H. Freeman andCo. Ltd., 6th Ed., 2006.
2. Robert Weaver, "Molecular Biology," MCGraw-Hill, 5th Edition, 2012.
3. Jon Cooper, "Biosensors A Practical Approach" Bellwether Books, 2004.
4. Martin Alexander, "Biodegradation and Bioremediation," Academic Press,1994.
5. Kenneth Murphy, "Janeway's Immunobiology," Garland Science; 8th edition, 2011.
6. Eric. R, Kandel, James.H, Schwartz, Thomas. M, Jessell, "Principles of Neural Science",Mc-Graw Hill, 5th Edition, 2012.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	To familiarize the basic organization of organisms and subsequent building to a living being	2	1	2			1						1	2		2
CO2	To provide knowledge about biological problems that require engineering	2	1	2			1						1	2		2

	expertise to solvethem															
CO3	To understand the concepts of enzymes and its industrial applications	2	1	2			1						1	2		2
CO4	To impart an understanding about the machinery of the cell functions that is ultimatelyresponsible for various daily activities.	2	1	2			1						1	2	2	2
CO5	To know about the nervous system, immune system and cell signaling	2	1	2			1						1	2	2	2

118PHP07 **ENGINEERING PHYSICS LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- To understand the practical concepts of Interference and diffraction.
- To understand the concept of velocities of sound in different liquids.
- To get better knowledge of modulus of elasticity.
- To understand the concepts of thermal conductivity.
- To understand the concepts of viscosities of liquid

LIST OF EXPERIMENTS

1. (a) Determination of laser parameters – Wavelength.
   (b) Particle size determination using Diode Laser.
2. Determination of thickness of a thin wire-Air wedge method.
3. Determination of velocity of sound and compressibility of liquid- Ultrasonicinterferometer.
4. Determination of wavelength of mercury spectrum-Spectrometer grating.
5. Determination of thermal conductivity of a bad conductor-Lee's disc method.
6. Determination of Young's modulus of the material –Non uniform bending.
7. Determination of viscosity of liquid – Poiseuille's method.
8. Spectrometer- Dispersive power of prism.
9. Determination of Young's modulus of the material - Uniform bending.
10. Tensional pendulum- Determination of Rigidity modulus.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understanding the moduli of elasticity by determining Young's modulus and Rigiditymodulus of a beam and cylinder respectively.

CO2: Understanding the phenomenon of diffraction, dispersion and interference of light

usingoptical component

CO3: Acquiring knowledge of viscosity by determining coefficient of viscosity of a liquid andmeasuring the parameters of ultrasound propagating through a liquid

CO4: Understanding the phenomenon of heat transfer through conductors and bad conductors by determining thermal conductivity.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Understanding the moduli of elasticity by determining Young's modulus and Rigidity modulus of a beam and cylinder respectively.	2		1		2		2		1		1	2	1	2	2
CO2	Understanding the phenomenon of diffraction, dispersion and interference of light usingoptical component		1	2	1		1		1	2	2		1		1	1
CO3	Acquiring knowledge of viscosity by determining coefficient of viscosity of a liquid and measuring the parameters of ultrasound propagating through a liquid	2		1		2		2		1		1	2	1	2	2
CO4	Understanding the phenomenon of heat transfer through conductors and bad conductors by determining thermal conductivity.		1	2	1		1		1	2	2		1		1	1

118PPP08 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY **L T P C**
0 0 2 1

COURSE OBJECTIVE:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.

- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS:

1. To Implement python scripts using Variables and operators
2. To Demonstrate Operator precedence to evaluate an expression
3. Display grade of a student using elif statement
4. Implement Floyd triangle using for loop
5. Checks the given number is prime or not using while loop
6. Compute the GCD of Numbers using functions
7. Finding factorial of a given number using recursive function.
8. Takes a list of words and returns the length of longest one using strings
9. To perform linear and binary search using strings
10. To implement list as arrays (multiply 2 matrices)
11. To demonstrate use of list & related functions
12. To demonstrate use of tuple, set& related functions
13. To demonstrate use of Dictionary& related functions
14. Finding most frequent words in a text read from a file
15. Programs that take command line arguments (word count)

TOTAL HOURS: 45 PERIODS

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:

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

CO1: Write, test, and debug simple Python programs.

CO2: Implement Python Programs with conditionals and loops.

CO3: Develop Python programs step-wise by defining functions and calling them.

CO4: Use Python lists, tuples, dictionaries for representing compound data.

CO5: Read and write data from/to files in Python.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Write, test, and debug simple Python programs.	2		1		2		2		1		1	2	1	2	2
CO2	Implement Python Programs with conditionals and loops		1	2	1		1		1	2	2		1		1	1
CO3	Develop Python programs step-wise by defining functions and calling them.		1	2	1		1		1	2	2		1		1	1

CO4	Use Python lists, tuples, dictionaries for representing compound data.	2		1		2		2		1		1	2	1	2	2
CO5	Read and write data from/to files in Python.	2		1		2		2	3	1		1	2	1	2	2

218ENT01 **COMMUNICATIVE ENGLISH** **L T P C**
2 0 2 3

COURSE OBJECTIVES:

- To help learners develop their listening skills which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To develop the basic reading and writing skills of first year engineering and technologystudents.
- To help learners develop grammar and vocabulary of a general kind by developing theirreading skills

UNIT I **9**

Listening - conversation - Speaking – introducing oneself - exchanging personal information - Reading – comprehension - Writing - paragraph - Vocabulary Development - synonyms and antonyms - Language Development – consonants & vowels - phonetic transcription.

UNIT II **9**

Listening - telephonic conversation - Speaking – sharing information of a personal kind – greeting - taking leave - Reading – short stories – The Gift of the Magi, A Service of Love and The Last Leaf by O. Henry – Writing – developing hints - Vocabulary Development – everyday vocabulary - Language Development – British and American English - infinitive and gerund.

UNIT III **9**

Listening – class memory quiz - Speaking – impromptu - Reading – magazines – Writing – agenda - proposals - Vocabulary Development - important words used in speaking and writing - Language Development – types of sentences - information and emphasis.

UNIT IV **9**

Listening – interviews of famous persons - Speaking – story narration - Reading – case study – Writing – invitation letter - quotation letter - Vocabulary Development – listening and reading vocabulary - Language Development – cause and effect – purpose and function.

UNIT V **9**

Listening - a scene from a film - Speaking - role play - Reading – jigsaw – Writing – essay writing - Vocabulary Development- business vocabulary - Language Development - degrees of comparison-real English phrases.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Comprehend conversations and talks delivered in English.
CO2: Participate effectively in formal and informal conversations; introduce themselves and their friends and express opinions in English.
CO3: Read short stories, magazines, novels and other printed texts of a general kind.
CO4: Write short paragraphs, essays, letters and develop hints in English.

TEXT BOOKS:

1. Board of Editors. Using English A Coursebook for Undergarduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2, New Delhi: CUP, 2015.
3. Uttham Kumar, N. Communicative English (with work book). Sahana Publications, Coimbatore, 2019.

REFERENCE BOOKS:

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.
3. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books:2013.
4. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. CengageLearning, USA: 2007.
5. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book &Workbook). Cambridge University Press, New Delhi: 2005.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Comprehend conversations and talks delivered in English.	2		1		2		2		1		1	2	1	2	2
CO2	Participate effectively in formal and informal conversations; introduce themselves andtheir	2		1		2		2	3	1		1	2	1	2	2

	friends and express opinions in English.															
CO3	Read short stories, magazines, novels and other printed texts of a general kind.	2		1		2		2		1		1	2	1	2	2
CO4	Write short paragraphs, essays, letters and develop hints in English.		1	2	1		1		1	2	2		1		1	1

218MAT02 ENGINEERING MATHEMATICS-II

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To understand double and triple integration concepts and apply to study vector calculus comprising of surface and volume integrals along with the classical theorems involving them.
- To learn analytic functions and their properties and also conformal mappings with few standard examples those have direct applications.
- To grasp the basics of complex integration and application to contour integration which is important for evaluation of certain integrals encountered in engineering problems.
- To introduce the concept of improper integrals through Beta and Gamma functions.

UNIT-I INTEGRAL CALCULUS 9+3

Definite and indefinite integrals - Substitution rule – Techniques of integration –Integration by parts – Trigonometric integrals - Trigonometric substitutions - Integration of rational functions by partial fractions – Integration irrational functions.

UNIT-II MULTIPLE INTEGRALS 9+3

Double integration – Cartesian and polar co-ordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates –Triple integration in Cartesian co-ordinates-Area as double integral – Volume as triple integral.

UNIT-III VECTOR CALCULUS 9+3

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal, vector fields-Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (Statement and applications only) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT-IV ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy–Riemann equation and Sufficient conditions (Statement and applications only) – Harmonic and orthogonal properties of analytic function (Statement and applications only) – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w= z+c, cz,

1/z, and bilinear transformation.

UNIT-V COMPLEX INTEGRATION 9+3

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points –Residues – Residue theorem- Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

TOTAL HOURS: 45+15 = 60 PERIODS

COURSE OUTCOMES:

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

CO1: Determine the area and volume in 2-dimension and 3-dimension respectively using multiple integrals and also extending the concept to vector fields.

CO2: Learn the basic concepts of analytic functions and transformations of complex functions.

CO3: Master the integration in complex domain.

CO4: Understand the use of improper integrals' applications in the core subject.

TEXT BOOK:

1. Grewal. B.S., "Higher Engineering Mathematics", 43th Edition, Khanna Publications,Delhi, 2015.

REFERENCE BOOKS:

1. James Stewart, "Stewart Calculus", 8th edition,2015, ISBN: 9781285741550/1285741552.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", tenth edition, Wiley India, 2011.
3. P.Kandasamy, K.Thilagavathy, K.Gunavathy, "Engineering Mathematics for first year",S.Chand & Company Ltd., 9th Edition, New Delhi, 2014.
4. V.Prameelakaladharan and G.Balaji, "Engineering Mathematics - II",1st Edition, Amrutha marketing, Chennai, 2017.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Determine the area and volume in 2-dimension and 3-dimension respectively using multiple integrals and also extending the concept to vector fields.	2		1		2		2		1		1	2	1	2	2

CO2	Learn the basic concepts of analytic functions and transformations of complex functions.		1	2	1		1		1	2	2		1		1	1
CO3	Master the integration in complex domain.		1	2	1		1		1	2	2		1		1	1
CO4	Understand the use of improper integrals' applications in the core subject.	2		1		2		2		1		1	2	1	2	2

218GET03 **ENVIRONMENTAL SCIENCE AND ENGINEERING** **L T P C**
2 0 0 2

COURSE OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions toenvironmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world;envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior andsurface.

UNIT I NATURAL RESOURCES **14**

Definition, scope and importance of environment – need for public awareness - Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMSANDBIODIVERSITY 8

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers –energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India –conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes.

UNIT III ENVIRONMENTAL POLLUTION 10

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soilpollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Gain knowledge about environment and ecosystem.

CO2: Learn about natural resource, its importance and environmental impacts of human activities on natural resource.

CO3: Gain knowledge about the conservation of biodiversity and its importance

CO4: Aware about problems of environmental pollution, its impact on human and ecosystem and control measures.

CO5: Learn about increase in population growth and its impact on environment

TEXT BOOKS:

1. Benny Joseph, Environmental Science and Engineering ', Tata McGraw-Hill, New Delhi,2006.
2. Gilbert M. Masters, Introduction to Environmental Engineering and Science ', 2nd edition, Pearson Education, 2004.
3. Dr. G. Ranganath, Environmental Science and Engineering, Sahana Publishers, 2018 edition.

REFERENCE BOOKS:

1. Dharmendra S. Sengar, Environmental law ', Prentice hall of India PVT LTD, New Delhi,2007.

COURSE OUTCOMES		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	Gain knowledge about environment and ecosystem.	2		1		2		2		1		1	2	1	2	2
CO2	Learn about natural resource, its importance and environmental impacts of human activities on natural resource.		1	2	1		1		1	2	2		1		1	1
CO3	Gain knowledge about the conservation of biodiversity and its importance	2		1		2		2		1		1	2	1	2	2
CO4	Aware about problems of environmental pollution, its impact on human and ecosystem and control measures.	2		1		2		2		1		1	2	1	2	2
CO5	Learn about increase in population growth and its impact on environment	2		1		2		2		1		1	2	1	2	2

218EGT04	ENGINEERING GRAPHICS	L	T	P	C
		2	0	4	4

COURSE OBJECTIVES:

- To understand the graphical skills for drawing the object and the principle of free-hand sketchingtechniques.
- To understand the principle of orthographic projection of points, lines and plane surfaces.
- To study the principle of simple solids.
- To understand the principle of section and development of solids.
- To understand the principle of Isometric and Perspective projections.

Concepts and conventions (Not for Examination) **3**

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

UNIT I PLANE CURVES AND FREE HAND SKETCHING **15**

Curves used in engineering practices:

Conics – Construction of ellipse, Parabola and hyperbola by Eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Free hand sketching:

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **15**

Projection of points and straight lines located in the first quadrant – Determination of true lengths andtrue inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS **15**

Projection of simple solids like prisms, pyramids, cylinders and cones when the axis is inclined to onereference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **15**

Sectioning of simple solids like prisms, pyramids, cylinders and cones in simple vertical position

by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncatedprisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL HOURS: 75 PERIODS

COURSE OUTCOMES:

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

CO1: Recognize the conventions and apply dimensioning concepts while drafting simple objects.
CO2: Draw the orthographic projection of points, line, and plane surfaces.
CO3: Draw the orthographic projection of simple solids.
CO4: Draw the section of solid drawings and development of surfaces of the given objects.
CO5: Apply the concepts of isometric and perspective projection in engineering practice.

TEXT BOOKS:

1. Ranganath G, Channankaiah and Halesh Koti, "Engineering Graphics", Second Edition, Sahana Publishers, 2015.
2. Bhatt. N.D., "Engineering Drawing" Charotar Publishing House, 53th Edition, 2014.

REFERENCE BOOKS:

1. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw HillPublishing Company Limited, 2017.
2. Gopalakrishnana. K. R, "Engineering Drawing" (Vol. I & II), Subhas Publications, 2014.
3. Basant Agarwal and C.M.Agarwal, "Engineering Drawing", Tata McGraw Hill, 2013.
4. Natrajan K. V, "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2012.
5. M.B.Shaw and B.C.Rana, "Engineering Drawing", Pearson Education India, 2011.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Recognize the conventions and apply dimensioning concepts while drafting simple objects.		1	2	1		1		1	2	2		1		1	1
CO2	Draw the orthographic projection of points, line,		1	2	1		1		1	2	2		1		1	1

	and plane surfaces.															
CO3	Draw the orthographic projection of simple solids.	2		1		2		2		1		1	2	1	2	2
CO4	Draw the section of solid drawings and development of surfaces of the given objects.	2		1		2		2	3	1		1	2	1	2	2
CO5	Apply the concepts of isometric and perspective projection in engineering practice.	2		1		2		2		1		1	2	1	2	2

218EDT05 ELECTRIC CIRCUITS AND ELECTRON DEVICES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Analyze the two port networks using different techniques
- Analyze the transient response in RLC circuits
- Discuss the concept of intrinsic and extrinsic semiconductors and its characteristics
- Infer the concept of different configurations of transistor and their characteristics
- Study the various forms of semiconductors devices

UNIT-I CIRCUIT ANALYSIS TECHNIQUES 9

Kirchhoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion. (Include Topic: General Methods of Network Analysis (mesh & nodal analysis)

UNIT - II TRANSIENT RESONANCE IN RLC CIRCUITS 9

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT – III SEMICONDUCTOR DIODES 9

Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT - IV TRANSISTORS 9

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N- Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation –comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT – V SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only) 9

Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistors equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the two port networks using different techniques
CO2: Compute transient response in RLC circuits
CO3: Describe the concept of intrinsic and extrinsic semiconductors and its characteristics
CO4: Explain the concept of transistor configurations and their applications
CO5: Recognize the various forms of semiconductors devices and their characteristics.

TEXT BOOKS:

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series, TMH, 2001.
2. S. Salivahanan, N. Suresh kumar and A. Vallavaraj, "Electronic Devices and Circuits",2nd Edition, 2008.

REFERENCE BOOKS:

1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.
2. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education,7th Education, 2006.
3. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering CircuitAnalysis", TMH, 6th Edition, 2002.
4. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits", TMH, 2nd Education, 2008.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Analyze the two port networks using different techniques			2	3										2	
CO2	Compute transient response in RLC circuits			2	3										2	
CO3	Describe the concept of intrinsic and extrinsic semiconductors and its characteristics	3		3											2	

CO4	Explain the concept of transistor configurations and their applications	3		3										2		
CO5	Recognize the various forms of semiconductors devices and their characteristics.	3		3										2		

218BSE08 PHYSICS FOR ELECTRONICS ENGINEERING

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To study the basic theory of structure of crystalline materials.
- To understand the essential principles of electrical properties of materials.
- To get the better knowledge of Physics of semiconductor materials.
- Become proficient in dielectric properties of materials.
- To understand the essential concepts of nanomaterial devices and applications

UNIT I CRYSTALLOGRAPHY **9**

Crystal structures- Parameters- Bravais lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for SC, BCC, FCC, HCP and Diamond cubic structure - NaCl, ZnS structures (qualitative). Miller indices- unit cell approach.

UNIT II ELECTRICAL PROPERTIES OF MATERIALS **9**

Classical free electron theory-Expression for electrical conductivity-Thermal conductivity, Expression-Wiedemann-Franz law-Success and failures-Quantum free electron theory-Particle in a finite potential well-Tunneling-Particle in a three dimensional box-degenerate States-Fermi- Dirac statistics-Density of energy states-Energy bands in solids.

UNIT III SEMICONDUCTORS AND TRANSPORT PHYSICS **9**

Intrinsic Semiconductors-Energy band diagram-direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors-extrinsic semiconductors-Carrier concentration in N-type & P-type semiconductors (qualitative) -Variation of carrier concentration with temperature -Hall effect and devices-Ohmic contacts-Schottky diode.

UNIT IV DIELECTRIC MATERIALS **9**

Dielectrics: Dielectric constant - Dielectric loss - Electrical susceptibility- Electronic, ionic - orientational and space charge polarization - Frequency and temperature dependence of polarization - internal field - Claussius - Mosotti relation (derivation) - Thermal conductivity by Lee's disc method for dielectric material.

UNIT V NANOMATERIAL DEVICES 9

Nano materials: Introduction – Synthesis – Plasma arcing – Chemical vapour deposition – Electrodeposition – Ball Milling – Sol-Gel method – Spin coating method- photo current in a P-N diode –Solar cell – LED- Properties of nanoparticles and their applications.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Have the necessary understanding on the functioning of crystalline in solids of materials.

CO2: Gain knowledge on classical and quantum electron theories, and energy band structures.

CO3: Acquire knowledge on basics of semiconductor physics and its applications in various devices.

CO4: Get knowledge on dielectric properties of materials and their applications.

CO5: Understand the basics of nanodevices and applications.

TEXT/REFERENCE BOOKS:

1. Donald Askeland, "Materials Science and Engineering", Cengage Learning India Pvt Ltd.,2010.
2. Kasap S.O., "Principles of Electronic Materials and Devices" Tata Mc Graw-Hill 2007.Pierret R.F, "Semiconductor Device Fundamentals", Pearson 2006
3. W.D.Callister and D.G.Rethwisch, "Materials Science and Engineering", John Wiley &Sons,Inc., New Jersey (2010).
4. Hanson G.W., "Fundamentals of Nanoelectronics", Pearson Education 2009.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Have the necessary understanding on the functioning of crystalline in solids of materials.	2		1		2		2		1		1	2	1	2	2
CO2	Gain knowledge on classical and quantum electron theories, and energy band structures.		1	2	1		1		1	2	2		1		1	1
CO3	Acquire knowledge on basics of semiconductor physics and its applications in various devices.	2		1		2		2		1		1	2	1	2	2
CO4	Get knowledge on dielectric properties of materials and their	2		1		2		2		1		1	2	1	2	2

	applications.															
CO5	Understand the basics of nanodevices and applications.	2		1		2		2		1		1	2	1	2	2

218CYP07 **ENGINEERING CHEMISTRY LABORATORY** **L T P C**
2 0 0 2

COURSE OBJECTIVES:

- Students will be conversant with the estimation of various compounds using volumetric andinstrumental analysis.

LIST OF EXPERIMENTS

1. Estimation of Total hardness by EDTA
2. Determination of percentage of calcium in Lime Stone by EDTA
3. Estimation of chloride in water sample
4. Estimation of alkalinity of Water sample
5. Determination of DO in Water (Winkler's Method)
6. Determination of Rate of Corrosion of the given steel specimen by weight loss method(Without inhibitor)
7. Determination of Rate of Corrosion of the given steel specimen by weight loss method (With inhibitor)
8. Conduct metric titration (Simple acid base)
9. Conduct metric titration (Mixture of weak and strong acids)
10. Conduct metric titration using $BaCl_2$vs Na_2SO_4
11. Potentiometric Titration (Fe^{2+}/$KMnO_4$ or $K_2Cr_2O_7$)
12. PH titration (acid & base)
13. Determination of water of crystallization of a crystalline salt -Copper sulphate
14. Preparation of Bio-Diesel by Trans etherification method.

A minimum of TEN experiments shall be offered.

COURSE OUTCOMES:

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

CO1: Carry out the volumetric experiments and improve the analytical skills.

CO2: Understand the maintenance and usage of analytical instruments and thereby develop their skills in the field of engineering.

CO3: Understand the principle and handling of electrochemical instruments and Spectrophotometer.

CO4: Understand the principle and handling of electrochemical instruments and Spectrophotometer.

CO5: Apply their knowledge for protection of different metals from corrosion by using different inhibitors

TEXT BOOKS:

1. Arthur I. Vogel's, "Quantitative Inorganic Analysis including Elementary Instrumental Analysis", ELBS, Group, 7th Edition, 2000.
2. Dr. K .Sivakumar, "Engineering Chemistry lab manual", S.S publishers, 2016.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Carry out the volumetric experiments and improve the analytical skills.		1	2	1		1		1	2	2		1		1	1
CO2	Understand the maintenance and usage of analytical instruments and thereby develop their skills in the field of engineering.		1	2	1		1		1	2	2	3	1		1	1
CO3	Understand the principle and handling of electrochemical instruments and Spectrophotometer	2		1		2		2		1		1	2	1	2	2
CO4	Understand the principle and handling of electrochemical instruments and Spectrophotometer.	2		1		2		2		1		1	2	1	2	2
CO5	Apply their knowledge for protection of different metals from corrosion by using different inhibitors	2		1		2		2		1		1	2	1	2	2

218EPP08 **ENGINEERING PRACTICE LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- To get the knowledge on welding techniques and its types.
- To do the fitting operation on a given material. (Specimen)
- To carry out sheet metal operation.

- To know the principle involved in plumbing work.
- To do the carpentry work on a given work piece.

LIST OF EXPERIMENTSWELDING:

Study of Electric Arc welding and Gas welding tools and equipment's.

Preparation of Arc welding and Gas welding models:

i) Butt joint ii) Lap joint iii) T - joint.

FITTING:

Study of fitting tools and operations.
Preparation of fitting models: i) V-fitting ii) Square fitting

SHEET METAL WORK:

Study of sheet metal tools and operations
Preparation of sheet metal models: i) Rectangular Tra ii) Funnel

PLUMBING WORKS:

Study of pipeline joints and house hold fittings.
Preparation of plumbing models: Basic pipe connections with PVC and GI pipe fittings.

CARPENTRY:

Study of wooden joints and tools used in roofs, doors, windows, furniture.

Preparation of carpentry models:
i) Lap joint ii) Dovetail joint iii) T-JointDEMONSTRATION ON:

ELECTRICAL ENGINEERING PRACTICE

Study of Electrical components and equipments: Residential house wiring using switches, fuse, indicator, lamp and energy meter.

ELECTRONICS ENGINEERING PRACTICE

Study of Electronic components –Resistor, color coding, capacitors etc
Soldering practice –components soldering in simple electric circuit & testing continuity

COMPUTER HARDWARE AND SOFTWARE PRACTICE

Study of PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, Power Point and Publisher.

COURSE OUTCOMES:

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

CO1: Prepare simple Lap, Butt and T- joints using arc welding equipment.

CO2: Prepare the rectangular trays and funnels by conducting sheet metal operation.

CO3: Prepare the pipe connections and identify the various components used in plumbing.

CO4: Prepare simple wooden joints using wood working tools.

CO5: Demonstrate basic electrical, electronic and computer components based on their physicalparameters and dimensions.

TEXT BOOKS:

1. Ranganath. G & Channankaiah, "Engineering Practices Laboratory Manual", S.S.Publishers, 2014.
2. Jeyapoovan.T & Gowri S "Engineering Practice Lab Manual", Vikas publishing house pvt.ltd,2016.

REFERENCE BOOKS:

1. Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications, 2015.
2. Ramesh BabuV, "Engineering Practices Laboratory Manual", VRB Publishers PrivateLimited, Chennai, Revised Edition, 2014.
3. Peter Norton, "Introduction to Computers", 7th Edition, Mc Graw Hill, 2010.
4. Bawa. H.S, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2009.
5. David Anfinson and Ken Quamme, "IT Essentials PC Hardware and Software CompanionGuide", CISCO Press, Pearson Education, Third Edition, 2008.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Prepare simple Lap, Butt and T- joints using arc welding equipment.		1	2	1		1		1	2	2		1		1	1
CO2	Prepare the rectangular trays and funnels by conducting sheet metal operation.	2		1		2		2		1		1	2	1	2	2
CO3	Prepare the pipe connections and identify the various components used in plumbing.	2		1		2		2		1		1	2	1	2	2
CO4	Prepare simple wooden joints using wood working tools.		1	2	1		1		1	2	2		1		1	1
CO5	Demonstrate basic electrical, electronic and computer components based on their physical parameters and dimensions.		1	2	1		1		1	2	2		1		1	1

218CDP09 **CIRCUITS AND DEVICES LABORATORY**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Verify different Laws for Network circuits
- Verify various Theorems for Network circuits
- Understand the frequency response of resonance circuits
- Study the characteristics of various semiconductor devices

LIST OF EXPERIMENTS:

1. Study of Electronic Components, Equipments and color coding of Resistors.
2. Verification of KVL and KCL
3. Verification of Thevenin and Norton Theorems.
4. Verification of superposition Theorem.
5. Verification of Maximum power transfer Theorem.
6. Frequency response of series and parallel resonance circuits.
7. Characteristics of PN and Zener diode
8. Characteristics of CE configuration
9. Characteristics of CB configuration
10. Characteristics of UJT and SCR
11. Characteristics of JFET and MOSFET.
12. Characteristics of DIAC and TRIAC.
13. Characteristics of Photodiode and Phototransistor.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate the different Laws for Network circuits

CO2: Analyze various Theorems for Network circuits

CO3: Determine the frequency response of resonance circuits

CO4: Compute the characteristics of various semiconductor devices

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Demonstrate the different Laws for Network circuits	3		3	3										2	
CO2	Analyze various Theorems for Network circuits	3		3	3										2	
CO3	Determine the frequency response of resonance circuits	3		3	3										2	
CO4	Compute the	3		3	3										2	

	characteristics of various semiconductor devices															

318MAT01 ENGINEERING MATHEMATICS – III

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To learn various methods to solve the partial differential equations.
- To introduce Fourier series analysis which plays a vital role in many applications in engineering.
- To understand the boundary value problems and to obtain the solution using partial differential equations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To develop z-transform techniques which analyze the discrete time signals.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Solutions of first order partial differential equations-Standard types-Singular solutions-Lagrange's Linear equation- Method of grouping and Method of multipliers-Solution of homogeneous and non-homogenous linear equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Change of scale - Odd and even functions – Half-range Sine and Cosine series – Parseval's identity applications – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9+3

Classification of Partial Differential Equations – Method of separation of Variables – Solutions of one dimensional wave equations and One-dimensional heat equations –Applications using Fourier series solutions in Cartesian coordinates - Steady state solution of two-dimensional heat equation.

UNIT IV FOURIER TRANSFORM 9+3

Fourier integral theorem – Fourier transform pair - Sine and Cosine transforms – Properties – Fourier Transform of simple functions – Convolution theorem (statement and applications only) – Parseval's identity (statement and applications only).

UNIT V Z – TRANSFORM 9+3

Z-Transform - Elementary properties and applications – Initial and final value theorems (Statement and applications only) - Inverse Z-Transform – Partial fractions method, Residue theorem method and Convolution theorem (statement and applications only) - Solution of difference equations by applying Z-transforms.

TOTAL HOURS: 45+15=60 PERIODS

COURSE OUTCOMES:

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

CO 1: Know the methods to solve partial differential equations occurring in various physical and engineering problems.

CO 2: Describe an oscillating function which appear in a variety of physical problems by Fourier series helps them to understand its basic nature deeply.

CO 3: Acquire the knowledge to construct partial differential equations with initial and boundary conditions for various physical and engineering real time problems and obtaining solution using Fourier series methods.

