



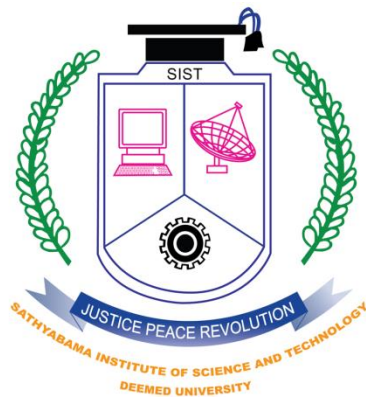
SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE
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SCHOOL OF BIO & CHEMICAL ENGINEERING

DEPARTMENT OF BIOMEDICAL ENGINEERING



**CRITERION 1.1.3
2019 Regulations**

PROGRAMME: B.Tech.
BIOMEDICAL ENGINEERING
CURRICULUM

2019

SEMESTER 1										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1102	Biostatistics	3	0	0	3	50	50	1
2	Theory	SCYA1101	Engineering Chemistry	3	0	0	4	50	50	2
3	Theory	SCSA1102	Fundamentals of Python Programming	3	0	0	3	50	50	3
4	Theory	SBTA1101	Environmental science and Engineering	2	0	0	0	-	-	4
5	Theory	SBMA1101	Cell biology & Genetics	3	0	0	3	50	50	5
6	Theory	SBMA1102	Principles of Biomedical Engineering	3	0	0	3	50	50	6
7	Theory	SBMA1103	Biochemistry	3	0	0	3	50	50	7
8	Practical	SCYA2101	Engineering Chemistry Lab	0	0	2	1	25	25	8
9	Practical	SCSA2102	Fundamental of Python Programming Lab	0	0	4	2	50	50	9
Total Credits for Semester 1 – 22										
Total Marks for Semester 1 - 750										

SEMESTER 2										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SHSA1101	Technical English	3	0	0	3	50	50	10
2	Theory	SMTA1202	Matrices, Calculus And Sampling	3	0	0	3	50	50	12
3	Theory	SMEA1102	Engineering Drawing	3	0	0	3	50	50	13
4	Theory	SEEA1203	Basic Electrical Engineering	3	0	0	3	50	50	14
5	Theory	SBMA1201	Microbiology And Pathology	3	0	0	3	50	50	15
6	Theory	SPHA1101	Physics for Engineers	3	0	0	4	50	50	16
7	Practical	SPHA2101	Physics Lab	0	0	2	1	25	25	18
8	Practical	SBMA2201	Biochemistry and Microbiology Lab	0	0	4	2	50	50	19
9	Practical	SMEA2201	Workshop Practice	0	0	4	2	50	50	20
Total Credits for Semester 2 - 24										
Total Marks for Semester 2 - 850										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C –
 CREDITSCAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION,

SEMESTER 3										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1303	Differential Equations and Numerical Methods	3	0	0	3	50	50	21
2	Theory	SBMA1301	Biosensors and Measurements	3	0	0	3	50	50	22
3	Theory	SBMA1302	Introduction to Immunology	3	0	0	3	50	50	23
4	Theory	SBMA1303	Human Anatomy and Physiology	3	0	0	3	50	50	24
5	Theory	SBMA1304	Biosignals and Systems	3	0	0	3	50	50	25
6	Theory	SBMA1305	Basic Electronic Devices Circuits and its Applications	3	0	0	3	50	50	26
7	Practical	SBMA2301	Electrical Circuits and Electronic Devices Lab	0	0	4	2	50	50	27
8	Practical	SBMA2302	Human Anatomy and Physiology Lab	0	0	4	2	50	50	28
Total Credits for Semester 3 - 22										
Total Marks for Semester 3 - 800										

SEMESTER 4										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBMA1401	Fundamentals Of Digital Systems	3	*	0	3	50	50	29
2	Theory	SBMA1402	Digital Signal Processing And Its Applications	3	*	0	3	50	50	30
3	Theory	SBMA1403	Biofluids And Biomechanics	3	0	0	3	50	50	31
4	Theory	SBMA1404	Radioimaging And Therapeutics	3	0	0	3	50	50	32
5	Theory	SAIC4001	Industry 4.0	2	0	2	2	50	50	33
6	Practical	SBMA2401	Immunology And Pathology Lab	0	0	4	2	50	50	34
7	Practical	SBMA2402	Digital System And Biotransducers Lab	0	0	4	2	50	50	35
Total Credits for Semester 4 - 18										
Total Marks for Semester 4 - 700										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C –
 CREDITSCAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION,