CO 4: Understand the effect of Fourier transform techniques and their applications.

CO 5: Gain the concept of analysis of linear discrete system using Z-transform approach.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd edition, 2015.

REFERENCE BOOKS:

1. Andrews L.C and Shivamoggi. B.K., "Integral Transforms for Engineers", SPIE Press Book, 1999
2. Wylie C R and Barrett L C, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Co., New Delhi, 1995.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition Wiley India, 2016.
4. V.Prameelakaladharan and G.Balaji ,"Engineering Mathematics-III", Amrutha marketing, Chennai,2016.
5. T.Veerarajan,"Engineering Mathematics-III", Tata McGraw-Hill Publishing company, New Delhi,2015.
6. P.Kandasamy, K.Thilagavathy, K.Gunavathy, "Engineering Mathematics-III", S.Chand Publishers,2015.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Know the methods to solve partial differential equations occurring in various physical and engineering problems.	3	3	3	1										3	
CO2	Describe an oscillating function which appear in a variety of physical problems by Fourier series helps them to understand its basic nature deeply	3	3	3	1					3			3		3	
CO3	Acquire the knowledge to construct partial differential equations with initial and boundary conditions for various physical and engineering real time problems and obtaining solution using	3	3	3	1					3					3	

	Fourier series methods.															
CO4	Understand the effect of Fourier transform techniques and their applications	3	3	3	1	1									3	
CO5	Gain the concept of analysis of linear discrete system using Z-transform approach	3	3	3	1	1									3	

318BMT02 **ELECTRICAL MACHINES** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study the magnetic circuits
- To understand the principle and application of transformers
- To study the principle of operation of DC machines
- To study the principle and operation of AC machines
- Understand the working principle of different types of machines

UNIT I MAGNETIC CIRCUITS **9**

Magnetic effects of electric current, Magnetic circuits, Magnetic materials and B-H relationship, Electromagnetic induction and force, Hysteresis and eddy current losses.

UNIT – II TRANSFORMERS **9**

Principle - Theory of ideal transformer - EMF equation - Construction details of shell and core type transformers - Tests on transformers - Equivalent circuit - Regulation and efficiency of a transformer - Introduction to three - phase transformer connections.

UNIT – III D.C. MACHINES **9**

Construction of D.C. Machines - Principle and theory of operation of D.C. generator - EMF equation - Characteristics of D.C. generators - Armature reaction – Commutation - Principle of operation of D.C. motor - Voltage equation - Torque equation - Types of D.C. motors and their characteristics –Starters - Speed control of D.C. motors - Applications.

UNIT – IV A.C. MACHINES **9**

Principle of alternators: - Constructional details, Equation of induced EMF - Synchronous motor: - Starting methods, Torque, Induction motor:- Construction and principle of operation, Classification of single phase and three phase induction motor, Torque equation, Condition for maximum torque, Starting methods and Speed control of induction motors.

UNIT – V SPECIAL MACHINES **9**

Constructional features of stepper motor – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations. Switched reluctance motor – Brushless D.C motor -Permanent magnet synchronous motor -Repulsion type motor – Universal motor – Hysteresis motor.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to:
CO1: Understand the magnetic effects, Magnetic materials in magnetic circuits
CO2: Understand the Construction, operating principle, characteristics, and applications of transformers
CO3: Understand the construction, working, characteristics and applications of DC generators & DC motors
CO4: Understand the principle and operation of AC Machines
CO5: Gain the basic knowledge on Special Machines

TEXT BOOKS:

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", TMH, 2nd, 2007.
2. Nagrath.I.J. & Kothari.D.P, "Electrical Machines", Tata McGraw-Hill, New Delhi, 5th edition 2012.
3. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw- Hill, Singapore, 6th edition 2003.

REFERENCE BOOKS

1. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chand and Co., New Delhi, 2007.
2. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 2002.
3. Cotton, H., "Advanced Electrical Technology", Sir Isaac Pitman and Sons Ltd., London, 1999

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Understand the magnetic effects, Magnetic materials in magnetic circuits		2		2			2			2		2		3	
CO2	Understand the Construction, operating principle, characteristics, and applications of transformers	2	2	2				2				2	2		3	
CO3	Understand the construction, working, characteristics and applications of DC generators & DC motors			3					3	3					3	
CO4	Understand the principle and operation of AC Machines			3					3	3					3	
CO5	Gain the basic knowledge on Special Machines			3					3	3					2	

318BMT03 **HUMAN ANATOMY AND PHYSIOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the role of cell components in human physiology
- To understand the importance of blood and related diseases.
- To understand the principle functions of kidney, the regulation of respiration and human circulatory system.
- To develop the basic knowledge of human sensory organs- eye and ear.
- To understand skeletal and digestive systems.

UNIT I BASICS OF HUMAN BODY **9**

Anatomy of a Generalized Cell- The Nucleus, The Plasma Membrane, The Cytoplasm, Cell Extensions, Cell Physiology-Membrane Transport

UNIT II HEMATOLOGICAL SYSTEM **9**

Composition and Functions of blood – Blood Components, Physical Characteristics and Volume, Plasma, Formed Elements, Hematopoiesis, Blood Groups and Transfusions - Human Blood Groups.

UNIT III RENAL, RESPIRATORY AND CARDIAC SYSTEM **9**

Renal System: Structure of Kidney and Nephron. Urine formation and Characteristics, Respiratory System: Functional Anatomy of the Respiratory System, Respiratory Physiology -Mechanisms of Breathing, Oxygen and carbon dioxide transport, Cardiac System: Anatomy of the Heart, Chambers and Associated Great Vessels

UNIT IV NERVOUS SYSTEM, SENSORY ORGANS AND ENDOCRINE SYSTEM **9**

Nervous System: Organization of the Nervous System, Nervous Tissue-Structure and Function-Supporting Cells, Neurons, Central Nervous System-Functional Anatomy of the Brain. Peripheral Nervous System- Structure of a Nerve, Autonomic Nervous System, Endocrine System: Thyroid gland, Adrenal gland, Sensory Organs: Anatomy of the Eye and Ear.

UNIT V SKELETAL, DIGESTIVE AND REPRODUCTIVE SYSTEM **9**

Skeletal System: Structure of Skin and Bone, Bone Formation, and Growth of bone and Remodeling, Joints. Digestive System: Anatomy of the Digestive System, Functions of the Digestive System. Reproductive System: Anatomy of male and female reproductive system

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the importance of transport of substances across the cell membrane.
CO2: Gain knowledge of blood components in blood grouping
CO3: Understand and implement the knowledge on physiology of kidney, respiratory and cardiac cycle.

CO4: Understand the image formation and vision, sound perception and different types of deafness in the ears.

CO5: Know the significance of digestive system, various bones and reproductive system

TEXT BOOKS:

1. Essential of human Anatomy and Physiology, Elaine.N. Marieb Eight edition, Pearson Education New Delhi ,2007.
2. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins: Pathologic Basis of diseases. WB Saunders Co. 7th edition, 2005.

REFERENCE BOOKS:

1. Review of Medical Physiology, William F.Ganong, 22nd edition, Mc Graw Hill, New Delhi
2. Text book of Physiology, Prof. A.K. Jain, Third edition volume I and II Avichal Publishing company, New Delhi.
3. Essentials of Medical Physiology, K.Sembulingam and Prema Sembulingam, 3rd edition, Jaypee Publications

COURSE OUTCOMES		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	Understand the importance of transport of substances across the cell membrane								3			3		3	2	1
CO2	Gain knowledge of blood components in blood grouping	2					2							3	2	1
CO3	Understand and implement the knowledge on physiology of kidney, respiratory and cardiac cycle.	2					2		2			3	3	3	2	1
CO4	Understand the image formation and vision, sound perception and different types of deafness in the ears.	2					2		2			2	3	2	3	1
CO5	Understand the importance of transport of substances across the cell membrane								3			3		3	2	1

318BMT04 **SENSORS AND MEASUREMENTS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- Know the principle and working of displacement, pressure and temperature sensors and study its biomedical applications.
- Know the principle and working of photo electric and Piezo electric sensors and its applications.
- Analyze the different types of signal conditioning element and signal analyzers.
- Know the different display and recording devices.

UNIT I SCIENCE OF MEASUREMENTS 9

Measurement System – Instrumentation – Classification and Characteristics of Transducers – Static and Dynamic – Errors in Measurements – Calibration – Primary and secondary standards.

UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS 9

Strain Gauge: Gauge factor, sensing elements, configuration, unbounded strain gage, biomedical applications; strain gauge as displacement & pressure transducers: force summing devices, capacitive transducer, inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, biomedical applications of Temperature sensors- Measurement of flow. Active type: Thermocouple – characteristics.

UNIT III PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS 9

Phototube, Photo Multiplier Tube (PMT), photovoltaic, photoconductive cells, photo diodes, phototransistor, comparison of photoelectric transducers, spectro-photometric applications of photo electric transducers. Piezoelectric active transducer and biomedical applications as pressure & Ultrasound transducer, Smart sensors.

UNIT IV SIGNAL CONDITIONING & SIGNAL ANALYSER 9

AC and DC Bridges –wheat stone bridge, Kelvin, Maxwell, Hay, Schering -Pre-amplifier – impedance matching circuits – isolation amplifier. Spectrum analyzer.

UNIT V DISPLAY AND RECORDING DEVICES 9

Digital voltmeter – Multi meter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, LED monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, X–Y recorder, thermal recorder.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Describe the purpose and methods of measurements
CO2: Understand the principle of displacement, pressure and temperature sensors
CO3: Understand the working of photo electric and Piezo electric sensors

CO4: Design different types of signal conditioners and analyzers.
CO5: Analyze the different display and recording devices for various applications.

TEXT BOOKS:

1. A.K.Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co., 19th edition, 2014.
2. Albert D.Helfrick and William D. Cooper., "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2nd edition, 2008.
3. L.A Geddas and L.E.Baker, "Principles of Applied Biomedical Instrumentation", John Wiley and sons, 3rd edition, 1991.

REFERENCE BOOKS

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Third Edition, Tata McGraw-Hill, New Delhi, 2014.
2. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2009.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Describe the purpose and methods of measurements	2	3	3	2		3				2		2	3	3	3
CO2	Understand the principle of displacement, pressure and temperature sensors	2	3	3	2		3				2		2	3	3	3
CO3	Understand the working of photo electric and Piezo electric sensors	2	2	2	2		3				2		2	3	3	3
CO4	Design different types of signal conditioners and analyzers.	2	2	2			3				2		2	3	3	3
CO5	Analyze the different display and recording devices for various applications.	2	2	2	2		3				2		2	3	3	3

318BMT05 **MEDICAL PHYSICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the principles of light, sound and ultrasound and its properties and about the non-ionizing radiation and their effects.
- To study various types of spontaneous radioactive emissions and various methods of producing radionuclides.

- To study various types of interaction of charged particles with matter and effects due to interaction of gamma radiation with matter.
- To study about the mechanical characteristics of lungs and cardiopulmonary system and application of Bernoulli's principle to cardiovascular system.
- To study the various types of acute and delayed effects of radiation and the various organs affected due to the radiation

UNIT I LIGHT, SOUND AND NON-IONIZING RADIATION 9

Electromagnetic spectrum and its medical application Light - Physics of light, Intensity of light, limits of Vision and color vision Sound -Physics of sound , Normal sound levels – Ultrasound fundamentals-Generation of ultrasound (Ultrasound Transducer) – Interaction of Ultrasound with Materials-Reflection and Refraction – Absorption and Scattering. Non- ionizing Electromagnetic Radiation Tissue as a leaky dielectric – Relaxation Processes – Overview of non – ionizing radiation effects -Low Frequency Effect – Higher frequency effect.

UNIT II NUCLEAR PHYSICS 9

Radioactive Decay – Spontaneous Emission – Isometric Transition - Gamma ray emission, alpha, beta, positron decay, electron capture. Principles of Nuclear Physics – Natural radioactivity, Decay series, Half life period, type of radiation and their applications. Production of radio nuclides – Cyclotron produced Radionuclide - Reactor produced Radionuclide – fission and electron Capture reaction, Radionuclide Generator – Milking Process - Linear accelerator, Radionuclide used in Medicine and technology.

UNIT III INTERACTION OF RADIATION WITH MATTER 9

Interaction of charged particles with matter – Specific ionization , linear energy Transfer Range, Bremsstrahlung , Annihilation Interaction of Gamma radiations with matter – Photoelectric effect, Compton Scattering , pair Production, Attenuation of Gamma Radiation, Interaction of neuron with matter

UNIT IV PHYSICS OF CARDIOPULMONARY SYSTEM 9

The Airways, - blood and lung interaction – measurement of lung volume – pressure air flow volume relation ships of lungs – physics of alveoli – the breathing mechanism – Major components of cardiovascular system – O_2 and CO_2 exchange in the capillary system – Physical activity of heart – transmural pressure – Bernolli's principles applied to cardiovascular system - Blood flow – laminar and turbulent

UNIT V RADIATION EFFECTS 9

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

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Study the principles of light, sound and ultrasound and its properties and about the non-ionizing radiation and their effects

CO2: Understand the various types of spontaneous radioactive emissions and various methods of producing radionuclides.

CO3: Understand the various types of interaction of charged particles with matter and the effects due to interaction of gamma radiation with matter and their characteristics

CO4: Study about the mechanical characteristics of lungs and cardiopulmonary system and application of Bernoulli's principle to cardiovascular system

CO5: Understand the various radiation effects on human body

TEXT BOOKS:

1. B.H Brown, PV Law ford, R H Small wood , D R Hose , D C Barber , "Medical Physics and Biomedical Engineering", Taylor & Francis, 1999.
2. Gopal B.Saha "Physics and Radiobiology of Nuclear Medicine" Springer, 4th edition, 2012.

REFERENCE BOOKS:

1. John R. Cameron and James G. Skofronick, "Medical Physics", John–Wiley & Sons, 1992.
2. P.Uma Devi, A. Nagarathnam, B S Satish Rao, "Introduction to Radiation Biology" B.I.Churchill Livingstone Pvt ltd, 2000.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Study the principles of light, sound and ultrasound and its properties and about the non-ionizing radiation and their effects	3			1		2				2				2	1
CO2	Understand the various types of spontaneous radioactive emissions and various methods of producing radionuclides.	3			1									2	1	
CO3	Understand the various types of interaction of charged particles with matter and the effects due to interaction of gamma radiation with matter and their characteristics	3		2	1								2	2	1	2
CO4	Study about the mechanical characteristics of lungs and cardiopulmonary	3			1									2	1	2

	system and application of Bernoulli's principle to cardiovascular system														
CO5	Understand the various radiation effects on human body	3			1									2	1

318BMT06 FUNDAMENTALS OF DATA STRUCTURES IN C

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Familiarize the basic programming concepts in C.
- Solve real time problems using functions, structure and union.
- Impart the basic concepts of linear data structures.
- Solve problem using nonlinear data structures.
- Identity the various Sorting, Searching and hashing 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.

UNIT II FUNCTIONS, POINTERS, STRUCTURES AND UNIONS 9

Functions - Pass by value - Pass by reference - Recursion - Pointers - Initialization - Pointers arithmetic. Structures and unions - Structure within a structure - Union - Files- Operations on Files- Memory Management

UNIT III LINEAR DATA STRUCTURES 9

Abstract Data Types - Linked list Implementation of List- polynomial addition- Linked List Implementation of Stack- Balancing Symbols - Postfix Expressions - Infix to Postfix Conversion - Linked list Implementation of Queues- Circular Queue

UNIT IV NON LINEAR DATA STRUCTURES 9

Preliminaries -Binary Trees -Tree Traversals - Binary Search Tree -Operations on Binary Search Tree - Heaps - Binary Heaps - Operations of Heaps - Graph and its representations -Graph Traversals - Shortest Path Algorithm: Dijkstra's Algorithm- Minimum Spanning Tree:Prim's Algorithm – Kruskal's Algorithm.

UNITV SEARCHING, SORTING AND HASHING 9

Linear Search - Binary Search -Bubble Sort - Insertion Sort - Quick Sort - Merge Sort - Hash Functions - Separate Chaining -Open Addressing

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Summarize the basic concepts of C

CO2: Develop programs for real time application using functions, structures, union

CO3: Gain knowledge on operations of linear data structures

CO4: Develop applications using nonlinear data structures

CO5: Apply appropriate sorting, searching technique for given problem.

TEXT BOOKS:

1. Ashok.N. Kamthane,- "Computer Programming" , Pearson Education, Second edition(India), 2012
2. Mark Allen Weiss, "Data Structures And Algorithm Analysis In C", Second Edition, Pearson Education,

REFERENCE BOOKS:

1. PradipDey and Manas Ghosh, —Programming in C, Second Edition, Oxford University Press, 2011.
2. E.Balagurusamy, - "Computing fundamentals and C Programming", Tata McGraw-Hill
3. Publishing Company Limited, 2008.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Summarize the basic concepts of C			3	2							3			2	1
CO2	Develop programs for real time application using functions, structures, union			3	2	3						2			2	1
CO3	Gain knowledge on operations of linear data structures			3	2	3						3			2	1
CO4	Develop applications using nonlinear data structures					3						3			2	1
CO5	Apply appropriate sorting, searching technique for given problem					3									2	1

318BMP07 HUMAN ANATOMY AND PHYSIOLOGY LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To estimate and quantify the blood cells
- To learn methods for identification of blood groups
- To estimate hematological parameters
- To learn visual and hearing test

LIST OF EXPERIMENTS:

1. Blood grouping.
2. Bleeding time/ clotting time.
3. Estimation of Hemoglobin
4. Total RBC Count
5. Estimation of differential count
6. Estimation of ESR
7. PCV, MCH, MCV, MCHC
8. Hearing test – Tuning fork
9. Visual Activity – Snellen's Chart
10. Ishihara chart for color blindness
11. Study of Compound microscope

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate the contents of blood and how to analyze it
CO2: Estimation of hematological parameters
CO3: Analysis of special sensory organs test

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Demonstrate the contents of blood and how to analyze it	3		2	3					1				3	3	1
CO2	Estimation of hematological parameters	3		2	3					1				3	3	1
CO3	Analysis of special sensory organs test	3		2	3					1				3	3	2

318BMP08 SENSORS AND MEASUREMENTS LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- Know the principle of transduction, classifications and the characteristics of different transducers and study its Biomedical applications.
- Design the signal conditioning elements

LIST OF EXPERIMENTS:

1. Calibration of voltmeter using shunt type Potentiometer
2. Calibration of Ammeter using shunt type Potentiometer
3. Characteristics of thermistor

4. Characteristics of thermocouple
5. Characteristics of LDR
6. Characteristics of Photo Diode
7. Characteristics of Photo transistor
8. Characteristics of RTD
9. Characteristics of LVDT
10. Measurement of unknown Resistance using Kelvin Double Bridge
11. Measurement of unknownCapacitance using Schering Bridge
12. Measurement of unknownResistance using Wheatstone bridge
13. Step response of Hall effect transducer
14. Characteristics of strain gauge
15. Study of Smart sensors

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Describe the purpose and methods of measurements

CO2: Design and analyze different type of transducers and study its biomedical applications

CO3: Design the signal conditioning elements

COURSE OUTCOMES		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	Describe the purpose and methods of measurements	1	2	2	1									2	3	1
CO2	Design and analyze different type of transducers and study its biomedical applications	1	2	2	1									2	3	1
CO3	Design the signal conditioning elements	1	2	2	1									2	3	1

318BMP09 **FUNDAMENTALS OF DATA STRUCTURES IN C LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- Understand and implement basic data structures using C
- Apply linear and non-linear data structures in problem solving
- Learn to implement functions and recursive functions by means of data structures
- Implement searching and sorting algorithms.

LIST OF EXERCISES:

1. Basic C Programs – Looping, Decision- Making
2. Programming using Arrays and String functions
3. Programming using Functions and Recursion
4. Programs using Structures and Union
5. Program using Pointers
6. Program using Memory Management Functions
7. Linked list implementation of List ,Stacks and Queues
8. Implementation of Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Graph Traversals
11. Implementation of Shortest Path Algorithm
12. Implementation of Linear search and binary search
13. Implementation of Insertion sort, Quick sort and Merge Sort

COURSE OUTCOMES:

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

CO1: Implement basic and advanced programs in C

CO2: Implement functions and recursive functions in C

CO3: Apply the different Linear Data Structures for Implementing Solutions to Practical Problems.

CO4: Apply and implement Graph Data Structures for Real Time Applications.

CO5: Implement various Searching, Sorting and hashing Algorithms.

LIST OF EQUIPMENTS AND SOFTWARE FOR A BATCH OF 30 STUDENTS

Hardware:

LAN System with 30 Nodes (OR) Stand-alone PCs -30 No's.

Printer – 3 No's.

Software:

OS: Windows

Turbo C

COURSE OUTCOMES		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	Implement basic and advanced programs in C			3						3					2	1
CO2	Implement functions and recursive functions in C			3		3				2					2	1
CO3	Apply the different Linear Data Structures for Implementing Solutions to Practical Problems.			3		3				3					2	1
CO4	Apply and implement Graph Data Structures for Real Time Applications.					3				3					2	1

CO5	Implement various Searching, Sorting and hashing Algorithms					3									2	

418MAT01 PROBABILITY AND RANDOM PROCESSES

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To impart the knowledge of basic probabilistic theory.
- To learn one dimensional discrete and continuous probability distributions occurring in natural phenomena.
- To extend the probability theory to two dimensional random variable and to study the statistical measures.
- To study the classification and analysis of few discrete random process.
- To be able to analyze the response of random inputs to linear time invariant systems.

UNIT I PROBABILITY AND RANDOM VARIABLE 9 + 3

Axioms of probability - Conditional probability - Total probability – Baye's theorem- Random variable - Probability mass function - Probability density function - Properties - Moments - Moment generating functions and their properties.

UNIT II PROBABILITY DISTRIBUTION 9 + 3

Binomial, Poisson, Geometric, Uniform, Exponential, and Normal distributions and their properties - Functions of a random variable-simple applications.

UNIT III TWO-DIMENSIONAL RANDOM VARIABLES 9 + 3

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Central limit theorem (Statement and applications only for independent and identically distributed random variables).

UNIT IV RANDOM PROCESSES 9 + 3

Classification – Stationary process – Poisson process - Markov process - Discrete parameter Markov chain – Chapman-Kolmogorov equations – Random telegraph process-Application problems for each process.

UNIT V CORRELATION AND SPECTRAL DENSITIES 9 + 3

Auto-correlation functions, Cross-correlation functions, Power spectral density, Cross spectral density –Properties (Statements and Applications only) – Wiener-Khintchine relations (Statement and Applications only).

TOTAL HOURS: 45 + 15 = 60 PERIODS

COURSE OUTCOMES:

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

CO 1: Imbibe the knowledge of basic probability

CO 2: Aquaint the ability of fitting the real time problems into probability distribution modals and interpret.

CO 3: Learn the concept of two dimensional random variables helps to understand and analyse the statistical measures which describe an outcome of a random experiment.

CO 4: Understand and characterizing the random variable phenomenon which evolve with respect to time in a probabilistic approach.

CO 5: Gain the concept of the linear system with random inputs.

TEXT BOOKS:

1. Ibe, O.C.,"Fundamentals of Applied Probability and Random Processes", Elsevier, U.P., 1st Indian Reprint, 2007.

REFERENCE BOOKS:

1. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill edition, New Delhi, 2014.
2. Veerarajan.T., "Probability, Statistics and Random Processes", Tata McGraw-Hill publishing company Limited, New Delhi, 2014.
3. Kandasamy. P.,Thilagavathy, K.,&Gunavathi.K., "Probability, Statistics and random processes"., S.Chand & Company Ltd., New Delhi, 2014.
4. Peebles, P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4th edition, New Delhi, 2005.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Imbibe the knowledge of basic probability	3	3												3	
CO2	Aquaint the ability of fitting the real time problems into probability distribution modals and interpret	3	3	2	1										3	
CO3	Learn the concept of two dimensional random variables helps to understand and analyse the statistical measures which describe an outcome of a random experiment.	3	3	2	1										3	
CO4	Understand and characterizing the random variable phenomenon which evolve with respect to time in a probabilistic approach.	3	3	2	1										3	
CO5	Gain the concept of the linear system with random inputs.	3	3	2	1										3	

418BMT02	ANALOG INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn about different applications of diodes and different biasing techniques for BJT and FET.
- To study the basic concept of feedback amplifiers & Current and voltage sources
- To acquire the knowledge about the characteristics and operation of operational amplifier
- To design the active filters and oscillators
- To learn the applications of Timer, PLL and converters.

UNIT I DIODE APPLICATIONS AND TRANSISTOR BIASING 9

Rectifiers – HWR, FWR, Bridge rectifier, Transistor operating point– Fixed bias circuit - Emitter stabilized bias Circuit – Voltage divider bias. Biasing the FET and MOSFET transistors. Review of SMD components.

UNIT II FEEDBACK AMPLIFIERS 9

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic concept of feedback amplifiers-positive feedback, Advantages of negative feedback – voltage / current, series , Shunt feedback – stability of feedback.

UNIT III OPERATIONAL AMPLIFIER 9

The characteristics of Ideal Operation – slew rate, offset voltage, bias current, CMRR, bandwidth - equivalent circuit of an op-Amp – virtual ground concept – Linear applications– inverting and non-inverting amplifier, summing, subtracting, averaging amplifier - voltage to current converter – current to voltage converter – Differential amplifiers – differentiator and integrator. Nonlinear applications – comparator - Schmitt Triggers – Precision Diode – Average detectors – peak detector.

UNIT IV ACTIVE FILTERS AND SIGNAL GENERATOR 9

Active filters (first and second order) – Low pass, high pass, band pass filters, band reject filters (notch filters). Oscillators - RC Phase shift - Wein-bridge-Hartley-Colpitts. Waveform generators - Square, triangular and saw tooth. Case study- Biomedical Application

UNIT V TIMER, PLL, A/D AND D/A CONVERTERS 9

555 Timer (internal diagram) and its applications – Monostable multivibrator, Astable multivibrator. Phase locked Loop (565 - block diagram approach) and its applications - Frequency multiplication, Frequency translation, voltage to frequency and frequency to voltage converters. DAC – Binary weighted DAC and R-2R DAC. ADC – single slope and dual slope ADCs, successive approximation ADC-Voltage Regulators Using IC 78XX, 79XX, Three terminal fixed and adjustable voltage regulators.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Design rectifiers using diode and apply suitable biasing circuits for BJT and FET.

CO2: To learnt the fundamentals feedback amplifiers & Current and voltage sources

CO3: Acquire the knowledge of inverting, non-inverting amplifier, integrator and differentiator

CO4: Get the ability to design filters and signal generator circuits according to required output.

CO5: Apply Multivibrators, Converters and regulators in circuits.

TEXT BOOKS:

1. Robert L. Boylestad, Louis Nashelsky , "Electronic Devices and circuit Theory", 11th Edition, Prentice Hall, 2013.
2. Ramakant A. Gayakwad , "OP-AMP and Linear ICs, 4th edition, Prentice Hall, 2013.
3. David A. Bell, "Electronic devices and circuits", Oxford University higher education, 5th edition 2008.

REFERENCE BOOKS:

1. David A. Bell , Electronic Devices and Circuits 4 th Edition Prentice Hall of India, 2003.
2. MillmanHaykins, Electronic Devices And Circuits,2nd Edition Tata MC Graw Hill,2007.
3. Robert B.Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation, CRC Press, 2004.
4. Sergio Franco, Design with Operational Amplifiers and analog Integrated circuits, 3rd edition, McGraw-Hills, 2002.
5. Millman, J. Halkis.C.C "Integrated Electronics".McGraw Hill, 2001.
6. Roy Choudhury, Shail B Jain, "Linear Integrated Circuits", New age International publishers, New Delhi, 2008.

E-REFERENCES:

1. http://nptel.ac.in/courses/108106068/
2. http://nptel.ac.in/courses/108106069/
3. http://nptel.ac.in/courses/117106086/

COURSE OUTCOMES		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	Design rectifiers using diode and apply suitable biasing circuits for BJT and FET.		2				2								3	1
CO2	To learnt the fundamentals feed back amplifiers & Current and voltage sources	3	2	3	2		2				2	2	2		3	1
CO3	Acquire the knowledge of inverting, non inverting amplifier, integrator and differentiator	3	2	3	2						2	2	2	2	3	1
CO4	Get the ability to design	3	2	3	2						2	2	2	2	3	1

	filters and signal generator circuits according to required output.															
CO5	Apply Multivibrators, Converters and regulators in circuits	3	2	3	2						2	2	2	2	3	1

418BMT03 **DIGITAL LOGIC DESIGN**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study various number systems and to simplify the mathematical expressions using Boolean functions –simple problems
- To study the implementation of combinational circuits
- To study the design of sequential logic circuits.
- To get expose the students to various Programmable Logic Devices and memory.
- To study the characteristics of digital ICs and logic families

UNIT I NUMBER SYSTEMS AND BOOLEAN ALGEBRA 9

Review of number Systems, Binary codes - BCD, Gray code, Excess 3 code, Parity, Hamming code. Boolean algebra - Basic postulates and theorems, Switching functions, Canonical forms, Logic gates-Standard representation of logic functions - Simplification of logic functions through K – maps and Quine-McClusky method.

UNIT II COMBINATIONAL LOGIC DESIGN 9

Implementation using logic gates: Binary / BCD adders and subtractors, Magnitude comparator, Decoders, Encoders, Multiplexers and Demultiplexers. Implementation of combinational logic function using multiplexers and demultiplexers.

UNIT III SEQUENTIAL LOGIC DESIGN 9

Introduction to Synchronous and Asynchronous Sequential circuits – Latch, Flip Flops. Mealy/Moore models – Concept of state, State diagram, State table. Design of synchronous sequential circuits – Up-down / Modulus counters, Sequence detector, Shift register: Ring counter, Johnson counter, Timing diagram.

UNIT IV PROGRAMMABLE LOGIC DEVICES AND MEMORIES 9

Introduction to PLDs –PAL, PLA, FPGA. Implementation of digital functions using PLDs. Memories: Read only memories, PROMs, EPROMs, EEPROMs, and RAMs: Static RAM, Dynamic RAM, Double Data Rate SDRAM, Magnetic memories, CD-ROM, Flash memories

UNIT V DIGITAL LOGIC FAMILIES 9

Characteristics of digital ICs – Voltage and current ratings, Noise margin, Propagation delay, Power dissipation, Fan-in, Fan-out. TTL, ECL MOS transistor switches –NMOS Inverter / Logic gates, CMOS Inverter / logic gates. Case studies - Biomedical Application.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Compute the Postulates of Boolean algebra using different techniques

CO2: Design the Combinational circuits

CO3: Design the synchronous and asynchronous sequential circuit

CO4: Analyze the various memories and programmable logic device

CO5: Understand the concept of digital logic families

TEXT BOOKS:

1. M. Morris Mano and Michael D. Cilette, “Digital Design”, Prentice Hall, Fifth Edition, 2012.
2. Thomas L Floyd, " Digital Fundamentals", Prentice Hall, 11th Edition, 2014.

REFERENCE BOOKS:

1. Tocci R J and Widmer.N S, “Digital Systems : Principles and applications” , Pearson Education Pvt. Ltd, Tenth Edition, 2011.
2. Donald D Givone, “Digital Principles and Design”, Tata McGraw-Hill, 2009.
3. Anand Kumar, “Fundamentals of Digital Circuits”, Prentice Hall of India, Pvt Ltd, New Delhi, Second Edition, 2010.
4. Donald P Leach, Albert Paul Malvino, and GoutamSaha, “Digital Principles and applications”, Tata Mcgraw Hill, Seventh Edition, 2011.

E-REFERENCES:

1. http://nptel.ac.in/courses/108106069/
2. http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/digital_circuit/frame/index.html
3. http://nptel.ac.in/courses/117106086/

COURSE OUTCOMES		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	Compute the Postulates of Boolean algebra using different techniques	3	2	3	2										3	1
CO2	Design the Combinational circuits	3	2	3	2										3	1
CO3	Design the synchronous and asynchronous sequential circuit	3	2	3	2										3	1
CO4	Analyze the various memories and programmable logic device	3	2	3	2										3	1
CO5	Understand the concept of digital logic families	3	2	3	2										3	1

418BMT04	PATHOLOGY AND MICROBIOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To gain knowledge on the structural and functional aspects of living organisms.
- To know the concept of hematological disorders.
- To know the basic concepts of microbiology.
- To understand the basic concepts of microbial diseases and microscopes.
- To gain knowledge on immune pathology

UNIT I CELL DEGENERATION, REPAIR AND NEOPLASIA 9

Cell injury - Pathogenesis of Cell Injury -Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Inflammation- Acute Inflammation-Vascular events, Cellular Events, Chronic Inflammation- General Features of Chronic Inflammation, Healing - Regeneration and Repair Fracture Healing, Neoplasia- Classification, Benign and Malignant tumours.

UNIT II FLUID AND HEMODYNAMIC DERANGEMENTS 9

Homeostasis-Normal water and electrolyte balance (Gibbs- Donnan Equilibrium), Disturbances of body water- Edema, Dehydration, Overhydration, Hemodynamic Derangements- Hyperaemia and Congestion, Haemorrhage, Shock, Thrombosis, Embolism, Ischaemia, Infarction,Hematological disorders- Leukaemias, Lymphomas, Bleeding disorders-Thrombocytopenia

UNIT III FUNDAMENTALS OF MICROBIOLOGY 9

Bacterial anatomy – Shape, arrangements and structure of bacteria. Culture media and its types. Bacterial growth curve. Pure culture methods (Streak, spread and pour plate methods). Identification of bacteria. Microscopy – Bright field, phase contrast, fluorescent and electron microscopes. Staining methods – Simple, Gram, Endospore, Acid fast and capsule staining, Automated staining method.

UNIT IV MICROBIAL DISEASES AND DIAGNOSIS 9

Infection – Source of infection, methods of transmission of infection and types of infection. Bacterial diseases – Pneumonia, tuberculosis, typhoid, cholera and syphilis. Viral diseases - Morphology of virus, viral multiplication – Hepatitis B and Rabies, Dengue. Fungal diseases – Dermatophytosis, Candidiasis; Parasitic diseases – Amoebiasis (Entamoeba histolytica), malaria (Plasmodium falciparum) and Filariasis (Wucheriria bancrofti).

UNIT V IMMUNOPATHOLOGY & IMMUNODIAGNOSIS 9

Structure and functions of immune system – Cells of immune system, Organs of immune system. Antigens & Antibodies – structure, properties and types. Antigen -Antibody reactions -agglutination, precipitation, ELISA, Immuno flourescence and RIA. Hypersensitivity. Autoimmunity – Graves disease, Good Pasteure's syndrome, Rheumatoid arthritis and Systemic Lupus Erythmatous (SLE) and treatment. Immunodeficiency and HIV.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze Pathogenesis of Cell injury and Inflammation

CO2: Explain the concept of homeostasis, Haemorrhage and hematological disorders.

CO3: Discuss the basic concepts of Bacterial anatomy, Staining methods and Microscopy.

CO4: Describe the concepts on various infection and microbial diseases.

CO5: Gain the knowledge on immune system, antigen-antibody reactions

TEXT BOOKS:

1. Ananthanarayanan & Panicker, Text book of Microbiology, Orient black swan, 10th edition, 2017.
2. Dr.Ajoy Paul, Text book of Immunology, Books & Allied (P) Ltd, 2015**.**

REFERENCE BOOKS:

1. Dubey RC and Maheswari DK., A Text Book of Microbiology, Chand & Company Ltd, 2007
2. Prescott, Harley and Klein, Microbiology, 10th edition, McGraw Hill, 2017

COURSE OUTCOMES		**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	Analyze Pathogenesis of Cell injury and Inflammation	3	3	3			1							3	2	1
CO2	Explain the concept of homeostasis, Haemorrhage and hematological disorders.		3				2		2		2	2		3	2	1
CO3	Discuss the basic concepts of Bacterial anatomy, Staining methods and Microscopy.	3					1			2			2	3	2	1
CO4	Describe the concepts on various infection and microbial diseases.		3				2		2		2	2		3	2	1
CO5	Gain the knowledge on immune system, antigen-antibody reactions	3	2				1							3	1	1

418BMT05	BIOCHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To gain basic knowledge on biomolecules
- To have a sound knowledge on classification, structure and properties of carbohydrates, lipids and amino acids and their functions
- To know about the overview of central metabolic pathways, the classification of enzymes and their general effects and regulation.
- To emphasize the role of these biomolecules by providing basic information on specific metabolic diseases and disorders of these biomolecules
- To Know Clinical applications of Biochemistry

UNIT I INTRODUCTION TO BIOCHEMISTRY 9

Biochemistry and the living state, Introduction to Biomolecules, Energy transformation in living organism. Chemical reactions in living cells, Water- Physical properties and hydrogen bonding, Solvent properties, pH, Acid and bases, buffers

UNIT II CARBOHYDRATES 9

Classification of carbohydrates - mono, di, and polysaccharides. Structure, physical and chemical properties of carbohydrates, Digestion and absorption of carbohydrates, Metabolisms of carbohydrates – Glycolysis-Reactions of glycolysis, Pasteur effect, Citric acid cycle, glycogenesis, glycogenolysis, Biological oxidation-electron transport chain. Oxidative phosphorylation. Biochemical aspect of Diabetes mellitus and Glycogen storage disease.

UNIT III LIPIDS 9

Lipids-Classification and Functions, Nomenclature of fatty acid, Triacylglycerols - Properties of triacylglycerol, Lipoproteins- Structure and classification, Metabolism of lipids- Fatty acid oxidation (beta oxidation), ketogenesis, Cholesterol biosynthesis. Disorders of lipid metabolism- Obesity, Atherosclerosis.

UNIT IV NUCLEIC ACID & PROTEIN 9

Nucleic acids- Structure and functions of Nucleotides, Structure of DNA-DNA double helix, Structure of RNA and its type. Metabolism of nucleotide-Biosynthesis of purine ribonucleotides, Disorders of purine metabolism, Biosynthesis of pyrimidine ribonucleotides, Proteins-Structure, properties and classification of proteins, Structure, Classification and Properties of amino acids, Inborn errors of amino acid metabolism

UNIT V ENZYME AND ITS CLINICAL APPLICATIONS 9

Nomenclature and Classification of enzymes, Chemical nature and properties, Factors affecting enzyme activity, Enzyme inhibition, Enzyme specificity, Coenzymes, Mechanism of enzyme action, Regulation of enzyme activity in the living system, Clinical applications of enzymes

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the fundamentals of biochemistry

CO2: Gain knowledge on classification, structure and properties of carbohydrates and its metabolic pathways

CO3: Understand the properties of Lipids and disorders of lipid metabolism

CO4: Gain knowledge on structure of DNA, RNA and Proteins

CO5: Know about the overview of the classification of enzymes, their general effects and regulation

TEXT BOOKS:

1. Satyanarayana U., Chakrapani U., "Biochemistry", Elsevier, 4th edition, 2013.
2. Albert L. Lehninger , "Principles of Biochemistry", W. H. Freeman publication, 7th edition,2017.

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, 2005.

COURSE OUTCOMES		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	Explain the fundamentals of biochemistry	3	2				2							3	1	1
CO2	Gain knowledge on classification, structure and properties of carbohydrates and its metabolic pathways	3	2		1		1							3	1	1
CO3	Understand the properties of Lipids and disorders of lipid metabolism	3	2		1		1							3	1	1
CO4	Gain knowledge on structure of DNA, RNA and Proteins	3	2		1		1							3	1	1
CO5	Know about the overview of the classification of enzymes, their general effects and regulation	3	2		1		1							3	1	1

418BMT06	SIGNALS, SYSTEMS AND ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the classification of signals and systems
- To analyze the CT periodic and aperiodic signals using CT Fourier and Laplace transform methods.
- To understand the characterization of total response, impulse response and frequency response of LTI CT systems.
- To find the discrete Time Fourier Transforms and Z transform for the discrete time signals.
- To acquire the knowledge in LTI DT systems.

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Continuous Time signals (CT signals), Discrete Time signals (DT signals) - Step, Ramp, Impulse, Exponential, Classification of CT and DT signals - periodic and aperiodic, Energy and power, even and odd, Deterministic and Random signals, Transformation on Independent variables -CT systems and DT systems, Properties of Systems – Linearity, Causality, Time Invariance, Stability, Invertibility and LTI Systems.

UNIT II ANALYSIS OF CT SIGNALS 9

Fourier Series Analysis, Continuous Time Fourier Transform and Laplace Transform in Signal Analysis, Properties of Fourier Transform, Laplace Transform-Properties-ROC, Parseval's Theorem, Sampling Theorem and Aliasing.

UNIT III LTI-CT SYSTEMS 9

Differential equations-Total Response- Fourier Transform & Laplace Transform, Impulse response, Convolution Integral, Frequency response.

UNIT IV ANALYSIS OF DT SIGNALS 9

Discrete Time Fourier Transform (DTFT), Z-Transform in signal analysis, Z-transform-Properties-ROC and Inverse Z Transform-Partial Fraction-Long Division.

UNIT V LTI-DT SYSTEMS 9

Difference equations, Total Response-Z- Transform, Impulse response, Convolution sum, Frequency response

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Categorize the properties and representation of discrete and continuous time signals.
CO2: Analyze the continuous time signal using Fourier and Laplace transform.
CO3: Determine total response, impulse response and frequency response of LTI-CT systems
CO4: Analyze the discrete time signals using Discrete Time Fourier Transforms and Z transform
CO5: Determine total response, impulse response and frequency response by using differential equations of LTI-DT Systems

TEXT BOOKS:

1. Allan V. Oppenheim, Alan S.Willsky with S.Hamid Nawab, "Signals and Systems", 2nd edn. Pearson Education, 2015.
2. M.J.Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH 2012.

REFERENCE BOOKS:

1. Lathi B.P, Signals Systems & Communications, B S Publications, Hyderabad, 2008.
2. Simon Haykin and Barry Van Veen, "Signals and Systems", John Willey, 2007
3. K.Lindner, "Signals and Systems", McGraw Hill International, 1999
4. Michael J Roberts, "Fundamentals of Signals and Systems" Tata McGraw Hill, 2007.
5. Moman H. Hays, "Digital Signal Processing", Schaum's outlines, Tata McGraw Hill Co Ltd., 2004.

COURSE OUTCOMES		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	Categorize the properties and representation of discrete and continuous time signals.	3	3	1	2									1	3	1
CO2	Analyze the continuous time signal using Fourier and Laplace transform	3	3	1	2									1	3	1
CO3	Determine total response, impulse response and frequency response of LTI-CT systems	3	3	1	2									1	3	1
CO4	Analyze the discrete time signals using Discrete Time Fourier Transforms and Z transform	3	3	1	2									1	3	1
CO5	Determine total response, impulse response and frequency response by using differential equations of LTI-DT Systems	3	3	1	2									1	3	1

418BMP07 **INTEGRATED CIRCUITS LAB**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To enhance the students about the areas where the simple electronic components are being used
- To acquire the knowledge about the characteristics and operation of analog IC 741

- To design filter circuits, oscillators and wave form generators using op amp.
- To design the adder , encoder and decoder using logic gates
- To enhance the knowledge in shift register and counters

LIST OF EXPERIMENTS

1. Rectifiers – HWR and FWR (with & without capacitor filter)
2. Zener diode as regulator
3. FET amplifier
4. Inverting, non-inverting amplifier and comparator
5. Integrator and Differentiator.
6. Active filter – first order LPF and HPF
7. Schmitt trigger using IC741
8. Wein bridge oscillator
9. Multivibrator using IC555 Timer
10. Study of logic gates, Half adder and Full adder
11. Encoder and BCD to 7 segment decoder
12. Multiplexer and demultiplexer using digital ICs
13. Universal shift register using flip flops
14. Design of mod-N counter

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the practical application of various electronic circuits like rectifiers and Regulators
CO2: Acquire the designing knowledge of linear and non-linear applications of IC 741
CO3: Gain knowledge in design of filter circuits, oscillators and wave form generators.
CO4: Design the adder, encoder and decoder using logic gates
CO5: Understand the design concept in shift register and counters

COURSE OUTCOMES		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	Understand the practical application of various electronic circuits like rectifiers and Regulators	3	3	3	3										3	2
CO2	Acquire the designing knowledge of linear and non-linear applications of IC 741	3	3	3	3										3	2
CO3	Gain knowledge in design of filter circuits, oscillators and wave form generators	3	3	3	3										3	2
CO4	Design the adder, encoder and decoder using logic gates	3	3	3	3										3	2

CO5	Understand the design concept in shift register and counters															

418BMP08 PATHOLOGY AND MICROBIOLOGY LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To practice various staining techniques
- To perform histopathological examinations
- To Diagnose typhoid fever using widal test

LIST OF EXPERIMENTS

1. Simple staining
2. Gram staining
3. Acid fast staining
4. Endospore staining
5. Capsule staining
6. Widal slide test
7. Rapid Plasma Reagin Test (RPR Test)
8. Counter Immuno Electrophoresis (CIE)
9. Slides of Plasmodium, Microfilaria and Entamoeba histolytica
10. Histopathological slides of benign and malignant tumours.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Practice various staining methods
CO2: Diagnose typhoid fever using widal test
CO3: Perform histopathological examinations

COURSE OUTCOMES		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	Practice various staining methods		2	2		2			2	2				2	2	
CO2	Diagnose typhoid fever using widal test		2	2		2			2	2				2	2	
CO3	Perform histopathological examinations		2	2		2			2	2				2	2	

418BMP09 BIOCHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To learn the laboratory analysis of carbohydrates, lipids and proteins qualitatively and quantitatively

- To provide basic training in biochemical techniques such as chromatography and electrophoresis

LIST OF EXPERIMENTS:

1. Qualitative analysis of carbohydrates
   i), Glucose ii) Fructose iii) Lactose iv) Sucrose
2. Qualitative analysis of proteins
   i) Casein ii) Albumin
3. Qualitative analysis of lipids
4. Preparation of serum and plasma from blood.
5. Estimation of blood glucose.
6. Estimation of serum cholesterol.
7. Estimation of serum protein
8. Assay of serum marker enzymes
   i) Determination of activity of SGOT
   ii) Determination of activity of SGPT
9. Estimation of creatinine in urine.
10. Separation of amino acids using paper chromatography.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate a qualitative and quantitative understanding of major biomolecules such as carbohydrates, lipids and proteins

CO2: Recognize and explain the basic features of chromatography and electrophoresis

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Demonstrate a qualitative and quantitative understanding of major biomolecules such as carbohydrates, lipids and proteins	3	3	2					3					2	2	3
CO2	Recognize and explain the basic features of chromatography and electrophoresis	3	3	2	3				3					2	1	3

518BMT01 BIOMEDICAL INSTRUMENTATION L T P C
3 0 0 3

COURSE OBJECTIVES:

- Understand the origin of biopotentials & different types of electrodes used in biopotential recording
- Know the different lead configurations used for recording biosignals like ECG, EEG, EMG, ERG & EOG.
- Understand the need for bioamplifiers and different types of bioamplifiers.

- Know the instrumentation concerned with measuring the non electrical parameters.
- Know the chemical sensors and analyzers.

UNIT I BIO POTENTIAL ELECTRODES 9

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

UNIT II BIOPOTENTIAL RECORDING 9

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

UNIT III BIO AMPLIFIERS 9

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier, Trans-impedance amplifier, Power line interference.

UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS 9

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

UNIT V BIO-CHEMICAL MEASUREMENT 9

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, Densitometer, Blood cell counter, Auto analyzer (simplified schematic description).

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Gain knowledge about various biopotential Electrodes and its effects

CO2: Learn the different types of electrodes used to record ECG, EEG, EMG.ERG, and EOG with lead configuration.

CO3: Gain knowledge about the need for various bioamplifiers and isolation amplifiers.

CO4: Learn the instrumentation concerned with measuring the blood pressure, Temperature, Respiration rate.

CO5: Know the biochemical sensors and blood gas analyzers.

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007.
2. John G. Webster, "Medical Instrumentation Application and Design", Fourth Edition, John Wiley and sons, New York, 2009

REFERENCE BOOKS:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Third Edition, Tata McGraw-Hill, New Delhi, 2014.
3. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design" , McGraw-Hill Publisher, 2003.

COURSE OUTCOMES		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	Gain knowledge about various biopotential Electrodes and its effects	3		3	2									1	3	1
CO2	Learn the different types of electrodes used to record ECG, EEG, EMG.ERG, and EOG with lead configuration	3		3	2									2	3	1
CO3	Gain knowledge about the need for various bioamplifiers and isolation amplifiers	3		3	2	1								2	3	1
CO4	Learn the instrumentation concerned with measuring the blood pressure, Temperature, Respiration rate	3		3	2	1									2	1
CO5	Know the biochemical sensors and blood gas analyzers	3		3	2	1									3	1

518BMT02 DIGITAL SIGNAL PROCESSING AND BIOMEDICAL APPLICATIONS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Compute FFT of a discrete time signal.
- Design the various FIR filter techniques.
- Design the various IIR filter techniques.
- Analyze the finite word length effects in signal processing.
- Learn the fundamentals of digital signal processors.

UNIT I FAST FOURIER TRANSFORM AND CONVOLUTION 9

Introduction to DFT – Efficient computation of DFT- Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms –Fast convolution- overlap save method-overlap add method. Case study - Biomedical Applications of DSP.

UNIT II FINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Linear phase filters-Frequency response of linear phase FIR filters-Fourier series method of designing FIR filters-Windowing techniques for design of linear phase FIR filters: Rectangular- Hamming-Hanning-Blackman and Kaiser Windows. Gibbs phenomenon –principle of frequency sampling technique- Realization - FIR filters-Direct form, Cascade realization, Linear phase FIR realization. Case study- FIR filters in a hearing aid.

UNIT III INFINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Review of design of analogue Butterworth and Chebyshev Filters- Frequency transformation in analog domain – Design of IIR digital filters using impulse invariance technique –bilinear transformation – pre warping –Frequency transformation in digital domain – Realization - Direct form I, Direct form II, cascade and parallel. Case study- IIR filters to extract alpha activity from EEG signal.

UNIT IV FINITE WORD LENGTH EFFECTS 9

Quantization noise – truncation and rounding error-derivation for quantization noise power – Binary fixed point and floating point number representations – Comparison – input quantization error-coefficient quantization error –Product quantization error-limit cycle oscillations-dead band-Overflow error-signal scaling.

UNIT V DIGITAL SIGNAL PROCESSOR TMS320C54X 9

Introduction-Architecture of C54X – 'C54X buses-Internal memory organization-Central Processing unit-Arithmetic Logic unit-Barrel Shifter-Multiplier/Adder unit-Compare, select and store unit-On-chip Peripherals-External Bus Interface - Overview of instruction set –Data addressing 'C54X-Arithmetic instructions-Data Transfer instructions-Logical instructions.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Compute FFT of a discrete time signal.
CO2: Design the various FIR filter techniques.
CO3: Design the various IIR filter techniques.
CO4: Analyze the finite word length effects in signal processing.
CO5: Learn the fundamentals of digital signal processors.

TEXT BOOKS:

1. John G Proakis- Dimtris G Manolakis- Digital Signal Processing Principles-Algorithms and Application- Pearson/PHI- 4th Edition- 2007
2. S.K.Mitra- "Digital Signal Processing- A Computer based approach"- TataMcGraw-Hill- 1998-New Delhi.
3. B.Venkataramani& M-Bhaskar- Digital Signal Processor Architecture-Programming and Application- TMH 2002.

REFERENCE BOOKS:

1. Allan V.Openheim, Ronald W.Sehafer& John R.Buck-"Discrete Time Signal Processing", Third edition-Pearson/Prentice Hall, 2014.
2. Johny R-Johnson: Introduction to Digital Signal Processing- Prentice Hall- 1984.
3. Emmanuel I feachor "Digital Signal Processing: A Practical Approach", Second edition - Prentice Hall
4. Li Tan " Digital Signal Processing" Elsevier-2008

COURSE OUTCOMES		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	Compute FFT of a discrete time signal	3	3		3	2								3	1	
CO2	Design the various FIR filter techniques	3	3		3	2								3	1	
CO3	Design the various IIR filter techniques	3	3		3	2								3	1	
CO4	Analyze the finite word length effects in signal processing	2	2		3	2								2	1	
CO5	Learn the fundamentals of digital signal processors	3	3		3	2								2	1	

518BMT03 **MICROPROCESSOR AND MICROCONTROLLER SYSTEM DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Understand the architecture and assembly language programming of microprocessors
- Understand the architecture and assembly language programming of microcontrollers
- Learn the concept of interrupts.
- Learn about interfacing the microcontroller with real time applications.
- Understand the architectural features of PIC

UNIT I 8085 MICROPROCESSOR **9**

8085 Architecture – Instruction set – Addressing modes – Timing diagrams – Assembly language programming – Interrupts.

UNIT II 8086 MICROPROCESSOR AND PERIPHERAL INTERFACING **9**

Intel 8086 Internal Architecture – 8086 Addressing modes- Instruction set- 8086 Assembly language Programming-Interrupts - Interrupt service routine-Serial I/O (8251)- parallel I/O (8255) –Keyboard and Display controller (8279).

UNIT III 8051 MICROCONTROLLER **9**

8051 Internal Architecture - Ports and circuits- External memory –instruction set – Addressing modes – Assembly language programming – I/O port programming -Timer and counter programming – Serial Communication – Interrupt programming.

UNIT IV 8051 REAL WORLD INTERFACING **9**

8051 Interfacing: Keyboard, LCD, Stepper Motors, Interfacing to external memory and 8255.

UNIT V PIC16F8XX MICROCONTROLLER **9**

Introduction to PIC16F8XX Flash microcontrollers: Pin diagram of 16F8XX, Architectural features, I/O Ports, & Timers, Addressing modes of 16F877-Instruction Set. AVR Microcontroller, Case study-Biomedical Applications.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the architecture and assembly language programming of microprocessors
CO2: Understand the architecture and assembly language programming of microcontrollers
CO3: Learn the concept of interrupts.
CO4: Learn about interfacing the microcontroller with real time applications.
CO5: Understand the architectural features of PIC

TEXT BOOKS:

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 6th Edition, Penram International Publishing, New Delhi, 2013.
2. JohnUffenbeck, The 80x86 Family, Design, Programming and Interfacing, Third Edition. Pearson Education, 2002.
3. Mohammed Ali Mazidi and Janice GillispieMazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, New Delhi, 2003.
4. John B.Peatman, Design with PIC Microcontrollers, Pearson Education Asia, 2002.

REFERENCES:

1. A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2000
2. Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, 2nd Edition, Penram International Publishers (India), New Delhi, 1996.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Understand the architecture and assembly language programming of microprocessors	1	3	3	3	2								3	2	
CO2	Understand the architecture and assembly language programming of microcontrollers	1	3	3	3	2								3	2	
CO3	Learn the concept of interrupts.	1	3	3	3	2								3	2	
CO4	Learn about interfacing the microcontroller with real time applications	1	3	3	3	2								3	2	
CO5	Understand the architectural features of PIC	1	3	3	3									3	2	

518BMT04	BIOCONTROL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand system concept and different mathematical techniques applied in analyzing any given system.
- Analyze a given system in time domain and frequency domain.
- Understand the techniques of plotting the responses in both domain analyses.
- Know the concept of stability and stability analysis.
- Apply time and frequency domain analysis to study the biological systems.

UNIT I CONTROL SYSTEM MODELLING 9

Terminology and basic structure of control system, example of a closed loop system, transfer functions, modeling of electrical systems, translational and rotational mechanical systems, electromechanical systems, block diagram and signal flow graph representation of systems, conversion of block diagram to signal flow graph, reduction of block diagram and signal flow graph.

UNIT II TIME RESPONSE ANALYSIS 9

Step and Impulse responses of first order and second order systems, determination of time domain specifications of first and second order systems from its output responses, simulation, definition of steady state error constants and its computation, Response with P,PI,PD and PID controllers.

UNIT III STABILITY ANALYSIS 9

Definition of stability, Routh-Hurwitz criteria of stability, root locus technique, construction of root locus and study of stability, definition of dominant poles and relative stability .

UNIT IV FREQUENCY RESPONSE ANALYSIS 9

Frequency response, Nyquist stability criterion, Nyquist plot and determination of closed loop stability, Bode plot and determination of gain margin and phase margin , Simulation of Bode plot, use of Nichol's chart to compute resonance frequency and band width.

UNIT V PHYSIOLOGICAL CONTROL SYSTEMS 9

Block diagram representation of the muscle stretch reflex, difference between engineering and physiological control systems, generalized system properties, models with combination of system elements, Introduction to simulation, Case Studies.

TOTAL HOURS: 45 PERIODS

Course Outcomes:

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

CO1: Gain knowledge in modeling of mechanical, electrical system with signal flow graph and block diagram reduction Techniques.
CO2: Measure the time domain and frequency domain specifications.
CO3: Plotting the responses in time domain and frequency domain analysis for the stability criteria.
CO4: Plotting the magnitude and phase for bode plot, Nyquist plot and Nichol's Plot for measuring stability.
CO5: Learn the concept of Physiological control systems.

TEXT BOOKS:

1. M. Gopal, "Control Systems Principles and Design", Fourth Edition, Tata McGraw Hill, India,

2014
2. Farid Golnaraghi, Benjamin C. Kuo,"Automatic control systems", Ninth Edition, Wiley, India, 2009
3. Michael C K Khoo, "Physiological control systems", IEEE press, Prentice –Hall of India, 2005.