SEMESTER 5										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBMA1501	Fundamentals of Microprocessor And Microcontroller	3	0	0	3	50	50	36
2	Theory	SBMA1502	Biomaterials	3	0	0	3	50	50	37
3	Theory	SBMA1503	Diagnostic Instrumentation	3	0	0	3	50	50	38
4	Theory	SBMA1504	Biosignal Conditioning	3	*	0	3	50	50	39
5	Theory		Professional Elective – I	3	0	0	3	50	50	-
6	Theory		Open Elective - I	3	0	0	3	50	50	-
7	Practical	SBMA2501	Medical Electronics And Circuit Designing Lab	0	0	4	2	50	50	40
8	Practical	SBMA2502	Microprocessor and Microcontroller Lab	0	0	4	2	50	50	41
9	Practical	S24APT1	Professional Training	4	0	0	2		100	!
Total Credits for Semester 5 – 24										
Total Marks for Semester 5 – 900										

SEMESTER 6										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBMA1601	Therapeutic Instrumentation	3	0	0	3	50	50	42
2	Theory	SBMA1602	Biological Control System	3	*	0	3	50	50	43
3	Theory	SBMA1603	Medical Image Processing	3	*	0	3	50	50	44
4	Theory		Professional Elective - II	3	0	0	3	50	50	-
5	Theory		Open Elective - II	3	0	0	3	50	50	-
6	Practical	SBMA2601	Medical Image And Signal Processing Lab	0	0	4	2	50	50	45
7	Practical	SBMA2602	Diagnostic Instrumentation Lab	0	0	4	2	50	50	46
8	Practical	S24AIPROJ1	Interdisciplinary Project	0	0	6	3		100	!
Total Credits for Semester 6 – 22										
Total Marks for Semester 6 - 800										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
CAE – CONTINUOUS ASSESSMENT EXAMINATION,
ESE – END SEMESTER EXAMINATION,

SEMESTER 7										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBAA4002	Principles Of Management and professional ethics	3	0	0	3	50	50	47
2	Theory	SBMA1701	Biotelemetry	3	*	0	3	50	50	48
3	Theory		Professional Elective – III	3	0	0	3	50	50	-
4	Theory		Open Elective - III	3	0	0	3	50	50	-
5	Practical	SBMA2701	Therapeutic Instrumentation Lab	0	0	4	2	50	50	49
6	Project	S24APROJ1	Project Work (Phase - I)	0	0	6	3		100	1
Total Credits for Semester 7 - 17										
Total Marks for Semester 7 - 600										

SEMESTER 8										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Project	S24APROJ2	Project Work (Phase - II)	0	0	14	7		100	1
2	Theory		Professional Elective – IV	3	0	0	3	50	50	-
3	Theory		Open Elective - IV	3	0	0	3	50	50	-
Total Credits for Semester 8 - 13										
Total Marks for Semester 8 - 300										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C –
 CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION,

SCSA1102	FUNDAMENTALS OF PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To learn how to design and program Python applications.

UNIT 1 INTRODUCTION

9 Hrs.

History of Python- Introduction to the IDLE interpreter (shell) -Expressions – Data Types - Built-in function - Conditional statements - Iterative statements- Input/output -Compound Data Types - Nested compound statements – Introduction to Object Oriented Concepts.

UNIT 2 FILES AND EXCEPTIONS HANDLING, MODULES, PACKAGES

9 Hrs.

File Operations – Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement-Introduction to PIP-Installing Packages via PIP-Using Python Packages

UNIT 3 GUI PROGRAMMING

9 Hrs.

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT 4 DATABASE AND NETWORK

9 Hrs.

Database (using NoSQL): Connector Module – Cursor – Statements - Exceptions in database. Network connectivity: Socket module - Client – Server – Email – URL Access

UNIT 5 CASE STUDY

9 Hrs.

Web Programming using Python, Image Processing – Facebook Analysis – Twitter Analysis.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
- CO2 - Do the decision making and write functions in Python.
- CO3 - Explain how to design GUI Applications in Python and evaluate different database operations.
- CO4 - Design and develop Client Server network applications using Python.
- CO5 - Ability to design real life situational problems and think creatively about solutions of them.
- CO6 - Apply the best features of mathematics, engineering and natural sciences to program real life problems.