REFERENCE BOOKS:

1. John Enderle, Joseph Bronzino "Introduction to Biomedical Engineering" Third edition, Academic Press, 2011.
2. Richard C. Dorf, Robert H. Bishop," Modern control systems", Twelfth Edition, Pearson, 2011.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Gain knowledge in modeling of mechanical, electrical system with signal flow graph and block diagram reduction Techniques	3	3	3	3	3								2	3	1
CO2	Measure the time domain and frequency domain specifications.	3	3	3	3									1	3	1
CO3	Plotting the responses in time domain and frequency domain analysis for the stability criteria	3	3	2	3										2	1
CO4	Plotting the magnitude and phase for bode plot, Nyquist plot and Nichol's Plot for measuring stability.	3	3	3	2									2	3	1
CO5	Learn the concept of Physiological control systems.	3	3	3	3					3			3	1	3	1

518BMT05 ANALOG AND DIGITAL COMMUNICATION L T P C
3 0 0 3

COURSE OBJECTIVES:

- Understand modulation and demodulation techniques.
- Understand various pulse modulation techniques.
- Acquire knowledge on different phase shift keying techniques.
- Learn the basics of coding and decoding methods.
- Know the recent trends in wireless technology.

UNIT I ANALOG MODULATION 9

Amplitude Modulation – AM, DSBSC, SSBSC, VSB, modulators and demodulators – Angle modulation – PM and FM, modulators and demodulators – Superheterodyne receivers

UNIT II PULSE MODULATION 9

Low pass sampling theorem – Quantisation - PAM – Line coding - PCM, DPCM, DM, ADPCM and ADM, Channel Vocoder,– Time Division Multiplexing, frequency Division Multiplexing Data compression of ECG signals using delta modulation

UNIT III DIGITAL MODULATION AND TRANSMISSION 9

Phase shift keying – BPSK, DPSK, DEPSK(Digitally encoded PSK), QPSK - Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding - Cosine filters – Eye pattern, equalizers

UNIT IV INFORMATION THEORY AND CODING 9

Measure of information – Entropy – Source coding theorem - Shannon-Fano coding, Huffman Coding, LZ Coding– Channel capacity – Shannon-Hartley law – Shannon's limit- Error control Codes – Cyclic codes, Syndrome calculation – Convolutional Coding, Sequential and Viterbi coding and decoding.

UNIT V WIRELESS COMMUNICATION SYSTEMS 9

Commercial Cellular / 3G networks, Overview of SATCOM, SOTM, wireless sensor networks, wireless personal area networks : Body LAN-Bluetooth, Zigbee-Wireless LANs, Internet-Wifi-WiMax, Case studies: IEEE 802.11A Wireless LAN Standard,4G,5G networks. Wireless patient monitoring system (WPM)

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand modulation and demodulation techniques.
CO2: Understand various pulse modulation techniques.
CO3: Acquire knowledge on different phase shift keying techniques.
CO4: Learn the basics of coding and decoding methods.
CO5: Know the recent trends in wireless technology.

TEXT BOOKS:

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" Fourth Edition, Tata McGraw Hill, India, 2013
2. S. Haykin "Digital Communication Systems", First Edition, John Wiley, 2013
3. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2012

REFERENCE BOOKS:

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", Fourth Edition, Oxford University Press, 2011
2. H P Hsu, "Analog and Digital Communications", Third Edition, Schaum Outline Series - Tata McGraw Hill, 2009
3. B.Sklar, "Digital Communications Fundamentals and Applications" , Second Edition, Pearson Education 2007

COURSE OUTCOMES		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	Understand modulation and demodulation techniques	3			2					3				2		2

CO2	Understand various pulse modulation techniques	3		2				2				2		2		
CO3	Acquire knowledge on different phase shift keying techniques	3	2		2		2			3				3		2
CO4	Learn the basics of coding and decoding methods		2		2			2			3			2		
CO5	Know the recent trends in wireless technology		3	2	2			2			3			2		

515EIO01 **VIRTUAL INSTRUMENTATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study the virtual instrumentation introduction.
- To familiarize the LabVIEW environment.
- To understand the programming techniques in VI.
- To study the DAQ hardware.
- To study the VI applications and learn to implement small projects in VI.

UNIT I INTRODUCTION **9**

Graphical System Design Model- Design Flow with GSD- Virtual Instrumentation and Lab VIEW– Virtual Instrument Verses Traditional Instrument – Architecture of Virtual Instrumentation- Hardware and software in virtual Instrumentation- Virtual Instrumentation for test , Control and Design- Virtual Instrumentation in the Engineering

UNIT II Lab VIEW ENVIRONMENT **9**

Front panel-Block diagram-Icon and Connector – Control Palette-Function Palette-Tools Palette-Creating, editing, wiring, debugging and saving VIs - sub- VIs-creating sub-VIs-simple examples-Looping: For loop, while loop-Shift registers- case and sequence; structures, formula nodes

UNIT III PROGRAMMING TECHNIQUES **9**

Arrays-clusters, charts and graphs, local and global variables-property node, string and file I/O, Feedback Nodes -Tables

UNIT IV DATA ACQUISITION AND INSTRUMENT CONTROL **9**

DAQ-Components-Buffers: Buffered and non-buffered I/O-Triggering-Analog I/O Digital I/O-Counters andtimers-Instrument control**:** VISA**,** GPIB, VXI and PXI.

UNIT V Lab VIEW APPLICATIONS **9**

Applications of LabVIEW: biomedical-glucose, blood pressure and ECG monitoring system, Image acquisitionand processing. Case Study: Digital stop watch and BCD to 7 segment Decoder.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Learn the virtual instrumentation fundamentals.

CO 2: Familiarize with the VI software and learn programming in VI

CO 3: Understand various programming techniques.

CO 4: Understand various Instrument Interfacing and data acquisition methods.
CO 5: Develops programs for Process control applications

TEXT BOOKS:

1. S.Sumathi, P.Surekha,' Virtual Instrumentation with LabVIEW' Acme Learning private Ltd,2011
2. Gary Johnson, 'LabVIEW graphical programming', II Ed., McGraw Hill, 1999.
3. Jovitha Jerome 'Virtual Instrumentation using LabVIEW' PH1 Learning Pvt Ltd, 2009

REFERENCE BOOKS:

1. Lisa K Wells & Jeffrey Travels, 'LabVIEW for everyone', Prentice Hall, 2003.
2. Sanjeev Gupta, 'Virtual Instrumentation using LabVIEW' Tata McGraw Hill, 2004

COURSE OUTCOMES		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	Learn the virtual instrumentation fundamentals.	2	2	2	1	2				1			1	1		1
CO2	Familiarize with the VI software and learn programming in VI	2	2	2	1	2	1			1		2	1	1		2
CO3	Understand various programming techniques.	2	2	2	2	2				1		2	1	1		2
CO4	Understand various Instrument Interfacing and data acquisition methods.	2	2	2	1	2	1			1		2	1	1		1
CO5	Develops programs for Process control applications	2	2	2	2	2	1			1		1	1	1		2

518CIO02 JAVA PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the basic syntax and semantics of the Java language and programming environment.
- To understand error handling and multithreading concepts in java.
- Have the ability to write a simple GUI programs with Applet & Swing.
- Be aware of the importance of Utility Classes & Generic Classes.

UNIT I INTRODUCTION TO JAVA **9**

Basic Concepts of Java - Features of Java - Difference between C++ and Java - Class fundamentals - Declaring Objects- Object Reference Variables - Introducing methods - Constructors – Input & Output - Type Conversions and Casting – Introduction to Wrapper classes- Arrays - Command line arguments - This keyword – static variables and methods. Polymorphism- Inheritance – Finalclass and Methods

UNIT II PACKAGES & EXCEPTION HANDLING 9

Abstract class and methods - Nested classes - Inner classes. Interfaces-Packages - Importing a Packages - Exception Handling: Exception Types - Uncaught Exceptions - Using Try Catch - Multiple Catch - Nested Try – Built in Exceptions - User defined Exceptions.

UNIT III MULTITHREADING&STRING HANDLING 9

Adapter classes - Thread Model - Synchronization – Interthread communication – String Handling: String functions - String class methods - Special String Operations - Character Extraction - String Comparison - Modifying a String - String Buffer – String Builder-Introduction to Collection Framework: ArrayList – Map – Set.

UNIT IV DATABASE CONNECTIVITY, APPLET & SWING 9

Accessing database using JDBC - Applet Architecture- Applet Lifecycle-Simple Applet - Introduction to Swings – JFrame – JLabels - JButtons – JComboBox - Event Handling: Event Delegation Model - Event Classes – Event Listener Interface.

UNIT V UTILITY CLASSES & GENERIC CLASSES 9

Utility Classes: String Tokenizer – BitSet – Date - Calendar - Gregorian – Random- Streams and Files – Byte stream - Character Streams - Stream I/O -Scanner Class – Serialization - Generic Class- Generic Method - Generic Interface.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop Java Programs using OOPs Principles

CO 2: Create a real-world application by applying the user defined packages, interfaces.

CO 3: Implement multithreading concepts in real time scenarios.

CO 4: Design a GUI-based application using Applets &Swings.

CO 5: Understand the usage of Utility & Generic Classes.

TEXT BOOKS:

1. R.NageswaraRao, “Core Java An Integrated Approach(Includes all versions JAVA 8)”, Dream tech Press, ISBN:978-8177228366,2013
2. C.Xavier, “Java Programming”, 1st Edition, McGraw Hill Education, 2011.

REFERENCE BOOKS:

1. Shirish Chavan, “Java for Beginners”, 2nd Edition, Shroff Publishers and Distributors Pvt. Ltd,ISBN: 9789350237557, 2012
2. Kathy Sierra, Bert Bates, “Head First Java”, 2nd Edition, O'Reilly Media, 2005.
3. H. Schildt, “Java: The complete Reference”, 9th Edition, TataMc GrawHill, 2014.
4. Paul Deitel, Harvey Deitel, “Java How to Program”,10th Edition, Pearson Education, 2016.
5. Cay S. Horstmann, “Core Java: Volume I- Fundamentals”, 10thEdition, Prentice Hall, 2015.

COURSE OUTCOMES		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	Develop Java Programs	2	2	1	3	2				1	2	2	2	1	2	2

	using OOPs Principles															
CO2	Create a real-world application by applying the user defined packages, interfaces	2	2	1	3	2				1	2	2	2	2	2	1
CO3	Implement multithreading concepts in real time scenarios	2	2	1	3	2				1	2	2	2	1	1	2
CO4	Design a GUI-based application using Applets &Swings	2	2	1	3	2				1	2	2	2	2	1	1
CO5	Understand the usage of Utility & Generic Classes	2	2	1	3	2				1	2	2	2	1	2	2

518BTO11 **MEDICAL CODING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Develop comprehensive knowledge in the area of Human Anatomy &Physiology, Medical Coding, and CPT Coding.
- Understand the knowledge of HCPCS Coding RCM, Coding Compliance and HIPAA Laws.
- Understand the knowledge of coding ICD
- Understand the knowledge of E&M coding, medical billing cycle

UNIT I HUMAN ANATOMY & PHYSIOLOGY PART I 9

Cardiovascular System, Blood & its Components, Integumentary System, Endocrine System, Urology, Male Reproductive System. Location, Shape, Size, Structure, Physiology, Pathology, Diagnostic Test, Terminologies

UNIT II HUMAN ANATOMY & PHYSIOLOGY PART II 9

Female Reproductive Systems, Nervous System, Gastro Intestinal System, Pulmonology, Special Sciences, Orthopedics, Lymphatic System - Location, Shape, Size, Structure, Physiology, Pathology, Diagnostic Test, Terminologies

UNIT III CURRENT PROCEDURE TERMINOLOGY CODING (CPT) 9

CPT Codes, CPT Description, Medical Record Format, Speciality Listings and its Format, Usage of CPT Manuals, Software usage, Examples of CPT Speciality Code Practice, HCPCS Coding, Basic steps of HCPCS coding, Differentiation of CPT and HCPCS Coding.

UNIT IV INTERNATIONAL CLASSIFICATION OF DISEASE CODING (ICD) 9

ICD Codes, ICD 9 CM – ICD 10 Transition, Diagnosis Interpretation, Usage of ICD Manuals, Index Listings, Tabular Listings, Software usage, Examples of Dx Code Practice.

UNIT V MODIFIERS, E&M CODING, MEDICAL BILLING CYCLE &OVERVIEW 9

Modifiers Listing, Usage and Indexing, E & M codes, classification, Application of E&M, Tabulation, Listings, Software usage, Examples of E&M Code Practice

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO 1: Familiarize in the medical coding procedures for various treatment process.

CO 2: Acquire knowledge about ICD coding and medical billing process.

CO 3: Acquire knowledge about human anatomy &physiology.

CO 4: Familiarize in the software usage.

CO 5: Acquire knowledge about E&M Code Practice.

TEXT BOOKS:

1. Current Procedural Terminology (*CPT*®)2013 American Medical Association*:* I & II, Professional Edition *(*American Medical Association*),* CPT AMA Professional Edition, London, UK, 2013.
2. ICD-9 CM Physicians Volume I and Volume II Contexo, A division of Access Intelligence, London, UK, Medicine & Health Science Books, CPT 2009 Professional Edition,2013.

REFERENCE BOOKS:

1. David N. Shier, Jackie Butler and Ricki Lewis, "Hole's Human Anatomy and Physiology Paperback-Import", McGraw Hill Higher Education, 12th edition, 2009.
2. Mader, "Understand Human Anatomy and Physiology Paperback", McGraw-Hill Education, 9^{th}edition, 2006.
3. Carol J. Buck, "Step-by-Step Medical Coding 2014 Text + Workbook Paperback – Import", W BSaunders Co, CSM edition December, 2013.

EBOOKS/WEBLINKS:

https://nptel.ac.in/courses/108/102/108102117/

COURSE OUTCOMES		**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	Familiarize in the medical coding procedures for various treatment process.	2		1		2		2		1		1	2	1	2	2
CO2	Acquire knowledge about ICD coding and medical billing process.	2		1		2		2		1		1	2	1	2	2
CO3	Acquire knowledge about human anatomy &physiology.		1	2	1		1		1	2	2		1		1	1
CO4	Familiarize in the software usage.	2		1		2		2		1		1	2	1	2	2
CO5	Acquire knowledge about E&M Code Practice.															

518ITO05 **C# & .NET PROGRAMMING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamentals of .NET Programming
- To develop real time applications using C#

UNIT I C# LANGUAGE FUNDAMENTALS 9

The Building Block of the .NET Platform (CLR,CTS, and CLS) – Overview of Assemblies - The Anatomy of a Simple C# Program - Defining Classes and Creating Objects - The System Console Class- Establishing Member Visibility - Default Values of Class Member Variables-Member Variable Initialization Syntax- Static Keyword - Method Parameter Modifiers - Iteration Constructs - Decision Constructs and the Relational / Equality Operators - Understanding Value Types and Reference Types-Boxing and Unboxing - Working with .NET Enumerations - Overriding Some Default Behaviors of System. Object - The System Data Types - String Data Type - .NET Array Types - Custom Namespaces.

UNIT II OBJECT ORIENTED PROGRAMMING WITH C# 9

Understanding the C# Class Type - Reviewing the Pillars of OOP - The First Pillars: C#'s Encapsulation Services, The Second Pillar: C#'s Inheritance Support - Programming for Containment/Delegation - The Third Pillar: C#'s Polymorphic Support-C# Casting Rules - Understanding Object Lifetime - Basics of Object Lifetime - Role of Application Roots - Garbage Collection - Building Finalizable and Disposable Types. Exception Handling - Throwing a Generic Exception - Catching Exceptions.

UNIT III INTERFACES, COLLECTIONS, DELEGATES, EVENTS AND LAMDA EXPRESSION 9

Defining Interfaces in C#-Implementing an Interface in C# - Contrasting Interfaces to Abstract Base Classes-Building Interface Hierarchies - Building Enumerable Types (IEnumerable and IEnumerator) Building Cloneable Objects (ICloneable) -Building Comparable Objects (IComparable) -The Interfaces of the System. Collections Namespace - Defining a Delegate in C# -Simplest Possible Delegate Example-Enabling Multicasting -C# Events - Lamdas Expression.

UNIT IV DEVELOPING WINDOW APPLICATION FORMS 9

Windows Forms Types - Application Class- Functionality of the Control Class - Functionality of the Form Class- Building Windows Applications - Working with Status Strips - Working with Tool Strips - Building an MDI Application - Basic Controls.

UNIT V ADO.NETAND ASP.NET 9

ADO.NET Overview – Using Database Connections, Commands, The Data Reader, The Dataset Class,ASP.NET Introduction – Web Forms – ADO.NET and Data Binding-ASP.NET Features – User and Custom Controls – Master Pages- Site Navigation – Security.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand anatomy of C# Programming.

CO2: Develop Console application using object oriented concepts, advanced features in C#.

CO3: Develop Applications using Interfaces and Events.

CO4: Develop Window form application with Database connectivity.

CO5: Build Applications using ADO.NETAND ASP.NET.

TEXT BOOKS:

1. Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework" Apress, Sixth Edition,2012 ISBN: 978-1-4302-4233-8
2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.

REFERENCE BOOKS:

1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012.
2. E. Balagurusamy, "Programming in C#", Tata McGraw-Hill, 2004.
3. O`Reilly "Programming C# 5.0", O'Reilly Media ISBN: 978-1-4493-2041-6 | ISBN 10:1-4493-2041-4, October 2012.
4. Michael Schmalz "C# Database Basics" O'Reilly Media ISBN:978-1-4493-0998-5, 2012

COURSE OUTCOMES		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	Understand anatomy of C# Programming.	1				1		1						1	2	3
CO2	Develop Console application using object oriented concepts, advanced features in C#.			3										1	2	3
CO3	Develop Applications using Interfaces and Events.			2		3									2	3
CO4	Develop Window form application with Database connectivity.		2				3							1	2	3
CO5	Build Applications using ADO.NETAND ASP.NET.			2		3									2	3

518BMP07 BIO MEDICAL INSTRUMENTATION LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Record the biosignals like ECG, EEG, EMG.
- Record the various physiological parameters.
- Measure nonelectrical parameters using the chemical sensors.
- Know about the safety aspects of surgical diathermy.

LIST OF EXPERIMENTS

1. Design of Biological Preamplifiers.
2. Recording of ECG signal and Analysis.
3. Recording of Audiogram and Analysis.
4. Recording of EMG and Analysis.
5. Recording of EEG and Analysis.
6. Measurement of Pulse rate using Photo Electric Transducer.
7. Recording of various physiological parameters using patient monitoring system

8. Measurement of pH, pO2 and conductivity.
9. Study and analysis of functioning and safety aspects of surgical diathermy.
10. Recording of Digital Blood Pressure Monitor

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Record the biosignals like ECG, EEG, EMG.
CO2: Record the various physiological parameters.
CO3: Measure nonelectrical parameters using the chemical sensors.
CO4: Know about the safety aspects of surgical diathermy.

COURSE OUTCOMES		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	Record the biosignals like ECG, EEG, EMG	3	3	3		3				3			3	3	3	
CO2	Record the various physiological parameters	3	3	3		3				3			3	3	3	
CO3	Measure nonelectrical parameters using the chemical sensors	3	3	3		3				3			3	3	3	
CO4	Know about the safety aspects of surgical diathermy.	3		3		3				3			3	3	3	

518BMP08 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Develop the code in assembly language programming.
- Test and develop code using 8085, 8086 processors and 8051 controllers.
- Demonstrate the interface peripherals with microprocessor and micro controller

LIST OF EXPERIMENTS:

I. <u>8085 based Experiments</u>

1. 8-bit Arithmetic operations using 8085.
2. 16-bit Arithmetic operations using 8085.
3. Searching of a Largest and smallest number in an array using 8085.
4. Sorting of an array using 8085
5. Conversion of Hexadecimal to ASCII code using 8085
6. Design of Simple ALU using 8085.

II. <u>8086 based Experiments</u>

7. 16-bit Arithmetic operations using 8086
8. Searching of a Largest and smallest number in an array using 8086
9. String manipulation using 8086.
10. Generation of Fibonacci series using 8086

III. 8051 based experiments

11. 8-bit arithmetic operations using 8051 microcontroller
12. Design of simple ALU using 8051 microcontroller.

IV. Interfacing Experiments with 8085/8086/8051

13. Stepper motor interfacing
14. DAC interfacing
15. 8253 timer
16. Traffic light controller
17. 8279 keyboard/display controller

COURSE OUTCOMES:

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

CO1: Develop the code in assembly language programming.
CO2: Test and develop code using 8085, 8086 processors and 8051 controllers.
CO3: Demonstrate the interface peripherals with microprocessor and micro controller

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Develop the code in assembly language programming.	3	1	3	3	2						3		3	2	
CO2	Test and develop code using 8085, 8086 processors and 8051 controllers	3	1	3	3	2						3		3	2	
CO3	Demonstrate the interface peripherals with microprocessor and micro controller	3	1	3	3	2						3		3	2	

518BMP09 DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- Compute FFT and IFFT of a discrete time signal.
- Design and analyze the various FIR filter techniques
- Design and analyze the various IIR filter techniques
- Demonstrate Finite word length effects
- Analyze the Biomedical signals

LIST OF EXPERIMENTS:

1. Generation of sequences (functional & random), correlation and convolution
2. Spectrum Analysis using FFT
3. Filter Design & Analysis
4. Study of Quantization errors in DSP algorithms

5. Difference equation Representation
6. Multirate Filters
7. Estimation of Power spectrum density
8. Upsampling and downsampling
9. Speech Processing
10. Analysis of ECG
11. Analysis of EEG

DSP Processor Implementation

1. Waveform Generation
2. FIR Implementation
3. IIR Implementation
4. FFT
5. Finite word Length effect
6. Multirate filters

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Compute FFT and IFFT of a discrete time signal.
CO2: Design and analyze the various FIR filter techniques
CO3: Design and analyze the various IIR filter techniques
CO4: Demonstrate Finite word length effects
CO5: Analyze the Biomedical signals

COURSE OUTCOMES		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	Compute FFT and IFFT of a discrete time signal.	1	1		3	3					2	2		3	1	2
CO2	Design and analyze the various FIR filter techniques	1	1	2	3	3					2	2		3	1	2
CO3	Design and analyze the various IIR filter techniques	1	1	2	3	3					2	2		3	1	2
CO4	Demonstrate Finite word length effects	1	1		3	3					2	2		3	1	2
CO5	Analyze the Biomedical signals	1	1		3	3		2			2	2		3	1	2

618BMT01 **DIAGNOSTIC EQUIPMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study the genesis and variation in ECG and EEG waveform
- To understand the concept of ultrasonic technique
- To understand about the different respiratory measurement techniques
- To analyze the use of an audiometer and the Galvanic Skin Resistance(GSR)

- To gain knowledge in patient monitoring systems and biotelemetry

UNIT I CARDIAC AND NEUROLOGICAL EQUIPMENT 9

CARDIAC EQUIPMENT -Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Arrhythmia Simulator, Holter Monitor, Phonocardiography, ECG machine maintenance and troubleshooting.

NEUROLOGICAL EQUIPMENT- Clinical significance of EEG, Multi channel EEG recording system, Epilepsy, Evoked Potential –Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG system maintenance and troubleshooting.

UNIT II ULTRASONIC TECHNIQUE 9

Basic principles of Echo technique, display techniques A, B and M mode, Applications of ultrasound as diagnostic tool – Echocardiogram, Echoencephalogram, abdomen, obstetrics and gynecology, ophthalmology. Doppler effect and its application.

UNIT III 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 plethysmography, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor, Oximetry- Invitro oximetry, Invivo oximetry, Ear oximeter,Pulse oximeter

UNIT IV SENSORY MEASUREMENT 9

Psycho Physiological Measurements-for testing and sensory responses, Electroocculograph, Electroretinograph, Audiometer-Puretone, Speech. EGG(Electro gastrograph), basal skin resistance (BSR), galvanic skin resistance (GSR).

UNIT V PATIENT MONITORING AND BIOTELEMETRY 9

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

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basics of Cardiac and neurological equipment
CO2: Gain knowledge on EEG signal and EEG machine.
CO3: Understand the mechanism of measurements in respiratory
CO4: Understand about the different sensory measurement techniques
CO5: Learn the working of ICU/CCU equipment and applications in ECG and EEG Transmission.

TEXT BOOKS:

1. Joseph J. Carr and John M. Brown, “Introduction to Biomedical equipment technology”, Fourth edition, Pearson education, 2003.
2. John G. Webster , Amit J. Nimunkar, Medical Instrumentation: Application and Design, Fifth Edition, Wiley India Edition, 2020.

REFERENCE BOOKS:

1. Myer Kutz, “Standard Handbook of Biomedical Engineering & Design”, Second Edition , McGraw Hill,2009.

2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Third edition, Tata McGraw Hill, 2014.
3. L.A Geddes and L.E.Baker, “Principles of Applied Biomedical Instrumentation”. Third edition, Wiley India Edition ,2008
4. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Second Edition, *Pearson* Education, 2016.

COURSE OUTCOMES		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	Understand the basics of Cardiac and neurological equipment	3		2		3	1						3	2	1	
CO2	Gain knowledge on EEG signal and EEG machine	3		2		3	2						3	2	1	
CO3	Understand the mechanism of measurements in respiratory	3		2		3	2						3	2	1	
CO4	Understand about the different sensory measurement techniques	2		2		3	2						3	2	1	
CO5	Learn the working of ICU/CCU equipment and applications in ECG and EEG Transmission	2		2		3	2						3	2	1	

618BMT02 **THERAPEUTIC EQUIPMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the principle of diathermy equipment and its types.
- To learn various cardiac therapeutic equipments
- To study the functioning of muscle and nerve stimulators.
- To acquire the knowledge of various extra-corporeal devices
- To gain knowledge on patient’s electrical environment and also on electrical safety codes and standards implemented towards the concern

UNIT I DIATHERMY EQUIPMENT **9**

Principles of surgical diathermy – Surgical diathermy machine- Current waveforms, Tissue Responses, Electro surgical current level, Hazards and safety procedures.High frequency therapy - Short wave diathermy, Ultrasonic diathermy, Microwave diathermy, Principles of Cryogenic technique and application.

UNIT II CARDIAC PACEMAKER AND DEFIBRILLATOR **9**

Cardiac Pacemaker- Internal, External Pacemaker and Programmable pacemaker –Batteries, electrodes and leads system, pacing system analyzers, AC and DC Defibrillator- Types of Internal and External Defibrillator, defibrillator safety and analyzers, RF ablation treatment for arrhythmia, Atherectomy.

UNIT III PHYSIOTHERAPY AND ELECTROTHERAPY EQUIPMENTS 9

Principles of physical therapy, Therapeutic heat, Pain relief through electrical stimulation –Tissue Responses to electrical stimulation, Muscle stimulator,TENS, spinal cord stimulator,brain stimulation for pain reduction, FES.IR and UV lamp and its applications.

UNIT IV EXTRA CORPOREAL DEVICES 9

Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenators, finger pump, roller pump, Haemodialyser unit, Lithotripsy, Endoscopy, Laparoscopy, Types of Ventilators – Pressure, Volume, Time controlled flow, Patient Cycle Ventilators, neonatal ventilators, ventilator testing, Humidifiers, Nebulizers, Inhalators

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 –Medical safety codes and regulatory standards- IEC 60601-1 2005 standard, Basic Approaches to protection against shock, Protection equipment design, Electrical safety analyzer – Testing the Electric system.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Learn the types and uses of diathermy technique and application.
CO2: Understand the defibrillator and pacemaker devices
CO3: Study the working of physiotherapy and electrotherapy equipment
CO4: Understand the working of extra-corporeal devices like Heart-lung machine, oxygenator.
CO5: Gain the knowledge on patient's electrical environment and electrical safety codes

TEXT BOOKS:

1. John G. Webster , Amit J. Nimunkar, "Medical Instrumentation: Application and Design", Fifth Edition, Wiley India Edition, 2020.
2. Joseph. Carr and John M. Brown, "Introduction to Biomedical equipment technology", John Willey and sons, 2003.

REFERENCE BOOKS:

1. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation",Third edition, Wiley India Edition ,2008.
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Second Edition, Pearson *Education, 2016.*
3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Third edition, Tata McGraw Hill, 2014.
4. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", Second Edition , McGraw Hill,2009.

COURSE OUTCOMES		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	Learn the types and usesof diathermy technique and application.	3		2		3	1						3	2	1	
CO2	Understand the defibrillator and pacemaker devices	3		2		3	2						3	2	1	
CO3	Study the working of physiotherapy and electrotherapy equipment	3		2		3	2						3	2	1	
CO4	Understand the working of extra-corporeal devices like Heart-lung machine, oxygenator	2		2		3	2						3	2	1	
CO5	Gain the knowledge on patient's electrical environment and electrical safety codes	2		2		3	2						3	2	1	

618BMT03 **RADIOLOGICAL EQUIPMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To get the clear understanding of X-ray generation and its application
- To study the functioning of computed tomography
- To understand the concept of magnetic resonance imaging.
- To gain knowledge on the radio isotopes and radiation detectors
- To study the special techniques adopted in radiation therapy

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. Digital Radiography - discrete digital detectors, storage phosphor and film Scanning, 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. Image characteristics, X-Ray Image intensifier tubes - Fluoroscopy – Digital Fluoroscopy. Angiography, Cine angiography. Digital Subtraction Angiography, Mammography, Dental X-ray machines

UNIT II COMPUTED TOMOGRAPHY 9

Principles of Tomography – Evolution of CT, X-Ray Sources – Collimation – X-Ray Detectors – Image reconstruction technique- Back projection and Iterative method, Viewing System, Patient dose in CT. Spiral CT Scanning - Ultra fast CT Scanners, 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 a magnetic resonance signal – bulk Magnetization – Relaxation Processes T1 and T2. Block diagram approach of MRI system- System

Magnet (Permanent, Electromagnet and super conductors), generation of Gradient magnetic Fields, Radio Frequency coils (sending and receiving) Shim coils, Electronic components, fMRI.