TEXT / REFERENCE BOOKS

1. Y. Daniel Liang, Introduction to Programming Using Python, Pearson, 2013.
2. Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming:
3. An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2nd Edition, 2014.
4. Magnus Lie Hetland, Beginning Python: From Novice to Professional, Apress.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA1102	PRINCIPLES OF BIOMEDICAL ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the basics of biomedical engineering in healthcare.
- To gain knowledge in the various fields of biomedical engineering.

UNIT 1 INTRODUCTION

9 Hrs.

Evolution of modern health care system, Engineering in modern medicine, Role of Biomedical Engineering, Roles played by Biomedical Engineers, Professional status of Biomedical Engineering, History of Biomedical Devices

UNIT 2 BIOLOGY AND ENGINEERING

9 Hrs.

Characteristics of human anatomy and physiology related to biomedical devices, Engineering of immunity and pathology, Communication systems in the body and its connection to biomedical engineering.

UNIT 3 ELECTRONICS AND MEDICINE

9 Hrs.

Medical Electronics, Basis of Bioelectric potential Bio potential electrodes, Biomedical amplifiers, Characteristics of recording systems, Computer applications in medicine, Design of electromedical equipment

UNIT 4 CLINICAL ENGINEERING

9 Hrs.

Evolution of clinical engineering, Clinical engineer Vs Biomedical engineer, Role of clinical engineers, Good clinical practice, Major functions of a clinical engineering department, Standards for clinical engineering

UNIT 5 RESEARCH IN BIOMEDICAL

9 Hrs.

Medical devices and Robotics, Biofabrication and Biomanufacturing, Biomedical Imaging, Biomolecular Science and Engineering, Musculoskeletal Biomechanics and Mechanobiology, Systems Biology, Tissue Engineering, Rehabilitation Engineering, Biomaterials and Nanotechnology, Neural Engineering- Case Studies.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Understand his/her role as a biomedical engineer.
- CO2 - Interpret the application of biology in engineering.
- CO3 - Assimilate the role of electronics in medicine.
- CO4 - Examine his/her responsibility as a clinical engineer.
- CO5 - Apply his/her knowledge to research in different areas of biomedical engineering
- CO6 - Implement the knowledge gained in understanding the concepts better in forthcoming semesters

TEXT / REFERENCE BOOKS

1. C. Raja Rao, Sujoy K. Guha, Principles of Medical Electronics and Biomedical Instrumentation, Universities Press, 2001.
2. W. Mark Saltzman, Biomedical Engineering: Bridging Medicine and Technology, Cambridge University Press, 2015.
3. Sundararajan V. Madihally, Principles of Biomedical Engineering, Artech House Publishers, 2010.
4. Azzam F.G. Taktak, Paul Ganney, David Long, Clinical Engineering: A Handbook for Clinical and Biomedical Engineers, Elsevier, 2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA1402	DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- This course will introduce the basic concepts and techniques for processing signals on a computer.
- By the end of the course, the student will be familiar with the most important methods in DSP, including digital filter design, transform-domain processing.

UNIT 1 INTRODUCTION TO DISCRETE TIME SIGNALS AND SYSTEMS

9 Hrs.

Representations - Classification of DT Signals & DT Systems - Concepts of Signal processing - Advantages of digital signal processing compared with analog processing - Typical applications - Analysis of DT-LTI Systems - Z- Transform and its properties - Inverse Z-Transform - Long division method - Partial fraction method - Residue or Contour integration method - Convolution method.

UNIT 2 FREQUENCY ANALYSIS OF SIGNALS

9 Hrs.

Discrete Fourier Transform and its properties - Relationship of the DFT to other transforms - General computation of DFT - convolution - Linear convolution, Circular convolution - Introduction to Fast Fourier Transform - Radix-2 FFT algorithms - Decimation in time (DIT), Decimation in Frequency (DIF) algorithms.

UNIT 3 DIGITAL FILTER DESIGNING

9 Hrs.

Introduction - Frequency selective filters - Digital versus Analog filters - Advantages & disadvantages of digital filters - Butterworth and Chebyshev Filters - Frequency Transformation in analog & Digital domain - Designing of FIR Filters - Fourier series method of designing FIR filters - Design of FIR filters using windows - Rectangular window - Hamming Window - Hanning Window functions

UNIT 4 BIOSIGNAL DETECTION AND COMPRESSION

9 Hrs.

QRS detection methods-Differentiation-based and template-based. Rhythm analysis and Arrhythmia detection algorithms. Automated ECG analysis. Data compression techniques: Data reduction algorithms- Lossy and Lossless types, Turning Point algorithm, AZTEC, CORTES.

UNIT 5 BIOSIGNAL ANALYSIS USING WAVELETS

9 Hrs.

Wavelets in Medicine: Need for wavelets, Types of wavelets, Selection of a wavelet for an application, Decomposition and reconstruction of signals using wavelets, Denoising using wavelets, Typical medical applications.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the basics of discrete time signals and systems.
- CO2 - Acquire knowledge to process the signals on a computer.
- CO3 - Apply the acquired knowledge to process the biosignals on a computer.
- CO4 - Analyse the various signals using different detection and compression techniques.
- CO5 - Investigate the results of various compressed signals in their frequency domain.
- CO6 - Develop the system to analyse the real time biosignals on a personal computer.

TEXT / REFERENCE BOOKS

- John G. Proakis & Dimitris G. Manolakis, Digital Signal Processing - Principles, Algorithms & Applications, 4th Edition, Pearson Education / Prentice Hall, 2007.
- Haykin. S and Van Been. B., Signals and Systems, 2nd Edition, John Wiley & Sons, 2003.
- Willis J. Tompkins, Biomedical Digital Signal Processing, Prentice Hall of India Pvt. Ltd., 2012.
- Sanjit K. Mitra, Digital Signal Processing - A Computer Based Approach, Tata McGraw Hill, 2007.
- Oppenheim, A.V., R.W. Schaffer and J.R. Buck, Discrete Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
- Stephane Mallat, Wavelet Tour of Signal Processing: The Sparse Way, 3rd Edition, Academic Press, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA1403	BIOFLUIDS AND BIOMECHANICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To appreciate the role of physiological fluid mechanics in Biomedical Engineering and build an appreciation for the applications of engineering in biology and medicine.
- To apply different mathematical models to describe the behavior of non-Newtonian viscous fluids such as blood.

UNIT 1 BIOMECHANICS

9 Hrs.

Biomechanics- Definition and perspective, Fundamental Mechanical Concepts- Kinetics and Kinematics, Newton's Laws, Mechanical Properties -Stress, Strain, Elasticity, Shear, Tension, Compression, Plastic Deformation, Creep, and Fatigue. Mechanical testing of biomaterials-UTM- Basic Engineering mechanics, Force - Resolution of forces.

UNIT 2 FLUID MECHANICS

9 Hrs.

Viscosity-Definition, properties. Types of fluids- Newtonian fluid, Non- Newtonian fluid, Types of fluid flow. Hagen-Poiseuille's equation. Viscoelasticity-Viscoelastic Models, Vascular tree, Flow properties of Blood, Physical, Chemical and Rheological properties of blood, Apparent and Relative and viscosity, Fahraeus-Lindqvist Effect.

UNIT 3 HUMAN LOCOMOTION

9 Hrs.

Anthropometric Characteristics of human body. Types of motion in humans, Gait analysis. Goniometry. Accelerometer, Foot Pressure Measurements – Pedobarograph, Podiascan - Force platform. Mechanics of foot.

UNIT 4 HARD AND SOFT TISSUE MECHANICS

9 Hrs.

Biomechanics of upper extremities-Elbow, Shoulder. Biomechanics of lower extremities-Hip and Knee.-Tissue Mechanics-Mechanical Properties of Tissues, Biological materials, Properties of Cortical, Cancellous Bone. Soft Tissue properties Mechanical testing of Soft tissue.

UNIT 5 KINESIOLOGY OF SPORTS

9 Hrs.

Application of biomechanics to neuromuscular fitness, gymnastics, Application of aerodynamics in sports, hydrodynamics in swimming. Analysis of throw and push patterns. Sports Medicine.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understands the principles of mechanics to the analysis of biological systems
- CO2 - Remembers the engineering features of complex problems involving living systems
- CO3 - Interrelates the appropriate problem-solving approach for biomechanical investigations
- CO4 - Analyses and interpret raw data, e.g. motion analysis outputs and experimental flow fields
- CO5 - Describes how mechanics plays a role in basic physiological processes in the human body
- CO6 - Employs kinematic and kinetic principles to describe human locomotion

TEXT / REFERENCE BOOKS

1. Susan J Hall, Basic Biomechanics, Mc Graw Hill, 5th Edition, 2006.
2. Fung, Y.G., Biomechanics, Springer-verlag, New York Inc., 2008.
3. Joseph Bronzino, Hand book of Biomedical Engineering, Springer, 2nd Edition, 2000.
4. Joseph Hamill and Kathleen M. Knutzen, Biomechanical Basis of Human Movement, Lippincott Williams & Wilkins, 3rd Edition, 2008, Philadelphia.
5. Duane Knudson, Fundamental of Biomechanics, Kluwer Academic/Plenum publishers, 2nd Edition, 2007, Chico, California.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA1404	RADIO IMAGING AND THERAPEUTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To provide the knowledge about the specialty of medicine in radiation therapy.
- To make the student understand about the application of imaging technology and effects of radiation.