UNIT IV NUCLEAR MEDICINE SYSTEMS 9

Radio isotopes- alpha, beta and gamma radiations. Radio pharmaceuticals. Radiation detectors - Gas Filled, ionization Chambers, proportional counter, GM counter and Scintillation Detectors. Gamma Camera- Principle of operation, Collimator, Photo multiplier tube, X-Y positioning Circuit, Pulse height Analyzer. Principles of SPECT and PET, Radionuclide imaging- Bone imaging, myocardial perfusion

UNIT V RADIATION THERAPY AND SAFETY EQUIPMENT 9

Radiation therapy-Linear accelerator, betatron, cesium and cobalt. 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, ICRP regulation Practical reduction of dose to staff and visitors.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Learn X ray equipment, their imaging techniques, appreciate their usage in the radiology department of hospital

CO2: Gain adequate knowledge about the fundamentals of CT imaging techniques

CO3: Know about the MRI imaging and their usage

CO4: Gain adequate knowledge about Nuclear medicine system

CO5: Understand about radiation therapy and its safety

TEXT BOOKS:

1. M A Flower, Webb's Physics of Medical Imaging , Second Edition, CRC Press, 2012.
2. William R. Hendee and Russell Ritenour, Medical Imaging Physics, Wiley, Fourth Edition 2002.

REFERENCE BOOKS:

1. Gopal B.Saha ,Physics and Radiobiology of Nuclear Medicine, Third edition, Springer publication, 2006.
2. B.H Brown , PV Lawford, R H Small wood , D R Hose , D C Barber , Medical Physics and Biomedical Engineering, First edition, CRC Press, 1999.
3. Myer Kutz, “Standard Handbook of Biomedical Engineering & Design”, Second Edition ,McGraw Hill,2009.

COURSE OUTCOMES		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	Learn X ray equipments, their imaging techniques, appreciate their usage in the radiology department of hospital	3	2	2	2	3	1				2	2	3	2	1	
CO2	Gain an adequate	3	2	2	2	3	2				2	2	3	2	1	

	knowledge about the fundamentals of CT imaging techniques															
CO3	Know about the MRI imaging and their usage	3	2	2		3	2				2	2	3	2	1	
CO4	Gain adequate knowledge about Nuclear medicine system	2	3		2	3	2				2	2	3	2	1	
CO5	Understand about radiation therapy and its safety	2	3	2		2	2				2	2	3	2	1	

618BMT04 **BIOMATERIALS AND ARTIFICIAL ORGANS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study the basics of biomaterials and compatibility.
- To study the characteristics and medical applications of metallic implants
- To understand the characteristics of polymeric implants materials.
- To understand the different soft and hard tissue replacements
- To study the artificial organs.

UNIT I STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY 9

Definition and classification of bio-materials, mechanical properties, viscoelasticity, wound-healing process, body response to implants, blood compatibility.

UNIT II IMPLANT MATERIALS 9

Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite glass ceramics carbons, Nano materials, medical applications.

UNIT III POLYMERIC IMPLANT MATERIALS 9

Polymerization, polyamides, Acrylic polymers, rubbers, high strength thermoplastics, medical applications. Bio polymers: Collagen and Elastin.

UNIT IV TISSUE REPLACEMENT IMPLANTS 9

Soft-tissue replacements, sutures, surgical tapes, adhesives, Percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, joint replacements.

UNIT V ARTIFICIAL ORGANS 9

Artificial Heart, Prosthetic Cardiac Valves, Artificial lung (oxygenator), Artificial Kidney (Dialyzer membrane), Dental Implants, 3D organ printing.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to:
CO1: Gain Knowledge about the characteristics of biomaterials.
CO2: Study the applications of metallic implants.
CO3: Learn the properties, characteristics and applications of polymeric implants
CO4: Learn about skin implants and blood interfacing implants
CO5: Gain knowledge on the artificial organs.

TEXT BOOKS

1. Sujata V. Bhatt, "Biomaterials", Narosa Publishing House, Seventh Edition, 2005.
2. Joon B.Park Joseph D. Bronzino, "Biomaterials - Principles and Applications", CRC press, 2003.

REFERENCE BOOKS

1. Park J.B., "Biomaterials Science and Engineering", Plenum Press, 1984.
2. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", Second Edition, McGraw Hill, 2009.
3. John Enderle, Joseph D. Bronzino, Susan M "Introduction to Biomedical Engineering", Blanchard, Elsevier, 2005.

COURSE OUTCOMES		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	Gain Knowledge about the characteristics of biomaterials	3	2	2			1						2	3	1	
CO2	Study the applications of metallic implants	3	2	2			1						2	3	1	
CO3	Learn the properties, characteristics and applications of polymeric implants	3	2	2			1						2	3	1	
CO4	Learn about skin implants and blood interfacing implants	3	1	2			1						2	3	1	
CO5	Gain knowledge on the artificial organs	3	1	2			1						2	3	1	

618BME05 MEDICAL SAFETY AND QUALITY ASSURANCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand how safety is important for health care systems.
- To gain knowledge about shocks and leakage current.
- To understand the safety in medical imaging and ventilation
- To know about safety codes, standards and regulations.
- To learn responsibility to maintain quality management, risk management.

UNIT I SAFETY IN HEALTH CARE 9

Quality assurance, Safe medical devices – device requirements - devices for varying age – initial inspection – maintenance. Safe handling and operation, Reporting, Bed rails, Flawed mechanics, removable parts and packaging.

UNIT II ELECTRICITY, GAS, FIRE SAFETY IN HOSPITALS 9

Macroshock and Microshock, Current, Voltage and conductance, Earth and protection classes, earth fault circuit breakers and isolation transformers, leakage currents in medical equipment, biological effects of electromagnetic fields, Susceptibility to water. Gas technology and Fire in hospital, Thermal injuries, Case study

UNIT III SAFETY IN MEDICAL IMAGING AND VENTILATION 9

Quality assurance and image improvement in diagnostic radiology with X-rays, specific quality assurance tests for X-rays. MRI safety. Risks in Ventilators, anesthetic machines, oxygen treatment, treatment with Nitric oxide, pressure chamber treatment, Incubators and monitoring, Case Study- DICOM image

UNIT IV SAFETY CODES, STANDARDS AND REGULATIONS 9

Electrical safety codes and standards-Medical Devices, Standards- Need for Standards , Voluntary and mandatory standards , Standards development process , Conformity assessment, ISO,EEC, IEC, CE, FDA,IMDR, CEN, CENELEC, IEC 60601-1, IEC 60601-1-2, IEC 60601-1-3, Case study- Bio waste management

UNIT V RISK MANAGEMENT AND SAFETY HAZARDS 9

Quality management, risk management, types of responsibilities, delegating, procurement, status and other publications, overall responsibility, safety aspects, Implantable devices, safety hazards.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand how safety is important for health care systems.
CO2: Gain knowledge about shocks and leakage current.
CO3: Know about the need for standards and codes.
CO4: Learn about safety codes, standards and regulations.
CO5: Learn the responsibility to maintain quality management, risk management.

TEXT BOOKS:

1. Bertil Jacobson and Alan Murray, “Medical Devices use and safety”, Reed Elsevier India Pvt. Ltd, New Delhi, 2011.
2. Michael Cheng, “Medical device regulations: global overview and guiding principles”, World Health Organization 2003.

REFERENCE BOOKS:

1. M A Flower, Webb's Physics of Medical Imaging, Second Edition, CRC Press, 2012.
2. G.D.Kunders, “Hospitals Facilities Planning & Management”, Tata Mcgraw Hill, 2013.
3. Joseph. Carr and John M. Brown, “Introduction to Biomedical equipment technology”, John Willey and sons, 2003.

COURSE OUTCOMES		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	Understand how safety is important for health care systems	1					2	1	2				1	2	3	
CO2	Gain knowledge about shocks and leakage current	1					2	1	2				1	2	3	
CO3	Know about the need for standards and codes	1					1	1	2				1	2	3	
CO4	Learn about safety codes, standards and regulations	1					3	1	1				1	2	3	
CO5	Learn the responsibility to maintain quality management, risk management	1					3	1	2				1	2	3	

618BME06 **BIO SIGNAL PROCESSING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Understand characteristics of some of the most commonly used biomedical signals, including ECG, EEG, EOG, and EMG.
- Understand choice of filters to remove noise and artifacts from biomedical signals.
- Apply established engineering methods to analyse ECG signal problems.
- Apply established engineering methods to analyse neurological signals.
- Analyse various biomedical signals through advanced techniques.

UNIT I INTRODUCTION TO BIOMEDICAL SIGNALS 9

Biosignal Characteristics of Electro Cardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Electrogastrogram (EGG), Electroneurogram (ENG), Event related potentials (ERPs), Phonocardiogram (PCG), Speech signal, Processing steps of Biomedical signal analysis-Signal acquisition, Signal amplification, Sampling, Nyquist criteria, Difficulties in Biomedical signal analysis, Computer-aided diagnosis.

UNIT II FILTERING FOR REMOVAL OF ARTIFACT 9

Time-domain Filters - synchronized averaging, Moving Average Filters, Derivative-based operators to remove low-frequency artifacts. Frequency-domain filters - Removal of High Frequency noise, Removal of low frequency noise, Removal of periodic artifacts, optimal filter- Wiener filter, Adaptive filters for removal of interference.

UNIT III CARDIOVASCULAR APPLICATIONS 9

Noise & Artifacts, ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection, Adaptive noise canceling in ECG, improved adaptive filtering in FECG, Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets. Computation of diagnostic signal parameters of ECG like Heart rate and QRS detection using Multivariate analysis (PCA and ICA). Segmentation of PCG, intensity patterns, Spectral modeling and analysis of PCG signals.

UNIT IV NEUROLOGICAL APPLICATIONS 9

EEG rhythms & waveforms, EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models - Nonlinear modeling of EEG - artifacts in EEG & their characteristics and processing – Nonparametric spectral analysis, Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis - correlation analysis of EEG channels - coherence analysis of EEG channels. Evoked potentials- noise characteristics, Noise reduction by linear filtering.

UNITV ANALYSIS ON WAVESHAPE, SIGNAL CLASSIFICATION AND RECOGNITION 9

Modeling intramuscular EMG-Intramuscular signal decomposition-Fractal analysis of EMG signals. Statistical analysis of VAG signals. Analysis on amplitude and latency of MEG signals. Analysis of ERP effect. Signal classification and recognition – Statistical signal classification, linear discriminant function, direct feature selection and ordering, Back propagation neural network based classification. Analysis of EEG using Empirical mode decomposition (EMD).

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Draw different types of biomedical signals and identify their spectral components.

CO2: Use different filters on biomedical signals and judge filter performance.

CO3: Identify physiological interferences and artifacts affecting ECG signal.

CO4: Compute power and correlation spectra of EEG signal.

CO5: Propose an algorithm to classify biomedical signals

TEXT BOOKS:

1. Rangaraj M. Rangayyan, “Biomedical Signal Analysis-A case study approach”, Wiley, 2nd Edition, 2016.
2. Reddy D C, "Biomedical Signal Processing”. Principles and Techniques, McGraw Hill, New Delhi, 2005.

REFERENCE BOOKS:

1. Willis J. Tompkins, “Biomedical Digital Signal Processing”, Prentice Hall of India, New Delhi, 2003.
2. John hall, .Guyton and Hall Textbook of Medical Physiology, Elsevier, 12th edition, 2015.
3. Kayvan Najarian and Robert Splerstor, “Biomedical signals and Image processing’’, CRC – Taylor and Francis, New York, 2nd Edition, 2012.
4. Emmanuel C.Ifeachor, Barrie W.Jervis, “Digital Signal Processing – A Practical Approach”, 2nd Edition, Pearson Education, New Delhi, 2003.
5. V.Udayashankara, “Real Time Digital Signal Processing”, Prentice Hall India, New Delhi, 2010.
6. B.Venkataramani, M.Bhaskar, “Digital Signal Processors- Architectures, Programming and Applications”, Tata McGraw Hill, New Delhi, 2004.

COURSE OUTCOMES		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	Draw different types of biomedical signals and identify their spectral components.	3	3	2	2	2							2	3	1	
CO2	Use different filters on	3	2	2	2	2							2	3	1	

	biomedical signals and judge filter performance															
CO3	Identify physiological interferences and artifacts affecting ECG signal	3	2	2	2	2							2	3	1	
CO4	Compute power and correlation spectra of EEG signal	3	3	2	2	2							2	3	1	
CO5	Propose an algorithm to classify biomedical signals	3	3	2	2	2	2						2	3	1	

618BME07 CLINICAL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To know about how does a health care environment.
- To know about management of technical staff in hospitals
- To know about standards and codes used in hospitals.
- To know about information systems
- To understand the safety precautions in clinical environment

UNIT I NEED AND SCOPE OF CLINICAL ENGINEERING 9

History of engineering and technology in health care – Health care environment – Educational responsibilities – Staff structure in hospitals – Careers, roles and responsibilities – Clinical engineering at the bedside, A model clinical engineering department.

UNIT II TRAINING AND MANAGEMENT OF TECHNICAL STAFF IN HOSPITAL 9

Industrial management in health care – Skills identification – Management styles and human resource development – Developing training programme – Advanced health technology management workshop – Evaluation of training – Wages and salary – Retraining programme – Employee appraisal method, Biomedical equipment - testing calibration and installation, Maintenance and repair of medical devices.

UNIT III STANDARDS AND CODES IN HEALTH CARE 9

Necessity for standardization – Hospital facilities – safety standards – Health care quality and ISO 9001:2000 – Joint Commission of Accreditation of hospitals – ICRP and other standard organizations – Methods adopted to monitor the standards.

UNIT IV INFORMATION SYSTEMS MANAGEMENT 9

Physiologic monitoring and clinical information systems – Advanced diagnostics and artificial intelligence – Telemedicine – Picture archiving and communication system (PACS) – The integration and convergence of medical and information technologies.

UNIT V CLINICAL ENGINEERING ENVIRONMENT 9

Physical plant – Heating – Ventilation – Air conditioning – Electrical power – Medical gas system – Support devices – Radiation safety – Sanitation – Water systems in hospitals – Disaster planning.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Know the role of clinical engineer in the health care industry.
CO2: Gain knowledge about maintenance and running of hospitals.
CO3: Understand about healthcare standards and quality policies.
CO4: Study about physiologic monitoring and clinical information systems
CO5: Learn about safety precautions in healthcare.

TEXT BOOKS:

1. Joseph Dyro, "Clinical Engineering Handbook", Elsevier Science & Technology Books, 2004.

REFERENCE BOOKS:

1. Webster J C and Albert M Cook, "Clinical Engineering Principles and Practice", Prentice Hall Inc., New Jersey, 2011.
2. Josef Kolman, Paul M and Graeme Scoot, "Good Clinical Practice: Standard Operating Procedures for Clinical Researchers", John Wiley & Sons Inc., 2002.
3. Goyal R C, "Handbook of Hospital Personnel Management", Prentice Hall of India, 2006.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Know the role of clinical engineer in the health care industry.	3					2	3	2					2	3	
CO2	Gain knowledge about maintenance and running of hospitals	3					2	3	2					2	3	
CO3	Understand about healthcare standards and quality policies	3					2	3	2					1	3	
CO4	Study about physiologic monitoring and clinical information systems	3					2	3	2					2	3	
CO5	Learn about safety precautions in healthcare.	3					2	3	2					2	3	

618BME08 PHYSIOLOGICAL MODELLING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To explain the application of Physiological models and vital organs..
- To Formulate the methods and techniques for analysis and synthesis of dynamic models
- To describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.
- To describe nonlinear models of physiological systems
- To compute the Simulation of physiological systems

UNIT I INTRODUCTION TO PHYSIOLOGICAL MODELING 9

Approaches to 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 physical systems, linear models of physiological systems, the Laplace transform, Transfer functions and block diagram analysis Physiology.

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 SYSTEMS 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 COMPARTMENTENTAL PHYSIOLOGICAL MODEL 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, Thermoregulation of cold bloodedness& warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples, mathematical model of the controlled process of the body.

UNIT V SIMULATION OF PHYSIOLOGICAL SYSTEMS 9

Simulation of physiological systems using Open CV / MATLAB software. Biological receptors: Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity. Neuromuscular model, Renal System, Drug Delivery Model. Simulation of thermal regulation, pressure and flow control in circulation, occulo motor system, endocrinal system, functioning of receptors.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the application of Physiological models
CO2: Describe the methods and techniques for analysis and synthesis of Linear and dynamic systems
CO3: Develop differential equations to describe the compartmental physiological model
CO4: Describe nonlinear models of physiological systems
CO5: Illustrate the simulation of physiological systems

TEXT BOOKS:

1. William B.Blesser, “System approach to Bio-medicine”, McGraw-Hill book Co., New York, 2011.
2. Manfred Clynes and John H.Milsum, “Bio-medical Engineering System”, McGraw-Hill book co., NewYork, 1970.
3. Michael C.K. Khoo,” Physiological Control Systems -Analysis, Simulation and Estimation” Prentice Hall of India Pvt. Ltd., New Delhi, 2001

REFERENCE BOOKS:

1. Douglas S. Rigg, "Control theory and Physiological Feedback Mechanism", The William & Williams co., Baltimore, 1976.

COURSE OUTCOMES		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	Explain the application of Physiological models	3				2	2							2	3	
CO2	Describe the methods and techniques for analysis and synthesis of Linear and dynamic systems	3	2	2	2									2	3	
CO3	Develop differential equations to describe the compartmental physiological model	3	2	2	2	2								1	3	
CO4	Describe nonlinear models of physiological systems	3	2	2	2	2								2	3	
CO5	Illustrate the simulation of physiological systems	3	2	2	2	2	3							2	3	

618BME09 **BIOTELEMETRY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To know about basic classification of telemetry system
- To know detailed description of biotelemetry components.
- To know how radio pill is useful in biotelemetry
- To know about various types of biotelemetry system
- To understand the applications of biotelemetry.

UNIT I INTRODUCTION TO TELEMETRY **9**

Basic system – classification – Non electrical telemetry systems – Voltage and Current telemetry systems – local transmitters and converters – frequency telemetering – Power Line Carrier Communication (PLCC).

UNIT II PRINCIPLES OF BIOTELEMETRY **9**

Introduction – Physiological parameters adaptable to Biotelemetry Components of Biotelemetry system: Transmitters – Receivers – Transmission lines – Antennas – Filters – modulation and multiplexing methods used.

UNIT III RADIOPILL IN BIOTELEMETRY **9**

Radio pill Telemetry, Portable and Landline Telemetry unit, frequency allotment, Applications in Gastroenterology.

UNIT IV BIOTELEMETRY SYSTEMS 9

Radio telemetry – Infrared telemetry – ultrasonic telemetry – storage telemetry – wired telemetry – wireless telemetry – single channel telemetry system – temperature telemetry system – multi channel telemetry system – multipatient telemetry – implantable telemetry system.

UNIT V APPLICATIONS OF BIOTELEMETRY 9

Applications of biotelemetry - Cardio vascular system, Neurology, Monitoring of Biomechanical parameters, Urology, Monitoring and control of Diabetes mellitus, Sports and medicine, Patient care.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand basic system of telemetry.
CO2: Understand basic biotelemetry principles and its components.
CO3: Gain knowledge about applications of radio pill in healthcare industry.
CO4: Know about the types of biotelemetry systems.
CO5: Identify biotelemetry applications and its importance in medical field.

TEXT BOOK:

1. John G Webster, "Encyclopedia of Medical devices and Instrumentation – Vol.1", John Wiley and Sons, 2006.

REFERENCE BOOKS:

1. Patranabis D, "Telemetry Principles", TMH, New Delhi, 2007.
2. Leslie Cromwell, Fred J Weibell and Erich A Pfeiffer, "Biomedical Instrumentation and Measurements", PHI, Second Edition, 2018.
3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Third edition, Tata McGraw Hill, 2014.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Understand basic system of telemetry	3		3									3	2	1	
CO2	Understand basic biotelemetry principles and its components	3		3	2						2	2	3	2	1	3
CO3	Gain knowledge about applications of radio pill in healthcare industry	3		2	2						3	2	3	2	1	3
CO4	Know about the types of biotelemetry systems	3		3	2						2	2	3	2	1	3
CO5	Identify biotelemetry applications and its importance in medical field	3		3	2						3	3	3	2	1	3

618BMO01	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Grasp the principles of data communication and to learn various mediums used in Physical layer
- Understand the functions of Data link layers.
- Understand the networking concepts and different routing protocol
- Get familiarized with different Transport and application layer protocols.

UNIT I DATA COMMUNICATIONS & PHYSICAL LAYER 8

Introduction: Components –Data representation –Direction of Data flow – Networks: criteria and physical structure – Network Types –Protocols and Standards – Layered Tasks–ISO / OSI model and layers in the OSI model – Addressing. Performance Metrics - Transmission Media: Guided Transmission Media –Twisted pair – Coaxial Cable – Fiber Optics – Unguided Media – Radio waves – Microwaves–Infrared. Network Components: Connectors – Transceivers – Media converters – Network Interface card – PC cards.

UNIT II DATA LINK LAYER 10

Error Detection and Correction: Types of Errors–Redundancy– LRC – CRC –Checksum- Data Link Control: Flow and Error control Protocols: Stop and wait – Stop and wait ARQ - Go back-N ARQ – Selective repeat ARQ- Sliding window – HDLC. Media Access Control (MAC) – CSMA / CD - Wired LAN: Ethernet IEEE 802.3 –IEEE 802.4 – IEEE 802.5 – Virtual LAN.

UNIT III NETWORK LAYER 10

Logical Addressing: IPv4 Addresses – Ipv6 Addresses - Connecting Devices: Repeaters – Hubs– Bridges – Switches – Routers – Modems – Gateways - Switching: Circuit Switching - Packet Switching– Logical Addressing: IPv4 Addresses – Ipv6 Addresses - Internet Protocols: IPV4 – IPV6 - Unicast Routing Protocols: Distance Vector Routing – Link State Routing –Address Mapping: ARP, RARP- ICMP.

UNIT IV TRANSPORT LAYER 9

Process to process delivery –User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control Techniques– Congestion Prevention Policies - Quality of services (QoS) – Techniques to improve QoS - Integrated Services - Differentiated Services.

UNIT V APPLICATION LAYER 8

Domain Name Space (DNS) – SMTP – POP3 – WWW - FTP – HTTP – SNMP – SSO

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of data communication and networking

CO2: Explore various flow and error control protocols in data link layer.

CO3: Understand and evaluate the performance of various routing algorithms.

CO4: Analyze flow control and congestion control algorithm for QoS at end to end level.

CO5: Explore the features and operations of various application layer protocols.

TEXT BOOK:

1. Behrouz A. Forouzan, "Data communication and Networking", Fifth Edition, Tata McGraw-Hill Publishing Co. Pvt., Ltd., New Delhi, 2013.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, "Computer Networks", Fifth Edition PHI Learning, New Delhi, 2016.
2. William Stallings, "Data and Computer Communication", Tenth Edition, Pearson Education, New Delhi 2014.
3. Alberto Leon Garcia and Indra Widjaja, "Communication Networks Fundamental Concepts and key Architectures", Second Edition, Tata McGraw-Hill Publishing Co. Pvt., Ltd., New Delhi, 2009.
4. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, New Delhi 2012.
5. Larry L.Peterson and Peter S. Davie, "Computer Networks", Fifth Edition Harcourt Asia Pvt. Ltd.,USA, 2011.
6. Prakash C Gupta, "Data Communications and Computer Networks", Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2009.

COURSE OUTCOMES		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	Understand the fundamentals of data communication and networking	2		1		1					2					1
CO2	Explore various flow and error control protocols in data link layer	2		1			1				1					1
CO3	Understand and evaluate the performance of various routing algorithms	2		1		1	1									1
CO4	Analyze flow control and congestion control algorithm for QoS at end to end level.	2		1							2					1
CO5	Explore the features and	2		1		1				2		2				1

	operations of various application layer protocols															

618CST06/618CSO07 BIG DATA ANALYTICS L T P C
3 0 0 3

COURSE OBJECTIVES:

- Understand the terminologies, analytics and processing concepts of Big Data**.**
- Learn various Big Data Analytic techniques.
- Explore the Data Streams processing concepts.
- Familiarize with Hadoop Ecosystem, HIVE, and PIG Framework.

UNIT I INTRODUCTION TO BIG DATA 8

Concepts and Terminologies – Big Data Characteristics – Types of Data – Big Data Analytics Lifecycle –Big Data Analytics: Classification of Analytics – Top Challenges Facing Big Data – Importance of Big Data Analytics – Data Analytics Tools- Big Data Processing Concepts: Parallel Data – Distributed Data –Batch Mode – Real Time Mode.

UNIT II BIG DATA ANALYTICS TECHNIQUES 9

Quantitative Analysis – Qualitative Analysis – Statistical Analysis: A/B Testing – Correlation – Regression – Linear Regression – Polynomial Regression – Multivariate Regression - Machine Learning: Classification – Clustering – Outlier Detection – Filtering – Semantic Analysis – Visual Analysis – Heat Maps – Time Series Plots – Network Graph – Spatial Data Mapping – Reinforcement Learning.

UNIT III STREAM MEMORY 9

Introduction to Stream Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Ones in a Window – Decaying Window – Case Studies: – Real Time Sentimental Analysis-Stock Market Predictions-Using Graph Analytics for Big Data:Graph Analytics.

UNIT IV NoSQL DATA MANAGEMENT FOR BIG DATA 9

Schema-less Models: Increasing Flexibility for Data Manipulation – Key Value Stores – Document Stores – Tabular Stores – Object Data Stores – Graph Databases –NoSQL Databases-MongoDB: Introduction to MongoDB – Terms used in RDBMS and MongoDB – Data Types in MongoDB – MongoDB Query Language.Case Studies:BigData for E-Commerce-BigData for Blogs

UNIT V BIG DATA FRAMEWORK 10

Hadoop: Introduction to Hadoop – RDBMS Vs Hadoop – Hadoop Overview – Hadoop Distributors – HDFS – Processing Data with Hadoop – Managing Resources and Application with Hadoop YARN – Hadoop Ecosystem.Hive: Introduction to Hive – Hive Architecture – Hive Data Types –Hive File Format – Hive Query Language – RC File Implementation – Ser De – User Defined Function (UDF). Pig: Introduction to Pig - The Anatomy of Pig - Pig on Hadoop - Pig Philosophy - Use Case for Pig: ETL Processing Data Types in Pig - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - User-Defined Functions (UDF).

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Discuss the challenges of big data, its analytics and processing concepts.

CO2: Apply analytics for various big data based problems.

CO3: Identify the appropriate solution to data streams related problems.

CO4: Develop applications using NoSQL DB.

CO5: Excel on big data applications using big data frameworks.

TEXT BOOK:

1. Thomas Erl, WajidKhattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers & Techniques" ,Prentice Hall, 2015
2. Seema Acharya, Subhashini Chellappan, "Big Data Analytics", Wiley India Private Limited, First Edition, 2018.

REFERENCE BOOKS:

1. David Loshin, Morgan Kaufman, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Elsevier Publishers, 2013.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Tom White, "Hadoop The Definitive Guide", O'Reilly Publishers, 4th Edition, 2015.
4. Edward Capriolo, Dean Wampler, Jason Rutherglen, "Programming Hive", O'Reilly Publishers, 2012.
5. Tim Hawkins, EelcoPlugge, Peter Membrey, David Hows, "The Definitive Guide to MongoDB: A complete guide to dealing with Big Data using MongoDB", Third Edition,Apress Publishers, 3rdEdition, 2015.
6. Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

COURSE OUTCOMES		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	Discuss the challenges of big data, its analytics and processing concepts.		2											1	1	1
CO2	Apply analytics for various big data based problems															1
CO3	Identify the appropriate solution to data streams related problems	2	2												1	

CO4	Develop applications using NoSQL DB			3		3										1
CO5	Excel on big data applications using big data frameworks					2		3						1	1	

618ECT02/ 618ECO09 **VLSI DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Understand the basic CMOS circuits.
- Learn the fabrication of the CMOS using several process.
- Know the concepts of designing VHDL.
- Design the inverter and logic gates using the CMOS technology.
- Learn the basic debugging process in digital circuits.

UNIT I MOS TECHNOLOGY 9

Chip Design Hierarchy- IC Layers –Photolithography and Pattern Transfers- Basic MOS Transistors-CMOS Fabrication – Submicron CMOS Process – Mask and Layout – CMOS Design Rules: Lambda based layout.