UNIT 1 ELEMENTS OF RADIATION

9 Hrs.

Radioactive elements and Radioisotopes in medicine, Radioactivity, General properties of alpha, beta and gamma rays -Laws of radioactivity, Radioactive decay - alpha decay, beta decay, positron decay, decay energy and half-life. Radiation units-Roentgen, Rad - rem - sievert. Radiation sources - Natural and artificial radioactive sources.

UNIT 2 RADIATION GENERATORS

9 Hrs

Particle Accelerators- Cyclotron, Klystron, Magnetron, Cascade generator, Van De Graff generator X ray films, X ray film processing, X Ray cassettes, Intensifying screens-New phosphor technology, photostimulable phosphor imaging. collimators, grids - bucky grids, Body section radiography, Xeroradiography

UNIT 3 RADIO DIAGNOSIS

9 Hrs.

Fluoroscopy – Digital Fluoroscopy. Angiography, Cine Angiography, Digital subtraction Angiography. Mammography and Dental x-ray unit. Digital radiography, Angiography, Image intensifier, PET, SPECT,

UNIT 4 RADIOTHERAPY

9 Hrs.

COBALT-60, Linac, Gamma camera, Nuclear scintigraphy, Brachytherapy, Cyber Knife, Gamma knife, Intraoperative radiotherapy

UNIT 5 RADIATION SAFETY MEASURES

9 Hrs.

Radiation Protection, Protective barrier-primary& secondary, Equivalent Dose, Biological effects of radiation, Somatic & genetic effects of radiation-LD 50/30, Effect of radiation on skin, blood forming organs, Personnel and area monitoring systems, Radiation measuring devices -dosimeter, survey meter. Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Understanding the elements of radiation and radioactive decay involved in radiation therapy.
- CO2 - Illustrate the working principle of radiation generators with the processing of X ray machine and its application.
- CO3 - Understanding the technique of fluoroscopy and various radio diagnosis techniques.
- CO4 - Demonstrate the applications of radiotherapy.
- CO5 - Attain the adequate knowledge about radiation measurements and effect of radiation on body.
- CO6 - Outline the methods of radiation safety.

TEXT / REFERENCE BOOKS

1. Thomas S. Curry, III, James E. Dowdey, Robert C. Murry J R., Christensen The Physics of Diagnostic Radiology Lea & Febiger, 6th Edition 2008.
2. Faiz M.Khan, The Physics of Radiation Therapy, 4th Edition, 2009.
3. Gopal,B.Saha , Physics & Radiology of nuclear medicine, Springer 2nd Edition, 2006.
4. Khandpur R.S., Handbook of Biomedical Instrumentation, Tata McGraw Hill Publishing Company Ltd., New Delhi and revised edition, 2007.
5. Thayalan K., Basic Radiological Physics, Jaypee Brothers Medical Publishers Pvt. Ltd., Revised Edition, 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks : 100 Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice 20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SAIC4001	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	-	-	2	100

UNIT 1 ADVANCED TECHNOLOGY AND ADVANCED MATERIALS

7 Hrs.

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING

7 Hrs.

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT

7 Hrs.

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies

UNIT 4 SMART MANUFACTURING

8 Hrs.

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self-propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles (UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT 5 SMART WORLD

8 Hrs

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS

8 Hrs.

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR): Case Studies.

Max. 45 Hrs.

TEXT / REFERENCE BOOKS

1. William D. Callister, "Materials Science and Engineering, An Introduction, John Wiley and Sons Inc. Singapore, 2001.
2. Raghavan V., "Physical Metallurgy: Principle and Practice, Prentice Hall India Pvt. Ltd., 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol.103, 2019.
3. Klaus Schwab, "Fourth Industrial Revolution", Random House, USA Inc, New York, USA, 2017.
4. Oliver Grunow, "Smart Factory and Industry 4.0. The current state of Application Technologies", Studylab Publications, 2016.
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
6. Sang C., Suh, U. John Tanik, John N. Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 11 Questions of 2 marks each-No choice

PART B: 2 Questions from each unit with internal choice, each carrying 13 marks

Exam Duration: 3 Hrs.

22 Marks

78 Marks

SBMA1501	FUNDAMENTALS OF MICROPROCESSOR AND MICROCONTROLLER	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The prime objective of this course is to introduce to the students the fundamentals of Microprocessor Microcontroller and Arduino.
- The students will be equipped with the basic knowledge of microprocessor, microcontroller and Arduino interfacing and their applications.

UNIT 1 INTRODUCTION TO INTEL 8085

9 Hrs.

Evolution of Microprocessor-Architecture of 8085-Instruction format-Addressing modes-Basic timing diagram of pcode fetch, memory read, memory write I/O read and I/O write-Interrupts of 8085-Software interrupts, Hardware interrupts, Priorities of interrupts 8085 based system design.

UNIT 2 INTEL 8085 INTERFACING

9 Hrs.

Interfacing devices-8255 Programmable Peripheral Interface-Architecture & various modes of operation- 8251 USART Architecture and programming features-8237, interfacing with ADC and DAC, LCD, keyboard Interface. Application: Stepper Motor Control, Temperature Control.

UNIT 3 INTRODUCTION TO 8051

9 Hrs.

Introduction to 8-bit Microcontrollers – 8051/8051, Microcontroller Architecture – Internal RAM & Internal ROM, Instruction set, Addressing Modes, Simple programs.

UNIT 4 INTERNAL PERIPHERALS OF 8051

9 Hrs.

Modes of Timer/Counter operation – Serial Port operation & Modes – Interrupt Structure of 8051 - Memory Interfacing with 8051 – I/O ports- Input and output devices interfacing with 8051.

UNIT 5 ARDUINO UNO

9 Hrs.

Arduino – Architecture, Pin diagram, Programming Structure, Simple program to blink LED, Subroutine, 16x2 LED display, Interfacing with Arduino: LCD, Temperature Sensor, Humidity Sensor and ultrasonic sensor.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understanding architectural principle of 8085 & 8051.
- CO2 - Interpret the various peripheral devices with 8085 & 8051 microprocessor
- CO3 - Design and implement programs on 8051 microprocessor.
- CO4 - Examine various I/O devices with 8051 microcontroller
- CO5 - Apply Arduino code and how to Interface various sensors with the Arduino Board.
- CO6 - Implement the interface circuit with various sensor and I/O devices with microprocessor and microcontroller and Arduino Board.

TEXT / REFERENCE BOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 4th Edition, Penram International Publishing, New Delhi, 2000
2. Kenneth J. Ayala, 8051 Microcontroller, Thomson, 2005.
3. Charles M. Gilmore, Microprocessor Principle and Application, McGraw Hill Publication, 1995.
4. Nagoor Kani A., Microprocessor & Microcontroller, Tata McGraw Hill, 3rd Edition, 2012.
5. Ram B., Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications, 2001.
6. Michael Mc Roberts, beginning Arduino, 2nd Edition, 2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice each carrying 16 marks

80 Marks

SBMA1502	BIOMATERIALS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The course provides an intriguing insight in chemistry, engineering, biology and medicine that has a significant impact on biomaterials.
- It highlights the way in which modern biology and medicine is inextricably linked to scientific discipline and helping us to understand the complex world of biomaterials.

UNIT 1 INTRODUCTION AND METALS

9 Hrs.

Biomaterials - Overview, Classification of biomaterials, Interfacial Phenomena and tissue response to biomaterials, Metals and alloys for orthopedic implants-Stainless steel, Cobalt chromium alloy, Titanium and its alloys, Precious metal alloys, Other metal alloys. Dental implants - Endosseous Tooth Implants, materials, types and designs.

UNIT 2 POLYMERS AND APPLICATIONS

9 Hrs.

Polymers in biomedical use, biodegradable polymers, microorganisms in polymeric implants, Polymer Sterilization, Deterioration of polymers, Polyethylene, Poly Vinyl Chloride, Hydrogels, silicone rubber.

UNIT 3 BIOCERAMICS AND COMPOSITES

9 Hrs.

Bioceramics, types - bioactive resorbable, non - resorbable, bioceramic coatings on metallic implants and bone bonding reactions on implantation. Hydroxyapatite - properties and applications. Composites - Types and Applications, Bioglass.

UNIT 4 REPLACEMENT AND FIXATION DEVICES

9 Hrs.

Bioelectric effect, Wolff's Law, Types of orthopedic fixation devices-pins, screws and plates, Intra Medullary and spinal nails. Interface Problems with artificial joints and various fixation methods, hard tissue replacements - total hip and knee joint replacements. Soft Tissue replacements- Sutures -Tapes, Staples, Adhesives. Maxillofacial Implants.