UNIT II MOS TRANSISTOR 9

NMOS and PMOS transistors, Threshold voltage - Body effect - Design equations - Second order effects. MOS models and small signal AC characteristics - CMOS-DC and transient characteristics.

UNIT III INVERTER AND LOGIC GATES 9

NAND and NOR Gates – Complex Logic Gates(AOI and OAI logic) –Tri state circuits – Large FETs-Transmission Gate and Pass Transistor Logic- NMOS and CMOS Inverters, Stick diagram, Inverter ratio, Driving large capacitance loads, Static CMOS design, dynamic CMOS design.

UNIT IV BASICS OF TESTING AND FAULT MODELING 9

Introduction to testing - Faults in Digital Circuits – Modeling of faults – Logical Fault Models – Fault detection – Fault Location – Fault dominance – Design for testability – Boundary scan.

UNIT V VHDL 9

VHDL Program Structure- concurrent code – sequential code - Variables- Signals and Constants-VHDL Operators -VHDL Description of Combinational Networks: Adders ¸Subtractor– VHDL Model for Multiplexer- Modeling Flip Flop using VHDL Processes ––Modeling a sequential Machine.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Discuss the different design hierarchy of the CMOS circuits.
CO2: Determine of the various characteristics of the MOS transistor.
CO3: Design the inverter and logic gates using the CMOS technology.
CO4: Perform the testing and fault modeling in any design.
CO5: Write Programs based on the VHDL structure

TEXT BOOKS:

1. John P Uyemura- "Chip Design for Submicron VLSI:CMOS layout and simulation" Thomson India Edition- 2006.
2. Neil H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education ASIA, 2nd edition, 2000.

REFERENCE BOOKS:

1. Eugene D.Fabricius, Introduction to VLSI Design McGraw Hill International Editions,1990
2. M.Abramovici, M.A.Breuer and A.D. Friedman, "Digital systems and Testable Design", Jaico Publishing House,2002.
3. Charles H Roth-"Digital System Design Using VHDL"- Thomson business Information India Pvt Ltd-2006 .
4. Kamran Eshraghian- Douglas A PucknellSholehEshraghian "Essentials of VLSI Circuits and Systems"- Prentice Hall of India Pvt Ltd- 2006 Wayne Wolf," Modern VLSI Design – System On Chip", PHI 2006, 3e, New Delhi.

COURSE OUTCOMES		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	Discuss the different design hierarchy of the CMOS circuits.	3	2	3	1	1	2					2	2	1	3	1
CO2	Determine of the various characteristics of the MOS transistor.	3	2	3	2	1	2					2	2	1	3	1
CO3	Design the inverter and logic gates using the CMOS technology.	3	2	3	2					1		2	2	2	3	1
CO4	Perform the testing and fault modeling in any design.	3	2	3	2					1		2	2	2	3	1
CO5	Write Programs based on the VHDL structure	3	2	3	2					1		2	2	2	3	1

718CST03/ 618CSO10 **CLOUD COMPUTING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the concept of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize themselves with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.
- To use cloud platforms

UNIT I INTRODUCTION **8**

Introduction - Historical Development - Cloud Computing Architecture – The Cloud Reference Model- NIST Cloud Computing Reference Architecture – Cloud Characteristics – Cloud Deployment Models:

Public, Private, Community, Hybrid Clouds - Cloud Delivery Models: IaaS, PaaS, SaaS – Open Source Private Cloud Software: Eucalyptus, Open Nebula, Open Stack.

UNIT II VIRTUALIZATION 9

Data Center Technology - Virtualization - Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques – Virtualization and Cloud Computing – Pros and Cons of Virtualization - Implementation Levels of Virtualization - Tools and Mechanisms: Xen, VMWare, Microsoft Hyper-V.

UNIT III CLOUD COMPUTING MECHANISM 10

Cloud Infrastructure Mechanism: Cloud Storage-Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3-Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

UNIT IV HADOOP AND MAP REDUCE 9

Apache Hadoop – Hadoop Map Reduce – Hadoop Distributed File System- Hadoop I/O- Developing a Map Reduce Application - Map Reduce Types and Formats - Map Reduce Features– Hadoop Cluster Setup – Administering Hadoop.

UNIT V SECURITY IN THE CLOUD 9

Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the architecture of Cloud computing stack
CO2: Differentiate between full and para virtualization
CO3: Identify the architecture, storage, infrastructure and delivery models of cloud computing
CO4: Design and apply Map Reduce Programming model.
CO5: Understand the necessity and approaches for cloud security.

TEXT BOOK:

1. Thomas Erl, Zaigham Mahood, Ricardo uttini, “Cloud Computing, Concept, Technology and Architecture”, Prentice Hall, 2013.

REFERENCE BOOKS:

1. Toby Velte, Anthony Velte, Robert C. Elsenpeter, - Cloud Computing, A Practical Approach Tata McGraw-Hill Edition, 2010.
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, - Mastering Cloud Computing, Tata McGraw-Hill, 2013.

3. Arshdeep Bahga, Vijay Madisetti, - Cloud Computing: A Hands- On Approach‖, Universities Press, 2014.
4. Tom White, - Hadoop: The Definitive Guide, O'Reilly Media, 4th Edition, 2015.
5. James E Smith and Ravi Nair, -Virtual Machines, Elsevier, 2005.
6. John Rittinghouse and James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010.
7. Barrie Sosinsky, "Cloud Computing Bible", Wiley, 2010.

COURSE OUTCOMES		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	Analyze the architecture of Cloud computing stack		3												1	1
CO2	Differentiate between full and para virtualization	1			2									1		1
CO3	Identify the architecture, storage, infrastructure and delivery models of cloud computing		3											1	1	
CO4	Design and apply Map Reduce Programming model.		3			3										1
CO5	Understand the necessity and approaches for cloud security.	2						2						1	1	1

618BMP07 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To study various display techniques and use of ultrasonic's in various fields of medicine
- To understand various patient monitoring systems and transmission of biosignals using telemetry principles
- To study the clinical applications of diathermy, its principle and types.
- To study some of extra-corporeal devices and few of the diagnostic techniques.
- To study the sources of leakage current and method of monitoring it.

LIST OF EXPERIMENTS:

1) Analysis of ultrasonic transducers and displays.
2) Analysis of pacemaker.
3) Analysis of shortwave diathermy.
4) Analysis of ultrasonic diathermy unit.
5) Simulation of biosignals.
6) Analysis of ECG signals.
7) Analysis of EEG signals.

8) Multichannel data acquisition system
9) Recording of single channel biotelemetry system.
10) Study of Leakage current and electrical safety measurements.

TOTAL HOURS: 60 PERIODS

COURSE OUTCOMES

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

CO1: Understand the basic and principle of ultrasound.
CO2: Know about telemetry and the various bio-telemetric units
CO3: Identify the types and uses of diathermy units.
CO4: Know the tissue responses and about electro-surgical units

COURSE OUTCOMES		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	Understand the basic and principle of ultrasound	3		2		3	2			2			3	3	2	
CO2	Know about telemetry and the various bio-telemetric units	3		2		3	2			2			3	3	2	
CO3	Identify the types and uses of diathermy units	3		2		3	2			2			3	3	2	
CO4	Know the tissue responses and about electro-surgical units	3		2		3	2			2			3	3	2	

618BMP09 **EMPLOYABILITY SKILLS LAB** **L T P C**
0 0 2 1

COURSE OBJECTIVE:

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations

LIST OF EXPERIMENTS:

1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
2. Creating effective PPTs – presenting the visuals effectively
3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.
4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics – brainstorming the topic
7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD

8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL HOURS: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Enhancing the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills

CO2: Improving their soft skills, including report writing, necessary for the workplace situations

CO3: Creating effective PPTs and presenting the visuals effectively

CO4: Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report

REQUIREMENTS FOR A CLASS OF 30 STUDENTS

1. A PC or a lap top with one or two speakers
2. A Collar mike and a speaker
3. An LCD projector and a screen
4. CD's and DVD's on relevant topics

REFERENCE BOOKS:

1. Dhanavel, S.P. 2010. English and Soft Skills. Hyderabad: Orient BlackSwan Ltd.
2. Corneilssen, Joep. How to Prepare for Group Discussion and Interview. New Delhi: Tata-McGraw-Hill, 2009.
3. D'Abreo, Desmond A. Group Discussion and Team Building. Mumbai: Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh. The ACE of Soft Skills. New Delhi: Pearson, 2010.
5. Gulati, Sarvesh. Corporate Soft Skills. New Delhi: Rupa and Co. 2006.
6. Van Emden, Joan, and Lucinda Becker. Presentation Skills for Students. New York: Palgrave Macmillan, 2004.

EXTENSIVE READERS:

1. Covey, Stephen R. The 7 Habits of Highly Effective People. New York: Free Press, 1989.
2. Bagchi, Subroto. The Professional. New Delhi: Penguin Books India, 2009.

WEB RESOURCES:

1. www.humanresources.about.com
2. www.careerride.com
3. http://nptel.ac.in/courses/109104031/
4. http://nptel.ac.in/courses/109106067/

COURSE OUTCOMES		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	Enhancing the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills					1	2			2	3	3				
CO2	Improving their soft skills, including report writing, necessary for the workplace situations					1	2			3	3				3	3
CO3	Creating effective PPTs and presenting the visuals effectively														3	3
CO4	Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report									3	3	2			3	

618BMP09 **HOSPITAL TRAINING** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- Observe medical professionals at work in the wards and the roles of Allied Health Professionals.
- Provide access to healthcare Professionals to get a better understanding of their work.
- Demonstrate patient-care in a hospital setting.

ASSESSMENT:

- Students need to complete training in any leading Multi-specialty hospital for a period of 15 days. They need to prepare an extensive report and submit to their respective course in- charges during the session.
- Out of the following departments, it is mandatory to complete training in any 10. The students can give a presentation of the remaining departments during laboratory hours.

S.No.	Departments for visit
1	Cardiology
2	ENT
3	Ophthalmology

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

TOTAL HOURS: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Advocate a patient-centred approach in healthcare

CO2: Communicate with other health professionals in a respectful and responsible manner

CO3: Recognize the importance of inter-professional collaboration in healthcare.

CO4: Propose a patient-centred inter-professional health improvement plan based upon the patient's perceived needs

CO5: Use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served.

COURSE OUTCOMES		**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	Advocate a patient-centred approach in healthcare	3			2		3		2	2	2	1	2	2	3	1
CO2	Communicate with other health professionals in a respectful and responsible manner		2		2		3		2	2	2	1	2	2	3	1
CO3	Recognize the importance of inter-professional collaboration in healthcare		2		2		3		2	2	2		2	2	3	1
CO4	Propose a patient-centred inter-professional health improvement plan based upon the patient's perceived needs		2		2		3		2	2	2		2	2	3	1

CO5	Use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served		2		2		3		2	2	2		2	2	3	1

718BMT01 **MEDICAL OPTICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To analyze the optical properties of tissue and its light applications in the field of medicine.
- To summarize the instrumental components in photonics.
- To discuss the different applications of lasers used in medicine.
- To understand the principles of optical coherence tomography.
- To summarize the different advanced optical techniques.

UNIT I OPTICAL PROPERTIES OF THE TISSUES 9

Fundamentals of optical properties-Refraction, Scattering, Absorption, Light transport inside the tissue-Coherence and incoherent light, Radiation transport equation, Tissue properties, Light interaction with tissues-Optothermal interaction, Fluorescence, Formation of speckles.

UNIT II INSTRUMENTATION IN PHOTONICS 9

Basic Spectrometer-Basic apparatus, Instrument for absorption, scattering and emission measurements, Instrumental components-Excitation light sources – High pressure arc lamp, Solid state LEDs, Lasers, Optical fibers and dispersive devices-Optical filters, Polarizer, Single channel and multichannel detectors, Detection Methods-Time resolved and Phase resolved detection methods.

UNIT III APPLICATIONS OF LASERS 9

Medical Laser system-fundamentals, principles. Laser safety-fundamentals. Laser interaction with tissue-principles; laser assisted diagnostic –principles, application of lasers in diagnosis and imaging-advances, laser surgery and therapy –principles-photothermal & photomechanical mechanism, thermal interaction between laser and tissue-advances, Holmium Laser.

UNIT IV OPTICAL COHERENCE TOMOGRAPHY 9

Optical coherence tomography (OCT)-Principles of operation, Optical coherence tomography technology and systems, OCT Elastography, Principles of Doppler OCT, Application towards clinical imaging.

UNIT V ADVANCED OPTICAL TECHNIQUES 9

Near field optical microscopy, Fluorescence Resonance Energy Transfer (FET) imaging, Fluorescence Lifetime Imaging Microscopy(FLIM), Photodynamic therapy (PDT)-Basic principles, Mechanism of photodynamic action, Light irradiation for PDT, Application of PDT.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to:
CO1: Identify the light interaction with the tissues.
CO2: Analyze the optical fibers and dispersive devices.
CO3: Formulate the laser surgery and therapy.
CO4: Summarize the applications of OCT in clinical imaging.
CO5: Understand the principles and applications of photodynamic therapy.

TEXT BOOKS:

1. Tuan Vo Dinh, "Biomedical photonics – Handbook", CRC Press, 2019 (Unit I,II,IV,V)
2. Abraham Katzir "Laser and optical fibers in Medicine", Academics Press,2012 (Unit-III)

REFERENCE BOOKS:

1. Mark E. Brezinski., Optical Coherence Tomography: Principles and Applications,Academic Press, 2006 (Unit-IV)
2. Paras N. Prasad, "Introduction to Biophotonics", A. John Wiley and Sons, Inc. Publications, 2003 (Unit-V)
3. Anders Brahme ,"Comprehensive biomedical physics",Elsevier,2014
4. Leon Goldman, M.D., & R. James Rockwell, Jr., "Lasers in Medicine", Gordon and Breach, Science Publishers Inc., New York, 1971.
5. R. Splinter and B.A Hooper, "An Introduction to Biomedical Optics", Taylor and Francis,2007

COURSE OUTCOMES		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	Identify the light interaction with the tissues	3			2	3			3				2	3	1	3
CO2	Analyze the optical fibers and dispersive devices	3		2									2	3	1	
CO3	Formulate the laser surgery and therapy	3		2				2					2	3	1	
CO4	Summarize the applications of OCT in clinical imaging	3		2				2					2	3	1	
CO5	Understand the principles and applications of photodynamic therapy	3		2	2			2	3		3	3	2	3	1	

718BMT02 **DIGITAL IMAGE PROCESSING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To illustrate digital image fundamentals.
- To explain the concepts in image enhancement.
- To interpret the methods in image segmentation.
- To classify the image restoration techniques.

- To estimate digital images using compression techniques.

UNIT I DIGITAL IMAGE FUNDAMENTAL AND TRANSFORMS 9

Elements of digital image processing systems, Digital Camera working principles, - Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT 9

Gray level transformation – Histogram processing – enhancement using arithmetic/logic operation – spatial filtering – smoothening and sharpening spatial filter – smoothening in frequency domain filter – homomorphic filtering, color image enhancement.

UNIT III IMAGE SEGMENTATION 9

Introduction– detection of discontinuities – edge linking and boundary detection – thresholding – region based segmentation – segmentation by morphological watersheds – use of motion in segmentation.

UNIT IV IMAGE RESTORATION 9

Image degradation models – unconstrained and constrained restoration – inverse filtering – Weiner filtering - LMS filter – geometric mean filter – geometric transformation – Medical applications in image processing- image registration.

UNIT V IMAGE COMPRESSION 9

Image compression models – elements of information theory – error free compression –lossy compression – run-length – shift codes – arithmetic coding – bit plane coding – transform coding – JPEG standards – MPEG standards –DICOM standards, wavelet transform – predictive techniques – block truncation coding schemes, Case studies.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Summarize the digital image fundamentals and classify the transform techniques.
CO2: Apply the concept in image enhancement techniques for digital images.
CO3: Dissect the images using segmentation technique.
CO4: Determine the restoration technique for digital images and examine its recognition.
CO5: Evaluate the digital images using compression techniques

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing" Pearson Education, 4th edition 2018.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI, 2007

REFERENCE BOOKS:

1. Kenneth R. Castleman, “Digital Image Processing”, PHI, 2010.

2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, ”Digital Image Processing using MATLAB”, PHI, 2017.
3. S.Sridhar, “ Digital Image processing” Oxford University press, Edition 2013
4. Bhabatosh Chanda, “Digital Image Processing And Analysis” Prentice Hall India Learning Private Limited, 2011

COURSE OUTCOMES		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	Summarize the digital image fundamentals and classify the transform techniques	3	2		3		2					3		3	1	
CO2	Apply the concept in image enhancement techniques for digital images	3	2		3		2			3		3		3	1	
CO3	Dissect the images using segmentation technique.	2		2		3		2	2	2		1	2	3	2	2
CO4	Determine the restoration technique for digital images and examine its recognition	2		2		3		2	2	2		1	2	3	2	2
CO5	Evaluate the digital images using compression techniques	3	2		3	3				3		3		3	1	

718BMT03 **BIOMECHANICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To apply the principles of mechanics that is used to analyse human movement.
- To demonstrate about the fluid mechanic system applied to human body
- To classify the structure and functions of skeletal muscle
- To explain the structure, movements, and loads applied to knee, shoulder and hip.
- To categorize the bone structure joints and cartilage

UNIT I INTRODUCTION TO MECHANICS 9

Newton’s law- mechanical behaviour of bodies in contact, work, power and energy relationship – Stress strain analysis, Angular kinematics of human movement-measuring angles, angular kinematic relationships –relationships between linear and angular motion – Angular kinetics of human movement-resistance to angular acceleration, angular momentum

UNIT II BIOFLUID MECHANICS 9

Newtonian viscous fluid – Non viscous fluid – Viscoelasticity – - Viscosity – Fluid motion-Fluid structure interaction-Heart valve function-Blood Rheology-Pressure, flow and resistance in arterial and venous system

UNIT III MECHANICS OF SKELETAL MUSCLE 9

The Functional Arrangement of Muscles -Structure of skeletal muscle –muscle fibers, motor units – Sliding element theory of muscle action.- Single Twitch and Wave Summation -Contraction of skeletal muscle bundles and Hill's three element model

UNIT IV MECHANICS OF SHOULDER, KNEE AND HIP 9

Structure of the shoulder – Movements of shoulder complex – Loads on the shoulder –Structure of the Knee – Movements of the Knee –Loads on the Knee – Structure and movements of the hip – Loads on the hip, Gait Analysis-abnormal gait-corrective measures.

UNIT V ORTHOPAEDIC MECHANICS 9

Mechanical properties of bone, Structure and functions of bone, Mechanical properties of cartilage – – Viscoelastic properties of articular cartilage – The Lubrication Quality of Articular Cartilage Surfaces, Joint Architecture – Joint Stability- Joint Flexibility, Ortho implants-types and applications.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Define the relationship between various motions by the principles of mechanics.
CO2: Explain about the fluid motion and interaction inside the human body
CO3: Outline the Functional Arrangement of Muscles
CO4: Summarize the movements and the loads on knee, shoulder and hip.
CO5: Analyze the mechanical properties of bone, joints and cartilage

TEXT BOOKS:

1. Fung, Y.C., "Biomechanics: Mechanical Properties of Living Tissues", Springer, 3rd edition, 1993 (Unit-II,III,V)
2. Susan .J. Hall: "Basic Biomechanics", Tata McGraw hill, 4th edition, 2004 (Unit-I,IV,V)

REFERENCE BOOKS:

1. Dawson, D. and Right, "Introduction to Biomechanics of Joints and Joint Replacement", Mechanical Engineering Publication Ltd, 2010.
2. Jacob Cline, "Handbook of Biomedical Engineering", Academic Press Inc., 1988.
3. David A.Rubenstein,Wei Yin and Mary D.Frame,"Biofluid Mechanics:An introduction to Fluid mechanics, Macrocirculation and Microcirculation", Academic Press Inc.,2nd edition,2015 (Unit-II)
4. Jim Richards, The Comprehensive Textbook of Clinical Biomechanics Elsevier; 2nd edition (1 June 2018)
5. Ronald L. Huston ," Fundamentals of Biomechanics", CRC Press; 1st edition 2013

COURSE OUTCOMES		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	Define the relationship between various motions by the principles of	3	2	3	3	2	3						2	3	1	

	mechanics															
CO2	Explain about the fluid motion and interaction inside the human body	3	2	3	3	2	3						2	3	1	
CO3	Outline the Functional Arrangement of Muscles	3	2	3	3	2	3						2	3	1	
CO4	Summarize the movements and the loads on knee, shoulder and hip	3	2	3	3	2	3						2	3	1	
CO5	Analyze the mechanical properties of bone, joints and cartilage	3	2	3	3	2	3						2	3	1	

718BMT04 **MEDICAL INFORMATICS** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To analyze the role of informatics in engineering and medicine.
- To understand the importance of medicine and the internet.
- To summarize the concept in medical imaging and clinical laboratory.
- To identify the importance of tele medicine and hand held computers.
- To understand the importance of computer aids for the physically challenged.

UNIT I MEDICAL INFORMATICS BASICS **9**

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

UNIT II MEDICINE AND THE INTERNET **9**

Internet-Internet Services, uses of internet in Medicine, Internet vs Online services. Security issues in computer and internet-Confidentially through cryptography, Digital Signature, User Authentication, Standards- HL7, JCAHO, JCIA

UNIT III COMPUTER ASSISTED MEDICAL IMAGING AND CLINICAL LABORATORY **9**

Computers in Nuclear Medicine, Radiation Therapy planning. Computers in a clinical laboratory-Automated Clinical Laboratories, Automated Methods in hematology, Chromosome analysis by Computer, Intelligent laboratory Information System (ILIS), Computer Assisted Semen Analysis (CASA)

UNIT IV TELEMEDICINE AND TECHNOLOGY **9**

Telemedicine and internet, Medical Peripheral devices, Applications of telemedicine, Satellite Based Telemedicine. Hand-Held Computers-Palm Top Personal Digital Assistant (PDA), Picture Achieving and Communication System (PACs), Electronic health record (EHR).

UNIT V COMPUTER ASSISTIVE DEVICES FOR THE PHYSICALLY CHALLENGED 9

Mobility-EMG controlled Limbs, Blind and visually physically challenged, Concept of Artificial Retina, Computer Aids for the Deaf, Computer speech Generation and recognition, Robotics to assist the elderly infirm, Smart medical homes, Personalized e-Health Services.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the health informatics and bioinformatics.

CO2: Summarize the importance of Medical standards

CO3: Identify the concept in radiation therapy planning

CO4: Elaborate the applications of telemedicine

CO5: Understand the importance of smart medical homes

TEXT BOOKS:

1. R.D.Lele, "Computers in medicine progress in medical informatics", Tata Mcgraw Hill Publishing computers Ltd,2005, New Delhi.
2. Mohan Bansal, "Medical informatics", Tata Mcgraw Hill Publishing computers Ltd, 2003 New Delhi

REFERENCE BOOKS:

1. N.Mathivanan, "PC-Based Instrumentation", Prentice Hall of India Pvt Ltd – New Delhi – 2007.
2. Orpita Bosu and Simminder Kaur Thukral, "Bioinformatics Databases, Tools and Algorithms", Oxford University press, 2007, New Delhi.
3. Yi – Ping Phoebe Chen, "Bioinformatics Technolgies", Springer International Edition, 2007, New Delhi
4. Bhatia Dinesh, "Medical Informatics", PHI Learning Private Limited ,2015
5. Dr. K C Mishra ," Medical Informatics: An Exploration", DGM Icfai Books 2008

COURSE OUTCOMES		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	Analyze the health informatics and bioinformatics	3		2			2		2		2	2		2	1	
CO2	Summarize the importance of Medical standards	3		2			2		2		2	2		2	1	
CO3	Identify the concept in radiation therapy planning	3		2			2		2		3	3		2	1	
CO4	Elaborate the applications of telemedicine	3		2			2		2		3	3		2	1	
CO5	Understand the importance of smart medical homes	3		2			2		2		3	3		2	1	

718BME05 **BIOSENSORS AND TRANSDUCERS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To summarize the working principles of biosensors.
- To understand the surface micromachining.
- To elaborate enzyme based biosensors and immunosensors.
- To understand the applications of biosensors.
- To analyze the optical transducers.

UNIT I GENERAL COMPONENTS AND WORKING PRINCIPLES OF BIOSENSORS 9

Historical perspective - signal transduction - physico-chemical and biological transducers - sensor types and technologies - terminology and main technical definitions: calibration, selectivity, sensitivity, reproducibility, detection limits, response time - problems and trade-offs.

UNIT II MICROMACHINING FOR BIOSENSORS AND BIOSENSING SYSTEMS **9**

Etching-Wet etching, Dry etching, Free-standing microstructure fabrication -Surface micromachining, Lost wafer process, High aspect ratio microstructure fabrication-LIGA, HEXSIL, Microchannel fabrication- Application of bulk micromachining, Application of surface micromachining, Bonding-Gluing, Low-temperature glass bonding, Eutectic bonding, Fusion bonding, HF bonding, Anodic bonding

UNIT III CLASSIFICATION OF BIOSENSORS 9

Classification of biosensors based on the biorecognition principle-- Catalytic biosensors, Affinity biosensor, Classification of biosensors based on the biorecognition Element-enzyme-based biosensors, Immunosensors, Nucleic Acid/DNA Biosensors, Cell-based biosensors, Biomimetic-based biosensors, Classification of biosensors based on the transducer elements-Electrochemical biosensors, Optical biosensors, Calorimetric biosensors, Piezoelectric biosensors

UNIT IV APPLICATIONS OF BIOSENSORS 9

Clinical chemistry - Test-strips for glucose monitoring - urea determination - implantable sensors for long-term monitoring - drug delivery and detection - environmental monitoring - technological process control - food quality control - forensic science benefits - problems & limitations.

UNIT V PHYSICO-CHEMICAL TRANSDUCERS 9

Electrochemical transducers (amperometric, potentiometric, conductimetric) - semiconductor transducers (ISFET, ENFET) - optical transducers (absorption, fluorescence, bio/chemiluminescence, SPR) - thermal transducers - piezoelectric and acoustic-wave transducers - limitations & problems to be addressed - an overview of performance and applications.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Summarize the working principle of physico-chemical.
CO2: Analyze the applications of surface micromachining.
CO3: Classify the biosensors based on the transducer elements.
CO4: Elaborate applications of biosensors in drug delivery and detection.
CO5: Understand piezoelectric and acoustic-wave transducers.

TEXT BOOKS:

1. Anthony E G Cass, Jonathan M Cooper, "Biosensors: Practical Approach", Oxford University Press, New York, 2nd edition, 2004.
2. Brian Eggins, "Chemical Sensors and Biosensors", John Willey & Sons, New York, 2003.

REFERENCE BOOKS:

1. Victor C Yang, That T Ngo, "Biosensors and their Applications", Kluwer Academic, New York, 2000 (UNIT III).
2. Pranab Goswami, Advanced Materials and Techniques for Biosensors and Bioanalytical Applications, CRC press, First edition, 2021 (UNIT IV)
3. Buerk, Donald G. "Biosensors: Theory and Applications" CRC Press; 1st edition 1995.
4. Jyotismita Chaki, "Smart Biosensors in Medical Care", Academic Press Inc; 1st edition 2020.
5. Chandran Karunakaran," Biosensors and Bioelectronics", Elsevier, 2015

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Summarize the working principle of physico-chemical	2	3	3	2		3				2		3	3	3	2
CO2	Analyze the applications of surface micromachining	2	3	3	2		3				2		3	3	3	2
CO3	Classify the biosensors based on the transducer elements	2	2	2	2		3				2		3	3	3	2
CO4	Elaborate applications of biosensors in drug delivery and detection	2	2	2			3				2		3	3	3	2
CO5	Understand piezoelectric and acoustic-wave transducers	2	2	2	2		3				2		3	3	3	2

718BME06 PATTERN RECOGNITION AND NEURAL NETWORKS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To summarize the fundamentals of pattern recognition and its application.
- To classify the algorithms suitable for pattern Classification.
- To explain the fundamentals of biological Neural networks
- To illustrate the back propagation network and neural networks based on competition
- To outline the knowledge in Fuzzy Logic and Genetic algorithms

UNIT I INTRODUCTION AND SUPERVISED LEARNING 9

Overview of Pattern recognition, Types of Pattern recognition, Application of pattern recognition. Parametric and Nonparametric approach- Bayesian classifier-Discriminant function. Non parametric density estimation- histograms- kernels- window estimators- k- nearest neighbor classifier- estimation of error rates.

UNIT II UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS 9

Unsupervised learning- Hierarchical clustering- Single-linkage Algorithm- Complete –linkage Algorithm- Average-linkage algorithm-Ward's method. Partitional clustering- Forgy's Algorithm- k-means algorithm -Isodata Algorithm.

UNIT III INTRODUCTION AND SIMPLE NEURAL NET 9

Elementary neurophysiology and biological neural network-Artificial neural network – Architecture-biases and thresholds- Hebbnet- Perceptron, SVM, Adaline- LMS learning algorithm rule-Application. Madaline- MRII Training Algorithm-Translation invariant pattern recognition

UNIT IV BACK PROPOGATION, ASSOCIATIVE MEMORY AND NEURAL NETWORKS BASED ON COMPETITION 9

Back Propogation Network, generalized delta rule, Bidirectional Associative Memory, Hopefield network. Kohonen Self Organizing Map, Learning Vector Quantization, Counter Propogation Network.