UNIT 5 OPHTHALMOLOGY

9 Hrs

Ophthalmology- Introduction, Contact lenses, Eye shields, Viscoelastic solutions, Vitreous implants, Acrylate adhesives, Scleral buckling materials for retinal detachment, artificial tears. Corrosion, Biocompatibility and Hemocompatibility, Biological Tests. Material surface characterization, 3D characterization.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify different types of biomaterials used for various applications.
- CO2 - Understand the hard tissue replacement and soft tissue replacement for various fixations.
- CO3 - Recognize various polymers, ceramics and composite used as biomaterials for organ replacement.
- CO4 - Acquire knowledge about how to rectify eye defect using various biomaterials.
- CO5 - Apply suitable methods to test Biocompatibility and Hemocompatibility of biomaterials.
- CO6 - Implement various characterization methods to identify biomaterials.

TEXT / REFERENCE BOOKS

1. Sujata V.Bhat, Biomaterials, Narosa Publishing House, New Delhi, 2002.
2. Rolando Barbucci, Integrated Biomaterials Science, Plenum Publishers, New York, 2002.
3. Von Recum A.F., Handbook of Biomaterials Evaluation-Scientific, Technical and Clinical Testing of Implant Materials, 1998.
4. Joseph D Bronzino, The Biomedical Engineering Hand Book, Vol.11, CRC Press, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA1503	DIAGNOSTIC INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge about instruments employed for disease diagnosis.
- To provide complete exposure of various recording mechanism and to understand the basic principles and working of biomedical instruments.

UNIT 1 INTRODUCTION AND GENERAL PURPOSE EQUIPMENT

9 Hrs.

Basic Measurement system, Types of Biomedical equipment,, Basic Audiometer – Bekesy audiometer, Pure tone & speech, Conventional hearing aids, BERA Test, Basic Spirometry. Auto Refractometer, Keratometer, Retinoscope, Tonometers.

UNIT 2 BIOMEDICAL RECORDER

9 Hrs.

ECG-Lead configuration-Instrumentation set-up - effects of artifacts. IECG, EEG-10-20 Electrodes configuration - Instrumentation - recording of Evoked potentials, EMG - Measurement of nerve conduction velocity. ERG, EOG, EGG, PCG, TMT and Holter Monitors.

UNIT 3 IMAGING EQUIPMENTS

9 Hrs.

X-Ray machine, CT - Scanning system, processing unit, viewing part & storage unit. MRI - The magnet, RF transmitter system, Gradient system, imager system, Advantages. Ultrasonic imaging systems - A Scan, B Scan, TM Mode Scan, Echocardiography, Biomedical Applications Thermographic Equipment.

UNIT 4 FLOWMETERS & PSYCOPHYSIOLOGICAL SYSTEMS

9 Hrs.

Flow meters and CO Measurement, Electromagnetic flow meters, Ultrasonic Blood flow meters, Laser Doppler Blood flow meters,, Indicator Dilution method, Dye dilution method, Thermal dilution method. Polygraph GSR Measurement, Sensory and motor measurement, Plethysmography.

UNIT 5 PATIENT MONITORING SYSTEMS

9 Hrs.

BP measurement - Direct and indirect method, pulse rate analysis, temperature measurement, Respiration Rate, Apnoea Monitors, Central monitoring system. Endoscopy, Capusule Endoscopy, Laparoscopy, Oximetry, Foetal monitors, Cardiotocograph.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Characterize the sources of biomedical signals and their application in biomedical recorders.
- CO2 - Understand and discuss about the various image acquisition machines.
- CO3 - Compare the different flowmeters and dilution methods and discuss about sensory instrumentation.
- CO4 - Discuss about the instruments associated with patient monitoring and its need in health care.
- CO5 - Analyze the performance of instruments related to hearing and vision.
- CO6 - Apply the knowledge acquired to design diverse diagnostic equipment.

TEXT / REFERENCE BOOKS

1. Khandpur R.S., Hand Book of Biomedical instrumentation, Tata McGraw Hill Publication, 2014.
2. John G. Webster, Medical Instrumentation, John Wiley & Sons, 2007.
3. Cromwell, Biomedical Instrumentation & Measurements Prentice Hall of India Private Limited, 2011.
4. Carr & Brown, Introduction to Biomedical Equipment Technology, 2001.
5. Ananda Natarajan R., Biomedical Instrumentation & Measurements, PHI Publication, 2011.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA1504	BIOSIGNAL CONDITIONING	L	T	P	Credits	Total Marks
		3	*	0	4	100

COURSE OBJECTIVES

- To gain in depth knowledge of fundamentals of operational amplifier circuits and to study the various applications using operational amplifiers.
- To discuss filters and circuits and introduce the application of signal conditioning in biomedical field.