UNIT V FUZZY LOGIC AND GENETIC ALGORITHM 9

Fuzzy Logic – Introduction, Fuzzy classification using Mamdani and Sugeno model, Fuzzy clustering – application in image segmentation. Introduction to Genetic Algorithm – Roulette wheel selection.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Distinguish the different pattern recognition techniques and its application.
CO2: Analyze the supervised and unsupervised algorithms suitable for pattern classification.
CO3: Summarize the fundamentals of Artificial neural network
CO4: Design the back propagation neural networks based on competition
CO5: Develop the Genetic algorithms used in soft computing.

TEXT BOOKS:

1. Earl Gose, Richard Johnsonbaugh, Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 2016.
3. Freeman J.A., and Skapura B.M, " Neural networks, algorithms, applications and programming techniques", Addison – Wesley, 2014

REFERENCE BOOKS:

1. Robert Schalkoff, " Pattern recognition, Statistical, Structural and neural approaches" John Wiley and Sons(Asia) Pte. Ltd., Singapore, 2005
2. LaureneFausett ," Fundamentals of neural networks – Architectures, algorithms and applications", Prentice Hall, 1994.
3. Hagan, Demuth and Beale, "Neural network design", Vikas Publishing House Pvt. Ltd., New Delhi , 2002
4. Duda R.O, Hart P.G, "Pattern classification and scene analysis", Wiley Edition,2000
5. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

COURSE OUTCOMES		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	Distinguish the different pattern recognition techniques and its application	3	2		3	2					2	2		3	2	2
CO2	Analyze the supervised and unsupervised algorithms suitable for pattern classification	3	2		3	2					2	2		3	2	2
CO3	Summarize the fundamentals of Artificial neural network	3	2		3	2					2	2		3	2	2
CO4	Design the back propagation neural networks based on competition	3	2		3	2					2	2		3	2	3
CO5	Develop the Genetic algorithms used in soft computing	3	2		3	2					2	2		3	2	2

718BME07 **EMBEDDED SYSTEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To explain the architecture of ARM processor.
- To build the embedded computing platform.
- To illustrate the basic concepts of real time Operating system.
- To summarize the system design techniques and networks for embedded systems.
- To show the embedded system application for medical devices.

UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 9

Complex systems and microprocessors– Embedded system design process – Formalism for system design– Design example: Model train controller- ARM Processor Fundamentals- Instruction Set and Programming using ARM Processor.

UNIT II COMPUTING PLATFORM 9

CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor– Memory system mechanism – CPU performance – CPU power consumption- CPU buses – Memory devices – I/O devices – Component interfacing- System Level Performance Analysis- Parallelism. Design Example : Data Compressor.

UNIT III PROGRAM DESIGN AND ANALYSIS 9

Program design – Model of programs – Assembly and Linking – Basic compilation techniques –

Program Optimization- Analysis and optimization of execution time, power, energy, program size – Program validation and testing- Example : Software Modem

UNIT IV PROCESS AND OPERATING SYSTEMS 9

Multiple tasks and Multi processes – Processes – Context Switching – Operating Systems –Priority based Scheduling- RMS and EDF - Inter Process Communication mechanisms – Evaluating operating system performance – Power optimization strategies for processes.

UNIT V MEDICAL APPLICATIONS 9

Applications: Real-Time Embedded Software Development, Sending a Message over a Serial Link, Simulation of a Process Control System, Controlling an Appliance from the RT Linux System, Embedded Database Applications, Embedded medical applications: Ophthalmology - Glaucoma screening device, Medical Imaging Acquisition User Interface, acquisition and implementation of biopotential, Drug delivery systems, Patient monitoring Systems**.**

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Build the architecture and develop programming in ARM processor.
CO2: Analyze the system level performance.
CO3: Create Program validation and testing tools.
CO4: Identify the system design techniques to develop software for embedded systems.
CO5: Develop an embedded system for different medical devices.

TEXT BOOKS:

1. Wayne Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Morgan Kaufmann Publisher (An imprint from Elsevier), Second Edition, 2008.
2. Andrew N Sloss, Dominic Symes, Chris Wright, “ARM System Developer’s Guide- Designing and Optimizing System Software”, Elsevier/Morgan Kaufmann Publisher, 2008.

REFERENCE BOOKS:

1. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2007.
2. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dreamtech press, 2005.
2. Jane.W.S. Liu, “Real-Time systems”, Pearson Education Asia.
3. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc-Graw Hill, 2004.
4. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier,2006.

COURSE OUTCOMES		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	Build the architecture and develop programming in ARM processor.	3	2	2	3	2	2				2	2		3	2	2

CO2	Analyze the system level performance.	3	2		3	2					2	2		3	2	2
CO3	Create Program validation and testing tools	3	2		3	2					2	2		3	2	2
CO4	Identify the system design techniques to develop software for embedded systems	3	2		3	2					2	2		3	2	3
CO5	Develop an embedded system for different medical devices	3	2		3	2					2	2		3	2	2

718BME08 **REHABILITATION ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To apply the concept of Rehabilitation & Rehabilitation team members
- To find knowledge about Orthotic devices in Rehabilitation Engineering
- To extend the knowledge about Therapeutic exercise technique.
- To analyze the Principles in Management of communication and virtual reality.
- To explain the general principles of Amputation surgery

UNIT I INTRODUCTION TO REHABILITATION & REHABILITATION TEAM 9

Introduction to Rehabilitation, Medical rehabilitation, Preventive Rehabilitation-Levels of prevention, Impairment, disability & handicap-Diagnosis of disability, Functional diagnosis, Primary & secondary Disabilities, Rehabilitation team- medical and paramedical team members, socio-vocational team members.

UNIT II ORTHOTIC DEVICES IN REHABILITATION ENGINEERING 9

General principles of Orthosis- Biomechanics of orthosis, Classification of orthotics-Functional & Regional ,merits & demerits of orthotics, Material and fabrication for lower limb orthosis , Calipers-FO, AFO, KAFO, HKAFO. Spinal Orthosis-Types of spinal orthosis-Cervical, Head cervical thoracic orthosis, Thoraco lumbar sacral orthosis, Lumbosacral orthosis, Splints- functions & types.

UNIT III THERAPEUTIC EXERCISE TECHNIQUE 9

Coordination exercises-Components of coordinated activity, General principles of coordination tranining, Frenkel's exercises, Gait–Gait analysis, Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

UNIT IV MANAGEMENT OF COMMUNICATION AND VIRTUAL REALITY 9

Introduction to communication, Speech, Aphasia, Types of aphasia, Dysarthria, Speech therapy, Augmentative communication-general form of communication, types of visual aids, Writing aids.

Introduction to virtual reality, Virtual reality based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation.

UNIT V AMPUTATION AND PROSTHETIC DEVICES 9

General principles of Amputation surgery, Upper limb amputation, Levels of upper limb Amputation, Lower limb amputation, Rehabilitation of lower limb amputation, Prosthetics- Classification, Components of prosthesis, Upper limb prosthetics, above elbow prosthesis, below elbow prosthesis, Prosthesis for lower extremity

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the levels of prevention in rehabilitation.
CO2: Develop the orthotic devices for the differently abled.
CO3: Explain about the importance Therapeutic exercise techniques and the training methods.
CO4: Demonstrate the virtual reality based rehabilitation aids.
CO5: Estimate the amputation level & choosing appropriate Prosthetic devices.

TEXT BOOKS:

1. Dr. S. Sunder, "Text book of Rehabilitation", 3rd Edition, Jaypee Medical Publications, 2010

REFERENCE BOOKS:

1. Joseph D.Bronzino, "The Biomedical Engineering Handbook", Third Edition: Three Volume Set, CRC Press, 2006
2. Rory A Cooper, "An Introduction to Rehabilitation Engineering", Taylor & Francis, CRC press, 2006.
3. Susan B O'Sullivan, Thomas J Schmitz, "Physical Rehabilitation", 5th Edition, Davis publications, 2007.

COURSE OUTCOMES		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	Apply the levels of prevention in rehabilitation	3		2			3	2					3	2	1	2
CO2	Develop the orthotic devices for the differently abled	3		2			3			2		2	3	2	1	2
CO3	Explain about the importance Therapeutic exercise techniques and the training methods	3	2	2			3		2	2		2	3	2	1	2
CO4	Demonstrate the virtual reality based rehabilitation aids.	3		2		2	3		2	2	2	2	3	2	1	2
CO5	Estimate the amputation level & choosing appropriate Prosthetic devices.	3			2		3		2	2		2	3	2	1	2

718BME09	ICU AND OPERATION THEATRE EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To analyze the various ICU equipments
- To summarize different types of dialyzers
- To elaborate surgical monitoring system
- To identify medical vacuum system
- To understand the concept of patient electrical safety

UNIT I ICU EQUIPMENT 9

Suction apparatus – Different types; automated drug delivery systems – Infusion pumps, Syringe pump, closed loop control infusion system, implantable infusion system.

UNIT II CRITICAL CARE EQUIPMENT 9

Hemo dialysis Machine – Different types of Dialyzers, Membranes, Machine controls and measurements, Peritoneal Dialysis, Heart Lung Machine – different types of oxygenators, peristaltic pumps, Incubators, Ventilators, Defibrillators, High flow Cannula Therapy.

UNIT III OPERATION THEATRE EQUIPMENT 9

Lighting and table in operation theatres, Surgical monitoring system, Surgical diathermy, Instruments for operation. Anesthesia Equipment – Humidification, Sterilization aspects- Sterilizers – Chemical, Radiation, Steam for small and large units, Scavenging system.

UNIT IV CENTRALIZED SYSTEMS 9

Centralized Oxygen, Nitrogen, Air supply & Suction. Medical vacuum system, Gas pipeline system, colour coding, regulators. Centralized Air – Conditioning, Oxygen Concentrator, Refrigerator, Water systems in hospitals

UNIT V PATIENT SAFETY 9

Patient electrical safety – Types of hazards – Natural protective mechanisms against electricity – Leakage current – Inspection of grounding and patient isolation, Hazards in operation rooms – ICCU and IMCUs – Opto couplers and Pulse Transformers.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Classify the automated drug delivery system
CO2: Summarize different types of oxygenators
CO3: Elaborate the instruments for operation
CO4: Examine the gas pipeline system
CO5: Understand the concept of hazards in operation rooms

TEXT BOOK:

1. Khandapur R S, "Handbook of Bio-Medical Instrumentation", Second Edition, Tata McGraw Hill Publishing Company, Ltd., 2014.

REFERENCE BOOKS:

1. John G Webster, "Medical Instrumentation- Application and Design", John Wiley & Sons, Inc., New York, Third Edition,2010.
2. Joseph Dubovy, "Introduction To Bio-Medical", McGraw Hill Co., 2007.
3. Terry Bahila, "Biomedical and Clinical Engineering", Prentice Hall Inc., 1981.

COURSE OUTCOMES		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	Classify the automated drug delivery system	3		2			2		2				2	3	1	
CO2	Summarize different types of oxygenators	3		2			2		2		2	2	2	3	1	
CO3	Elaborate the instruments for operation	3		2			2		2		2	2	2	3	1	
CO4	Examine the gas pipeline system	3		2			2		2		2	2	2	3	1	
CO5	Understand the concept of hazards in operation rooms	3		2			2		2		2	2	2	3	1	

718BME10 HOSPITAL WASTE MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Know the hazardous control used in hospital and accidents and its prevention
- Recognize various Biomedical waste disposal procedures and management.
- Be familiar with hazardous materials and protection
- Be aware of Facility and safety guidelines
- Understand the necessity of Infection Control, Prevention and Patient Safety

UNIT I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS 9

Healthcare Hazard Control : Introduction, Hazard Control, Hazard Control Management, Hazard Control Responsibilities, Addressing Behaviors, Hazard Control Practice, Understanding Hazards, Hazard Analysis, Hazard Control and Correction, Personal Protective Equipment, Hazard Control Committees, Hazard Control Evaluation, Hazards, System Safety, Ergonomics. Understanding Accidents: Accident Causation Theories, Human Factors, Accident Deviation Models, Accident Reporting, Accident Investigations, Accident Analysis, Organizational Functions That SupportAccident Prevention, Workers' Compensation, Orientation, Education, and Training.

UNIT II BIOMEDICAL WASTE MANAGEMENT 9

Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste,

Categories and classification of biomedical waste, hazard of biomedical waste, need for disposalof biomedical waste, waste minimization, waste segregation and labeling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT III HAZARDOUS MATERIALS 9

Hazardous Materials : Hazardous Substance Safety, OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Radiation materials, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

UNIT IV FACILITY SAFETY 9

Facility Safety : Introduction, Facility Guidelines Institute, Administrative Area Safety, Slip, Trip, and Fall Prevention, Safety Signs, Colors, and Marking Requirements, Scaffolding, Fall Protection,Tool Safety, Machine Guarding, Compressed Air Safety, Electrical Safety, Control of Hazardous Energy, Permit Confined Spaces, OSHA Hearing Conservation Standard, Heating, Ventilating, and Air-Conditioning Systems, Assessing IAQ, Landscape and Grounds Maintenance, Fleet and Vehicle Safety.

UNIT V INFECTION CONTROL, PREVENTION AND PATIENT SAFETY 9

Healthcare Immunizations, Centers for Disease Control and Prevention, Disinfectants, Sterilants, and Antiseptics, OSHA Bloodborne Pathogens Standard, Tuberculosis, Healthcare Opportunistic Infections, Medical Waste. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures, Patient-Centered Healthcare, Quality Improvement Tools and Strategies, Healthcare-Associated Infections, Medication Safety.

TOTAL HOURS : 45 PERIODS

COURSE OUTCOMES:

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

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

TEXT BOOKS:

1. Tweedy, James T., Healthcare hazard control and safety management-CRC Press_Taylor and Francis (2014).
2. Anantpreet Singh, Sukhjit Kaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd (2012).

REFERENCE BOOKS:

1. R.C.Goyal, -Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006
2. V.J. Landrum, -Medical Waste Management and disposal‖, Elsevier, 1991

COURSE OUTCOMES		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	Analyze various hazards, accidents and its control	3		2			2		2				2	3	1	
CO2	Design waste disposal procedures for different biowastes	3		2			2		2		2	2	2	3	1	
CO3	Categorize different biowastes based on its properties	3		2			2		2		2	2	2	3	1	
CO4	Design different safety facility in hospitals	3		2			2		2		2	2	2	3	1	
CO5	Propose various regulations and safety norms	3		2			2		2		2	2	2	3	1	

718BME11 **INTELLECTUAL PROPERTY RIGHTS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

1. Classify IPR portfolio and comprehend the extent of their protection.
2. Outline a business plan that advances the value of IPR portfolio.
3. Infer the strategy of marketing IPR globally.
4. Explain the Indian legislations with global competition.
5. Show the competition in IPR internationally.

UNIT I INTRODUCTION **9**

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property - Movable Property - Immovable Property and - Intellectual Property.

UNIT II REGISTRATION OF IPRs **9**

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

UNIT III INTERNATIONAL AGREEMENTS **9**

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT) – TRIPS Agreement.

UNIT IV INDIAN LEGISLATIONS TOWARDS IPR **9**

Indian position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V ENFORCEMENT OF IPRs 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Review an intellectual property portfolio and comprehend the extent of their protection.
CO2: Develop a business plan that advances the value of their intellectual property portfolio
CO3: Develop a strategy of marketing their intellectual property and understand some negotiation basics.
CO4: Explain some of the limits of their intellectual property rights and comprehend some basic legal pitfalls.
CO5: Explore the legal & business issues surrounding marketing of new products related to technology.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.
2. Neeraj Pandey, Khushdeep Dharni," Intellectual Property Rights" 1st Edition, Kindle Edition PHI Learning Publisher, 2014

REFERENCE BOOKS:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000. (www.ipmatters.net/features/000707_gibbs.html).
4. Mittal, D.P. (1999) Indian Patents Law. Taxmann Allied Services (p) Ltd.

COURSE OUTCOMES		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	Review an intellectual property portfolio and comprehend the extent of their protection	3					2						2	3	1	
CO2	Develop a business plan that advances the value of their intellectual property portfolio	3					2						2	3	1	
CO3	Develop a strategy of marketing their intellectual property and understand some negotiation basics	3					2						2	3	1	
CO4	Explain some of the limits of their intellectual	3					2						2	3	1	

	property rights and comprehend some basic legal pitfalls.															
CO5	Explore the legal & business issues surrounding marketing of new products related to technology.	3					2						2	3	1	

718BME12 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Course Objectives:

- To recognize the quality and basic concepts of TQM
- To understand the TQM Principles
- To investigate the TQM Tools and techniques
- To be aware of the concepts of Six Sigma and Taguchi quality loss function
- To explore the different standard Quality systems

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES **9**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I **9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II **9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors, NABH, NABL.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Be aware of the quality and basic concepts of TQM and Customer satisfaction
CO2: Comprehend the TQM Principles
CO3: Evaluate the TQM Tools and techniques and apply Bench marking process and FMEA
CO4: Recognize the concepts of Six Sigma and Taguchi quality loss function and performance measures of TPM
CO5: Implement the different standard Quality systems

TEXT BOOKS:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint 2006.
2. Naagarazan, RS ,Arivalagar AA, " Total Quality Management" 3Rd Edition 2015, New Age International (P) Ltd Publishers 2015

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
4. P.N. Mukherjee "Total quality Management",PHI Learning Pvt. Ltd., 2006
5. Poornima M. Charantimath "Total quality Management", Pearson Education; Third edition,2017

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Be aware of the quality and basic concepts of TQM and Customer satisfaction	2			2		3	1	2						2	
CO2	Comprehend the TQM Principles	2			2		3	1	2						2	
CO3	Evaluate the TQM Tools and techniques and apply Bench marking process and FMEA	2			2		3	1	2						2	
CO4	Recognize the concepts of Si Sigma and Taguchi qualit loss function an performance measures o TPM	2			2		3	1	2						2	
CO5	Implement the differen standard Quality systems	2			2		3	1	2						2	

718BME13	DISASTER MANAGEMENT & MITIGATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the basic concepts of fundamentals of Disaster Management
- To Get the knowledge of environmental Disaster
- To Analyze the prediction of earthquake and Tsunami
- To Analyze the prediction of cyclone
- To Understand the application of technology in disaster management

UNIT I INTRODUCTION 9

Disaster- Disaster management- Disaster prevention and preparedness measures-Types of Disaster – Causal factor of Disaster – Natural, Manmade, creeping disaster-Disaster in the Indian context- various measures – Disaster related policy goals – United Nations Development Program (UNDP) – United Nations Disaster Relief Organization (UNDRO) .

UNIT II ENVIRONMENTAL DISASTER 9

Environmental hazards – Typology – Assessment and response – the strategies – the scale of disaster – Vulnerability – Disaster trends – Paradigms towards a balanced view – Chemical hazards and Toxicology – Biological hazards – Hazard caused by world climate change – Risk analysis – other technological disasters.

UNIT III EARTHQUAKE AND TSUNAMI 9

Earthquake – Causes of earthquake – Earthquake scales – Measures of earth – quake – Magnitude and Intensity – Earthquake Recurrence hazard assessment –Seismic zoning – Earthquake disaster mitigation – Component research focus –Forecasting techniques and Risk analysis – Tsunami – Causes of Tsunami –Effects of Tsunami – Tsunami warning system – Tsunami warning system in India – International status of Tsunami warning and communication system –Tsunami warning centers – Pacific Tsunami Warning Center (PTWC) – Pacific Tsunami Warning System (PTWS) components – Institutional arrangements and design criteria for Tsunami mitigation.

UNIT IV CYCLONE 9

Tropical cyclone- Warning system – Protection of buildings from cyclones- Precaution before and during cyclones – Tropical cyclone warning strategy in India – Cyclone related problems – aerial survey – Management strategy – risk reduction by public awareness and education.

UNIT V APPLICATION OF TECHNOLOGY IN DIASTER MANAGEMENT 9

Hazard map – Multi hazard mapping – Application of satellites in Disaster Management – Application of remote sensing in forecasting and disaster relief – Use of digital image processing in disaster management – GIS in disaster management – Spatial data – GIS data base design – Convention mapping concepts and Coordinate system – Methods of spatial Interpolation in GIS.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understood the basic concepts of fundamentals of Disaster Management
CO2: Get the knowledge of environmental Disaster
CO3: Analyzed the prediction of earthquake and Tsunami
CO4: Analyzed the prediction of cyclone
CO5: Understood the application of technology in disaster management

TEXT BOOKS:

1. Pardeep Sahni, Madhavi malalgoda and ariyabandu, "Disaster risk reduction in South Asia", PHI Press, 2003.
2. Amita Sinhal, "Understanding earthquake disasters" TMH, 2010.

REFERENCE BOOKS:

1. Pardeep Sahni, Alka Dhameja and Uma medury, "Disaster mitigation: Experiences and reflections", PHI Press,2001.
2. Jeff Groman (2002) The atlas of Natural Disasters by (author) Publisher: Friedman/Fairfax publishing;(March 2002)
3. Jaikrishna & Chandrasekar, Elements of Earthquake Engineering. South Asian Publishers Private, Limited, 2000.
4. Sinha, P.C Wind & water Driven Disasters, Anmol Publications, 1998.
5. R.B.Singh," Natural Hazards and Disaster Management: Vulnerability and Mitigation" Rawat Publications , 2006

COURSE OUTCOMES		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	Understood the basic concepts of fundamentals of Disaster Management	3						3							1	
CO2	Understood the basic concepts of fundamentals of Disaster Management	3						3							1	
CO3	Get the knowledge of environmental Disaster	3						3							1	
CO4	Analyzed the prediction of earthquake and Tsunami	3						3							1	
CO5	Understood the application of technology in disaster management	3						3							1	

718BME14 PROFESSIONAL ETHICS AND HUMAN VALUES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To generate an awareness on Human Values
- To explore the Senses of 'Engineering Ethics
- To instill Moral , Social Values and Loyalty
- To realize Safety ,Responsibilities appreciate the rights of Others
- To Analyze the various global issues

UNIT I HUMAN VALUES 9

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights -Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers(India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers(IETE),India, etc.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Generate an awareness on Human Values and Ethics
CO2: Analyze the theories in Senses of 'Engineering Ethics
CO3: Inculcate Moral , Social Values and Loyalty
CO4: Identify the Safety ,Responsibilities and Appreciate the rights of Others
CO5: Reflect on the various global issues and sample code of Ethics.

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York, 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Professional Ethics and Human Values”, Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS:

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey, 2004 (Indian Reprint)
2. Charles E Harris, Michael S. Protchard and Michael JRabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, " Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists And Engineers", Oxford University Press, Oxford, 2001.
5. Dr. Naagarazan, RS ,"Professional Ethics and Human Values", New Age International (P) Ltd Publishers 2016

COURSE OUTCOMES		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	Generate an awareness on Human Values and Ethics	1		1			2	2	3						3	
CO2	Analyze the theories in Senses of 'Engineering Ethics	1		1			2	2	3						3	
CO3	Inculcate Moral , Social Values and Loyalty	1		1			2	2	3						3	
CO4	Identify the Safety ,Responsibilities and Appreciate the rights of Others	1		1			2	2	3						3	
CO5	Reflect on the various global issues and sample code of Ethics	1		1			2	2	3						3	

718BMP07 **DIGITAL IMAGE PROCESSING LAB** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- To practice the basic image processing techniques.
- To understand the functions of transforms.
- To know the effect of quantization.
- To explore the applications of image processing

LIST OF EXPERIMENTS:

1. Histogram equalization

2. Linear and non linear filtering
3. Edge detection using operators
4. Two dimensional discrete Fourier transform
5. Discrete wavelet transform of images
6. Image Segmentation
7. Conversion between color spaces
8. Two dimensional discrete cosine transform
9. Filtering in frequency domain
10. Study of DICOM standards.
11. Stegnography
12. Medical Image Compression techniques.

COURSE OUTCOMES:

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

CO1: Perform filtering operations in the image
CO2: Use transforms and analyzes the characteristics of the image.
CO3: Analyze the texture of the image
CO4: Implement project on simple image processing applications.

TEXT BOOK:

1. Sreelal R K, Laboratory Manual For Digital Image Processing With Matlab & Python [Print Replica] Kindle Edition,2020

COURSE OUTCOMES		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	Perform filtering operations in the image	3	3		2	3									3	2
CO2	Use transforms and analyzes the characteristics of the image	3	3		2	3									3	2
CO3	Analyze the texture of the image	2	2		2	3									3	2
CO4	Implement project on simple image processing applications	3	3	2	3	3									3	2

78BMP08 **MINI PROJECT** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- It will cover all the aspects like investigation, designing, coding detailing, implementation of a biomedical Electronic circuits / systems in which the aspects like performance analysis, application of relevant standards etc., will find a place.

- Alternately, a few research problems also may be identified for investigation and the use of laboratory facilities to the fullest extent may be taken as a project work.

This laboratory would focus on training and honing technical skills of the students with regard to design and development of basic prototypes leading to low cost systems applied in the field of Biomedical Engineering. These prototypes will be used either to develop basic level rehabilitation tools and aids or to have decision making or control by the introduction of intelligence in the system. This laboratory is thus to provide a platform for the students to gain knowledge in the development of socially relevant projects in the field of Medical Electronics.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to:
CO1: Culminate in gaining of major design experience in the related area of specialization.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Culminate in gaining of major design experience in the related area of specialization	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

718BMP09 INTERPERSONAL SKILLS/LISTENING & SPEAKING L T P C
0 0 2 1

COURSE OBJECTIVES:

- To equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- To provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- To improve general and academic listening skills.
- To make effective presentations.

UNIT I **9**

Listening as a key skill - its importance - speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification - Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II **9**

Listening to process information - give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources - converse with reasonable accuracy over a wide range of everyday topics.

UNIT III **9**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist - listen for detail.

UNIT IV **9**

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures - conversational speech - listening to and participating in conversations - persuade.

UNIT V **9**

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL HOURS: 45 PERIODS

LAB REQUIREMENTS:

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

COURSE OUTCOMES:

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

CO1: Listen and respond appropriately.
CO2: Participate in group discussions
CO3: Make effective presentations
CO4: Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCE BOOKS:

1. Bhatnagar, Nitin and MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.Vargo, Mari. Speak Now Level, Oxford University Press: Oxford, 2013.
3. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
4. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

COURSE OUTCOMES		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	Listen and respond appropriately					1	2			2	3	3				
CO2	Participate in group discussions					1	2			3	3		3			3
CO3	Make effective presentations												3			3
CO4	Participate confidently and appropriately in conversations both formal and informal									3	3	2				3

818BMT01 HOSPITAL ENGINEERING AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamentals of hospital administration and management
- To learn the concept of human resource management in hospital
- 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, Medical Ethics, Legal issues in hospital management, Current Issues in Hospital Management

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL 9

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. Telemedicine - Bio-Medical Waste Management.

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. NABH,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, Calibration of medical equipments.

TOTAL HOURS: 45 PERIODS

COURSES OUTCOMES:

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

CO1: Understand the concepts of hospital administration and biomedical waste management
CO2: Apply the ideas of man power management in hospitals
CO3: Analyze the marketing information system
CO4: Explore various clinical and management information systems
CO5: Know the medical standards and safety aspects in hospitals

TEXT BOOKS:

1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI Learning, Seventh edition, 2017.
2. G.D.Kunders, "Hospitals -Facilities Planning and Management" TMH, New Delhi, Tenth Reprint, 2008.

REFERENCE BOOKS:

1. Cesar A.Caceres and Albert Zara, "The Practice of Clinical Engineering", Academic Press, New York, First edition, 1977.
2. Norman Metzger, "Handbook of Health Care Human Resources Management", Aspen Publication Inc. Rockville, Second edition 1990.
3. William A. Reinke, "Health Planning For Effective Management" ,Oxford University Press.1988.
4. Blane, David, Brunner, "Health and social organization towards a health policy for the 21st Century", Eric Calrendon Press, First edition, 1996.
5. Arnold D. Kalcizony & Stephen M. Shortell, "Health Care Management", Cengage Learning, Sixth Edition, 2011.

COURSE OUTCOMES		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	Understand the concepts of hospital administration and biomedical waste management	1					3		2	2	2	1			2	3
CO2	Apply the ideas of man power management in hospitals	1					3		2	2	2	1			2	3
CO3	Analyze the marketing information system	1					2			2	2	1			2	3
CO4	Explore various clinical and management information systems						2		2	3	2	1			2	3

CO5	Know the medical standards and safety aspects in hospitals						2		3	2	1	1			2	3

818BME02 **NANOTECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand a broad view of the nascent field of nanotechnology.
- To learn the concept of fabrication and characterization of nanomaterials.
- To analyze the properties and measurement of nanomaterials.
- To know the concept of nanostructures.
- To summarize the applications of nanotechnology.

UNIT 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, bio nano-particles.

UNIT II FABRICATION AND CHARACTERIZATION OF NANOMATERIALS 9

Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Bucky balls, Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. 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 magneto resistance, etc. Cells response to Nanostructures.

UNIT V APPLICATIONS OF NANOTECHNOLOGY 9

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

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand a broad view of the nanoparticles
CO2: Interpret the concept of biosynthesis of nanomaterials
CO3: Infer the optical properties and measurement of nanomaterials
CO4: Demonstrate the applications of nanostructures
CO5: Categorize the diagnostic applications of nanotechnology

TEXT BOOKS:

1. Bharat Bhushan ,“Handbook of Nanotechnology”, Springer, Fourth Edition, 2017.
2. Hari Singh Nalwa ,“Nanostructured Materials and Nanotechnology”, First Edition, 2001

REFERENCE BOOKS:

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

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Understand a broad view of the nanoparticles	3		2			2	2			2		2	3	2	1
CO2	Interpret the concept of biosynthesis of nanomaterials	3		2	2			2			2	2		3	2	1
CO3	Infer the optical properties and measurement of nanomaterials	2	2		2				3		3	2		3	2	1
CO4	Demonstrate the applications of nanostructures	3		2		2	2	2	2			2		3	2	1
CO5	Categorize the diagnostic applications of nanotechnology	2		2		3	3	2	2			2		3	2	1

818BME03 CELL BIOLOGY AND TISSUE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know about basics of cell biology.
- To understand about cell engineering.
- To learn about the concept of cell mechanics
- To survey about basics of tissue engineering.
- To summarize about tissue engineering

UNIT I BASIC CELL BIOLOGY 9

Cells – DNA/RNA and Proteins – Tissue Culture – Antibodies – Tools for Protein Analysis – Tools for DNA Analysis – Recombinant DNA and Protein Engineering – Gene Theraphy – DNA – Antisense Technology – Viruses.

UNIT II CELL ENGINEERING 9

Principles of Cell Adhesion – Adhesion Molecules – Immobilisation of Adhesion Ligands for Investigation of Cell – Substrate Interactions – Mechanics of Cell Adhesion. Example: Platelet Adhesion – Principles of Cell Migration – Intracellular Signaling Pathways.

UNIT III CELL MECHANICS 9

Cells Under Stress, Strain, Pressure and Flow Fields – The Role of Mass Transfer in Tissue Function – Selected Examples of Mass Transfer Between Blood and Tissue – Cell Motility – Chemotaxis – Angiogenesis and Other Examples.

UNIT IV BASIC TISSUE ENGINEERING 9

Basic Definition – Current Scope of Development – Use in Therapeutics and Invitro testing – Structure and Organization of Tissues – Transport Properties of Tissues – Introduction to Mass Transfer – Diffusion of Simple Metabolism – Diffusion and Reaction of Proteins – Hormone and Growth Factor Signaling.

UNIT V ORGAN TISSUE ENGINEERING 9

Scaffolds and Tissue Engineering – Basic Properties – Tissue Engineering of Bone Marrow – Liver Nervous System – Engineering of Vascular Grafts – Regional Patency Thrombosis – Tissue Engineering of Cartilage – Kidney.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Know the concept of DNA/RNA in cell biology
CO2: Understand about cell adhesion and migration
CO3: Recall the concept of cell mechanics
CO4: Interpret the scope of basic tissue engineering
CO5: Analyze about the concept of organ tissue engineering

TEXT BOOK:

1. Lanza R P, Langer R S and Chick W L, “Principles of Tissues Engineering”, Academic Press, Fourth Edition, 2014.

REFERENCE BOOKS:

1. Bruce Alberts and Alexander Johnson, “Molecular Biology of the Cell”, Garland Publishing Inc., Newyork, Sixth Edition, 2014.
2. Joseph D Bronzino, “The Biomedical Engineering Handbook”, Volume II, CRC Press, Boca Raton, Fourth Edition, 2015.

COURSE OUTCOMES		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	Know the concept of DNA/RNA in cell biology	3												3		1
CO2	Understand about cell adhesion and migration	3												2		1
CO3	Recall the concept of cell mechanics	3												3		1
CO4	Interpret the scope of basic tissue engineering	3		3										2		1
CO5	Analyze about the concept of organ tissue engineering	3		3										3		1

818BME04 **ASSIST DEVICES** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study various cardiac assist devices
- To learn the functioning of Hemodialysers
- To apply the principles of hearing aids
- To design various orthotic devices and prosthetic devices to overcome orthopedic problems.
- To demonstrate 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, Pulmonary assist device.

UNIT II HEMODIALYSERS 9

Artificial kidney, Dialysis action, Hemodialysis unit, Peritoneal dialysis, membrane dialysis, portable dialyser monitoring and functional parameters, Continuous Renal Replacement Therapy (CRRT), Urinary bladder replacement.

UNIT III HEARING AIDS 9

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

UNIT IV PROSTHETIC AND ORTHOTIC DEVICES 9

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthotic system, functional electrical stimulation, Transcutaneous Electrical Nerve Stimulator (TENS), Face Orthotics, Dental Implants, Bowel and hip replacement techniques.

UNIT V BIOFEEDBACK 9

Bio-feedback - EMG, EEG, Electrodermal, Cardiorespiratory biofeedback, Applications of biofeedback, Brain Computer Interface

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply various mechanical techniques that will help failing heart.
CO2: Analyze the functioning of the unit which does the clearance of urea from the blood
CO3: Understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
CO4: Make use of the concepts of orthotic devices and prosthetic devices
Illustrate the principles of TENS and Bio feedback

TEXT BOOKS:

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

REFERENCE BOOK:

1. D.S. Sunder, "Rehabilitation Medicine", Fourth Edition, Jaypee Medical Publication, 2020.

COURSE OUTCOMES		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	Apply various mechanical techniques that will help failing heart	3		3										2	3	1
CO2	Analyze the functioning of the unit which does the clearance of urea from the blood	3		3										2	3	1
CO3	Understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss	3		3										2	3	1
CO4	Make use of the concepts of orthotic devices and prosthetic devices	3		3										2	3	1
CO5	Illustrate the principles of TENS and Bio feedback	3												2	3	1

818BME05 **BIOMEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To learn various MEMS fabrication techniques.
- To understand different types of Mechanical and Thermal Sensors and Actuators
- To Analyze the concepts of Electrostatic and Piezoelectric Sensors and Actuators
- To elaborate Microfluidic Systems
- To know the applications of BIOMEMS in different fields 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, thermo mechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever – micro plates, 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 9

Parallel plate capacitor, pull in effect, Electrostatic sensors and actuators- Inertia sensor, Pressuresensor, 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 micro conduits, 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, MUMPS, Lab –on a chip, gene chips, diagnostic chips, neural implants, Space applications..

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Learn various MEMS materials and fabrication techniques.

CO2: Categorize different types of Mechanical and Thermal Sensors and Actuators and their principles of operation

CO3: Classify different types of Electrostatic and Piezoelectric Sensors and Actuators

CO4: Gain knowledge on Microfluidic Systems

CO5: Analyze the application of BIOMEMS in various field of medicine.

TEXT BOOKS:

1. Tai Ran Hsu, “MEMS and Microsystems Design and Manufacture”, Tata McGraw Hill Publishing Company, First edition, 2017. (Unit I, II, III & IV).

2. Wanjun Wang, Stephen A.Soper, ”BioMEMs: Technologies and Applications”, CRC Press, First edition, 2007.(Unit V)

REFERENCE BOOKS:

1. Marc J. Madou “Fundamentals of Microfabrication: the Science of Miniaturization”, CRC Press, Second edition, 2017.

2. Nadim Maluf, Kirt Williams. “An introduction to Microelectro Mechancial Systems Engineering”, Second Edition, Artech House Inc, MA, 2004.

3. Chang Liu,’ Foundations of MEMS’, Pearson Education International, Second edition, 2011

4. Nitaigour Premchand Mahalik, “MEMS”, Tata McGraw Hill Publishing Company, New Delhi, 2009

COURSE OUTCOMES		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	Learn various MEMS materials and fabrication techniques	3	2	3			2							1	2	
CO2	Categorize different types of Mechanical and Thermal Sensors and Actuators and their principles of operation	3	2	3	2		2					2		1	2	
CO3	Classify different types of Electrostatic and	3		3	2	2	2					2		1	2	

	Piezoelectric Sensors and Actuators															
CO4	Gain knowledge on Microfluidic Systems	3		3	2	2	2					2		1	2	
CO5	Analyze the application of BIOMEMS in various field of medicine	3		3	2	2	2					2		1	2	

818BME06 INTERNET OF THINGS IN MEDICAL APPLICATIONS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand the Internet of Medical Things
- To develop IoT infrastructure for medical applications

UNIT I FUNDAMENTALS OF IoT **9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II IoT PROTOCOLS **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

U**NIT III DESIGN AND DEVELOPMENT** **9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming, Renesas Flash Programmer , MySQL

U**NIT IV INTERNET OF MEDICAL THINGS (IoMT)** **9**

Introduction-overview of Internet of Medical Things (IoMT), The requirements of the IOMT systems, Remote patient healthcare and health monitoring system, Network architecture of Internet of Medical Things (IoMT), Real-time analysis remote patient health monitoring, Methodology and analysis- data sensing and acquisition, Sensor interface circuits, Physical sensors, ,Security and privacy concerns of IoMT, Advantage of remote patient monitoring

UNIT V APPLICATIONS OF IoMT **9**

Applications of remote patient health monitoring and healthcare paradigm, Monitoring In-House (i.e., within Hospital or Clinics), Patients' Movement within Hospitals and Other Management, IoT in Healthcare, Cancer Treatment, CGM and InPen, Artificial Pancreas and OpenAPS, Connected Inhalers, Ingestible Sensors, Connected Contact Lenses, The Apple Watch App that Monitors Depression, Coagulation Testing , Apple's Research Kit and Parkinson's Disease, ADAMM Asthma Monitor, Challenges in the IoT Healthcare Sector

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

Upon Completion of this course, students will be able to:
CO1: Explain the concept of IoT.
CO2: Analyze various protocols for IoT.
CO3: Design a PoC of an IoT system using Rasperry Pi/Arduino
CO4: Analyze the real-time remote patient health monitoring.
CO5: Analyze applications of IoMT in real time scenario

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, First edition, 2017.
2. Anirban Mitra Jayanta Mondal Anirban Das , “Medical Internet of Things Techniques, Practices and Applications”, CRC Press, First edition, 2022 (UNIT V).
3. Aboul Ella Hassanien, Nilanjan Dey, Surekha Borra, “Medical Big Data and Internet of Medical Things Advances, Challenges and Applications”, CRC Press, First edition, 2019 (UNIT IV).

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things –A hands-on approach”, Universities Press, First edition, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, Second edition, 2012 (UNIT-II).
3. Jan Holler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, First edition, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, First edition, 2011.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Explain the concept of IoT.	3					1		3		2	3		2	3	1
CO2	Analyze various protocols for IoT.	3		3			1		3		2	3		2	3	1
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino	3		3			1		2		3	3		2	3	1
CO4	Analyze the real-time remote patient health monitoring	3		2			1		2		3	3		2	3	1
CO5	Analyze applications of IoMT in real time scenario	3		1			1		2		3	3		2	3	1

818BME07 ADVANCED MEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the working function of implantable stimulators.
- To learn about sensory instruments.
- To gain knowledge about various special equipment.
- To summarize different analytical instruments.
- To gain knowledge about in medical application

UNIT I IMPLANTABLE STIMULATORS **9**

Implantable Stimulators for Neuromuscular Control, block diagram, packaging of implantable electronics, leads and electrodes, safety issues of implantable stimulators, spinal fusion stimulator, Bladder stimulators, cerebellar stimulators, clinical use.

UNIT II SENSORY INSTRUMENTS **9**

Sound stimulators- Detection of evoked cortical potential, Measurement of average auditory evoked potential - Visually evoked potential measurement and application, somatosensory evoked potential, Brain mappers (EEG)- principles and measurements, Computerized tonometer, Keratometers.

UNIT III SPECIAL EQUIPMENT **9**

Impedance techniques: Bipolar and retrapolar circuits, detection of physiological activities usingimpedance techniques - cardiac output, neural activity, respiratory activity, impedance plethysmography- resistance and capacitance type. Spirometer.

UNIT IV ANALYTICAL INSTRUMENTS **9**

Advanced analytical aids - Fundamentals of NMR spectroscopy, X-ray spectrometers, mass spectrometers, Raman and Moss Beer spectroscopy. Blood Gas Analyzer, Automated Biochemical analysis Systems. Thermography – Principles and Recording. Auto analyzer.

UNIT V APPLICATIONS OF MEDICAL EQUIPMENT **9**

Brain–Computer interface, Pervasive Medical Care – Sports, Space, Military applications, Body Area Network. Smart phone based ECG monitoring system, Cloud computing technology in IoT,

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

*Upon Completion of this course, students will be able to:***:**

CO1: Distinguish between neuromuscular stimulator and spine fusion stimulator.
CO2: Apply the concept of evoked potential response.
CO3: Infer about impedance technique
CO4: Construct biochemical analysis system
CO5: Develop cloud computing technology in medical application

TEXT BOOKS:

1. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and Sons, Fifth Edition, 2020.
2. J. D. Bronzino, “The Biomedical Engineering Handbook- Vol. 1 & 2”, CRC Press, Fourth Edition, 2015
3. R.S. Kandhpur, “Handbook of Analytical Instrumentation”, Tata McGraw Hill, Third Edition, 2015.

REFERENCE BOOKS:

1. John G. Webster, Haalit Eren, "The Measurement, Instrumentation & Sensors Handbook", Second Edition, CRC Press, 2014.
2. S. E. Sutphin, "Advanced Medical Instrumentation and Equipment", Prentice Hall, First Edition, 1987
3. John D. Enderle, Susan M. Blanchard, "Introduction to Biomedical Engineering", Academic Press, Third edition, 2011.
4. Sandeep K.S. Gupta,Tridib Mukherjee, Krishna Kumar Venkatasubramanian, "Body Area Networks Safety, Security, and Sustainability," Cambridge University Press, First edition, 2013.

COURSE OUTCOMES		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	Distinguish between neuromuscular stimulator and spine fusion stimulator	3					1							2	3	1
CO2	Apply the concept of evoked potential response	3		3			1				2			2	3	1
CO3	Infer about impedance technique	3		3			1		2		2			2	3	1
CO4	Construct biochemical analysis system	3		2			1		2		2	3		2	3	1
CO5	Develop cloud computing technology in medical application	3		1			1		2		2	3		2	3	1

818BME08 BRAIN COMPUTER INTERFACE AND APPLICATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of brain computer interface
- To organize the brain activation patterns
- To learn about the feature extraction used in BCI
- To illustrate the concept machine learning methods
- To summarize 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 cognitive tasks.

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 METHODS 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 BCI FOR ASSISTIVE TECHNOLOGY 9

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 HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Categorize invasive and noninvasive of brain computer interface
CO2: Classify the various types of BCIs
CO3: Learnt about PCA and ICA used in BCI
CO4: Understood the concept various classification techniques
CO5: Learnt about the ethics of BCI

TEXT BOOKS:

1. Rajesh.P.N.Rao, "Brain-Computer Interfacing: An Introduction", Cambridge University Press, First edition, 2013.
2. Jonathan Wolpaw, Elizabeth Winter Wolpaw,"Brain Computer Interfaces, Principles and practice", Oxford University Press, USA, First Edition, 2012.

REFERENCES:

1. Ella Hassianien, A & Azar.A.T (Editors),"Brain-Computer Interfaces Current Trends and Applications", Springer, 2015.
2. Bernhard Graimann, Brendan Allison, Gert Pfurtscheller,"Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, First edition, 2010
3. Ali Bashashati, Mehrdad Fatourechi, Rabab K Ward, Gary E Birch,"A survey of signal Processing algorithms in brain–computer interfaces based on electrical brain signals" Journal of Neural Engineering, Vol.4, 2007.

COURSE OUTCOMES		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	Categorize invasive and noninvasive of brain computer interface	3		3	2	2					2	2		1	3	1
CO2	Classify the various types of BCIs	3		3	2	2			2		2	3		1	3	1
CO3	Learnt about PCA and ICA used in BCI	3		3	2	2			2		2	3		1	2	1

CO4	Understood the concept various classification techniques	3	2	3	2	2					2	3		1	2	1
CO5	Learnt about the ethics of BCI	3	3	3	2	2	3		3	2	2			1	3	1

818BME09 **MEDICAL ROBOTICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To learn the basics of Robotics
- To understand the basics of Inverse Kinematics
- To apply the concept of robot vision
- To explore various kinematic motion planning solutions for various Robotic configurations
- To make use of various applications of Robots in Medicine

UNIT I ROBOTIC MANIPULATION AND DIRECT KINEMATICS 9

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

UNIT II INVERSE KINEMATICS 9

Inverse Kinematics-General properties of solutions, Tool configuration, Five-axis articulated robot, Four-axis SCARA robot, Six-axis articulated robot, Three-axis planar articulated robot, Workspace analysis and trajectory planning- Workspace analysis, Work envelope of Four-axis SCARA robot, Workspace fixtures, The pick and place operations, Continuous-Path motion, Interpolated motion, Straight-Line motion.

UNIT III ROBOT VISION 9

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

UNIT IV TASK PLANNING 9

Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp Planning, Fine-motion planning, Simulation of planar motion, Source and Goal scenes, Task Planner simulation.

UNIT V APPLICATIONS 9

Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Neural Engineering, Application in Rehabilitation – Interactive Therapy, Bionic Arm, Clinical and Surgical – Gynaecology, Orthopaedics, Neurosurgery

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate the basics automation in robots
CO2: Construct basic Robotics system and formulate Kinematics
CO3: Analyze Template matching and Camera calibration
CO4: Know about stimulation of planar motion
CO5: Adapt orthopaedic application in Robotic systems

TEXT BOOKS:

1. Robert Schilling, "Fundamentals of Robotics-Analysis and control", Prentice Hall of India, Fifth Indian reprint, 2003.
2. J.J.Craig, "Introduction to Robotics", Pearson Education, Third edition, 2005.

REFERENCE BOOKS:

1. Staugaard, Andrew C,"Robotics and Artificial Intelligence: An Introduction to Applied Machine Learning", Prentice Hall of India, First edition, 1987.
2. Grover, Wiess, Nagel, Oderey,"Industrial Robotics: Technology, Programming and Applications", McGraw Hill, First edition, 1986.
3. Wolfram Stadler, "Analytical Robotics and Mechatronics", McGraw Hill, 1995.
4. Saeed B. Niku, "Introduction to Robotics: Analysis, Systems, Applications", Prentice Hall, Second edition, 2010.
5. K. S. Fu, R. C. Gonzales and C. S. G. Lee, "Robotics", McGraw Hill, 2008.

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Demonstrate the basics automation in robots	3		3	2	2	1		2		2				2	1
CO2	Construct basic Robotics system and formulate Kinematics	3		3	2	2	1		2		2	2			2	1
CO3	Analyze Template matching and Camera calibration	3		3	2	2	1		2		2	2			2	1
CO4	Know about stimulation of planar motion	3		3	2	2	1		2		2	2			2	1
CO5	Adapt orthopaedic application in Robotic systems	3		3	2	2	1		2		2	2			1	1

818BME10 WEARABLE SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To categorize the Sensors for wearable systems
- To inspect the placement of sensor, technical challenges of sensor design and signal acquisition
- To explore the energy harvesting for wearable devices
- To construct Wireless communication techniques.
- To apply the applications of wearable systems

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 V APPLICATIONS 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

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

*Upon Completion of this course, students will be able to:***:**

CO1: Distinguish different Wearable motion Sensors
CO2: Know about light weight signal processing
CO3: Make use of the concept of solar cell and thermopile
CO4: Build BAN architecture in Wireless communication techniques.
CO5: Apply the applications of smart fabrics

TEXT BOOKS:

1. Annalisa Bonfiglio,Danilo De Rossi ,"Wearable Monitoring Systems", Springer, First edition, 2011.
2. Sandeep K.S. Gupta,Tridib Mukherjee,Krishna Kumar Venkatasubramanian, "Body Area Networks Safety,Security, and Sustainability," Cambridge University Press, 2013.

REFERENCE BOOKS:

1. Hang,Yuan-Ting,"Wearable medical sensors and systems", Springer, First edition, 2013.
2. Mehmet R. Yuce,JamilY.Khan, "Wireless Body Area Networks Technology, Implementation and Applications", Jenny Stanford Publishing, First edition, 2012.
3. Guang-ZhongYang(Ed.), "Body Sensor Networks", Springer, Second edition, 2014.
4. Andreas Lymberis, Danilo de Rossi ,"Wearable eHealth systems for Personalised Health Management, State of the art and future challenges", IOS press, The Netherlands, 2004.

COURSE OUTCOMES		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	Distinguish different Wearable motion Sensors	3		3	2	1	2				2	3			2	3
CO2	Know about light weight signal processing	3		3	2	1	2		2		2	3			3	1
CO3	Make use of the concept of	3		3	2	1	2		2		2	3			3	1

	solar cell and thermopile															
CO4	Build BAN architecture in Wireless communication techniques	3		3	2		2		2		2	3			2	1
CO5	Apply the applications of smart fabrics	3		3	2		2		2		2	3			1	2

818BME11 **BIOMETRICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Understand the technologies of biometric systems.
- Learn the general principles of design of biometric fingerprint systems and the underlying trade-offs.
- Make use of the concept of multibiometrics.
- Identify issues in the realistic evaluation of biometrics based systems.
- Develop the Modalities of Biometric Authentication

UNIT I INTRODUCTION TO BIOMETRICS 9

Introduction and back ground – biometric technologies – passive biometrics – active biometrics - Biometric systems – Enrolment – templates – algorithm – verification – Biometric applications – biometric characteristics- Authentication technologies –Need for strong authentication – Protecting privacy and biometrics and policy

UNIT II FINGERPRINT TECHNOLOGY 9

History of fingerprint pattern recognition - General description of fingerprints - Finger print feature processing techniques - fingerprint sensors using RF imaging techniques – fingerprint quality assessment – computer enhancement and modelling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching

UNIT III FACE RECOGNITION AND HAND GEOMETRY 9

Introduction to face recognition– face recognition from correspondence maps, Types of algorithm – Eigenface , Local feature analysis , Neural networks, Automatic face processing, Hand geometry – Image capture , Hand segmentation,Feature Extraction, Feature matching, Challenges in hand geometry recognition - Visual-Based Feature Extraction and Pattern Classification.

UNIT IV MULTIBIOMETRICS 9

Introduction , Sources of Multiple Evidence-Multi-sensor systems, Multi-algorithm systems, Multi-instance systems, Multi-sample systems, Multimodal systems, Acquisition and Processing Architecture - Acquisition sequence, Processing sequence, Fusion Levels- Sensor-level fusion, Feature-level fusion, Score-level fusion, Rank-level fusion, Decision-level fusion

UNIT V BIOMETRIC AUTHENTICATION 9

Introduction - Different Biometric Modalities, Biometric Authentication Process, Performance Measures of Biometric Systems – FAR, FRR, FTE, EER, Details of Biometric Authentication Modalities- Face Recognition, Fingerprint Recognition, Iris Recognition, Retina Recognition, Hand Geometry, Voice (Speaker) Recognition, Gait-Based Recognition, Limitations of Biometric Systems, New Biometric Challenges, Attacks on Biometric-Based Authentication Systems.

TOTAL HOURS: 45 PERIODS

COURSES OUTCOMES:

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

CO1: Maximize the technologies of biometric systems.

CO2: Analyze the general principles of design of biometric fingerprint systems and the underlying trade-offs.

CO3: Apply the concept of Multibiometrics.

CO4: Identify issues in the realistic evaluation of biometrics based systems.

CO5: Make use of the principles of Biometric Authentication

TEXT BOOKS:

1. James Wayman, Anil Jain, Davide Maltoni, Dario Maio, "Biometric Systems, Technology Design and Performance Evaluation", Springer, First edition, 2005 (Units I, II, III & IV)
2. S.Y. Kung, S.H. Lin, M.W.Mak, "Biometric Authentication: A Machine Learning Approach", Prentice Hall, 2005(Unit V)

REFERENCE BOOKS:

1. Paul Reid, "Biometrics for Network Security", Pearson Education, 2004.
2. Nalini K Ratha, Ruud Bolle, "Automatic fingerprint Recognition System", Springer, 2003
3. L C Jain, I Hayashi, S B Lee, U Halici, "Intelligent Biometric Techniques in Fingerprint and Face Recognition" CRC Press, 1999.
4. John Chirillo, Scott Blaul, "Implementing Biometric Security", John Wiley, 2003.
5. Arun A. Ross, Karthik Nanda Kumar, Anil K. Jain, "Handbook of Multibiometrics", Springer, 2006.

COURSE OUTCOMES		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	Maximize the technologies of biometric systems	3		3	2	1	3				2	3		3	1	
CO2	Analyze the general principles of design of biometric fingerprint systems and the underlying trade-offs	3		3	2	1	3		2		2	3		3	1	
CO3	Apply the concept of Multibiometrics	3		3	2	1	3		2		2	3		3	1	
CO4	Identify issues in the realistic evaluation of biometrics based systems	3		3	2	1	3		2		2	3		2	1	
CO5	Make use of the principles of Biometric Authentication	3		3	2	1	3		2		2	3		2	1	

818BMP04 **PROJECT WORK** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.

- To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL HOURS: 210 PERIODS

COURSES OUTCOMES:

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

CO1: On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

COURSE OUTCOMES		**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	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

X18GCTXX	GENDER, CULTURE AND DEVELOPMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

- To familiarize with the concepts of sex and gender through literary and media
- To help students ask critical questions regarding gender roles in society.
- To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
- To help students think critically about gender-based problems and solutions.
- To help students to analyse impact of gender-based society and culture.

UNIT I INTRODUCTION TO GENDER 9

Definition of Gender - Basic Gender Concepts and Terminology -Exploring Attitudes towards Gender -Social Construction of Gender.

UNIT II GENDER ROLES AND RELATIONS 9

Types of Gender Roles- Gender Roles and Relationships Matrix -Gender-based Division and Valuation of Labour.

UNIT III GENDER DEVELOPMENT ISSUES 9

Identifying Gender Issues -Gender Sensitive Language- Gender, Governance and Sustainable Development - Gender and Human Rights- Gender and Mainstreaming.

UNIT IV GENDER-BASED VIOLENCE 9

The concept of violence- Types of Gender-based violence- The relationship between gender, development and violence-Gender-based violence from a human rights perspective

UNIT V GENDER AND CULTURE 9

Gender and Film - Gender, Media and Advertisement

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

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

CO1: Critically read literary and media texts and understand the underlying gender perspectives in them.
CO2: Analyse current social events in the light of gender perspectives.
CO3: Discuss, analyse and argue about issues related to gender.
CO4: Analyse and differentiate between gender-based violence.
CO5: Discuss the gender based impact on society, culture and development.

TEXT BOOKS

1. Sukhu and Dukhu (Amar Chitra Katha). [Unit 1]
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir.London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.). [Unit 1]
3. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011). [Unit 2]
4. The Many Faces of Gender Inequality (Essay, Amartya Sen, Frontline, Volume 18 - Issue 22, Oct. 27 - Nov. 09, 2001) [Unit 3]
5. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta) [Unit 3]

REFERENCES VIDEOS:

1. Video Witness: Freeing Women from Cleaning Human Waste (2014, HRW, Manual Scavenging, India) [Unit 2]
2. Lights Out (Play, Manjula Padmanabhan) [Unit 4]
3. Lights Out (Video of play enacted) [Unit 4]
4. Mahanagar (Movie: Satyajit Ray) [Unit 5]

COURSE OUTCOMES		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
CO1	Critically read literary and media texts and understand the underlying gender perspectives in them.	3	2		1	2						3	1		1
CO2	Analyse current social events in the light of gender perspectives.	3	2		1	2						2	1		1
CO3	Discuss, analyse and argue about issues related to gender.	3	2		1	2						3	1		1
CO4	Analyse and differentiate between gender-based violence	2	2		1	3						2	1		1
CO5	Discuss the gender-based impact on society, culture and development										3		1	2	2

X18MCTXX **INDIAN CONSTITUTION** **L T P C**
2 0 0 0

COURSE OBJECTIVES:

- To know about Indian constitution.
- To know about central and state government functionalities in India.
- To know about Indian society.

UNIT I INTRODUCTION **9**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **9**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 9

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS 9

Indian Federal System – Center – State Relations – Presidents Rule – Constitutional Amendments – Constitutional Functionaries – Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY 9

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

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

CO1: Understand the functions of the Indian government

CO2: Understand and abide the rules of the Indian constitution.

CO3: Understand and appreciate different culture among the people.

TEXT BOOKS:

1. Durga Das Basu. Introduction to the Constitution of India. Prentice Hall of India, New Delhi.
2. R. C. Agarwal. Indian Political System. S. Chand and Company, New Delhi:1997.
3. Maciver and Page. Society: An Introduction Analysis, Mac Milan India Ltd., New Delhi.
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