UNIT 1 INTRODUCTION TO OPAMP

9 Hrs.

Introduction, Signal conditioning, 741 General purpose OPAMP: ideal characteristics, offset voltages and currents. Open & Closed Loop Configuration. Inverting, Non-Inverting, Summing, Voltage Follower, Integrator, differentiators, Log & Anti-Log Amplifiers, Differential Amplifiers, CMRR.

UNIT 2 APPLICATION OF OPAMP

9 Hrs.

Comparator- Zero crossing detector, Inverting and non inverting comparator, Schmitt Trigger, Precision rectifiers- Half wave and Full wave rectifiers, Peak detectors, Monostable, Astable multivibrators, Sawtooth generator, Triangular waveform generator, Sine Wave Generators-RC Phase Shift Oscillator, Wein Bridge oscillator.

UNIT 3 FILTERS

9 Hrs.

Introduction- Analog Filters, Active Filters and Passive Filters, First order and Second order Low Pass Filters, High Pass Filters, Band Pass Filters- Narrow Band Pass, Wide band Pass Filters,, Band Reject Filters- Notch Filter, All Pass filters and higher Order filters- Design and applications.

UNIT 4 DATA CONVERTERS AND TIMERS

9 Hrs.

Sample and Hold circuit - D/A converters: Resistive divider and R-2R ladder networks, inverted R-2R DAC. A/D converters: Counting type, Successive approximation, parallel comparator. Voltage to Current Converter, 555 Timer and its applications- Astable multivibrators and Monostable Multivibrator.

UNIT 5 AMPLIFIERS AND VOLTAGE REGULATORS

9 Hrs.

Instrumentation amplifiers, Bridge Amplifiers. Bioelectric Amplifiers: - Properties desired, Isolation Amplifiers:- Battery Powered, Carrier, Optically Coupled, Current Loading, Chopper Stabilized amplifier, Input Guarding. Series op-amp regulator, fixed voltage regulator and 723 general purpose regulator.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Design and implement linear and non-linear applications of operational amplifiers.
- CO2 - Implement waveform generation using operational amplifier.
- CO3 - Analyze and design bio filters and isolation circuits used in signal conditioning.
- CO4 - Design ADC and DAC using Operational Amplifiers.
- CO5 - Describe the basic concepts of Timers and voltage regulators.
- CO6 - Recognize various bioamplifier for biosignal acquisitions using opamps.

TEXT / REFERENCE BOOKS

1. Ramakant A Gayakwad, Operational Amplifiers & Linear Integrated Circuits. Prentice Hall, 2000.
2. Joseph J. Carr & John M. Brown, Introduction to Biomedical Equipment Technology, 4th edition, Pearson Education Pvt. Ltd, 2001.
3. Roy Choudhary, Linear Integrated Circuits 2nd edition, New Age International (P) Ltd, 2004.
4. John P. Bentley, Principles of Measurement System, 3rd edition, Longman Science & Technology, 2000.
5. Robert Coughlin and Fredrer, Operational Amplifiers & Linear Integrated Circuits, Prentice Hall, 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA1601	THERAPEUTIC INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gather adequate knowledge about treatment of various physiological ailments.
- To understand the fundamental principles and working of the biomedical instruments involved in the therapy.

UNIT 1 INSTRUMENTS FOR CARDIOLOGY

9 Hrs.

Cardiac Pacemakers – Evolution of pacemakers, Need for Cardiac Pacemaker - External Pacemakers - implantable Pacemakers - Recent Developments in Pacemakers, Pacemaker analyzer. Cardiac Ablation Catheter, Cardiac Defibrillators - Need for a Defibrillator - DC Defibrillator – Automatic Implantable Defibrillators (AID) - Pacer-cardioverter - defibrillator analysers, LVAD.

UNIT 2 DIATHERMY AND ELECTROTHERAPY EQUIPMENT

9 Hrs.

Surgical diathermy machine – Principle – Working Hazards and safety aspects in ESU. High frequency heat therapy - Short wave Diathermy - Microwave diathermy - Ultrasonic diathermy - TENS – Interferential Current Therapy - Bladder Stimulators - DBS.

UNIT 3 EXTRACORPOREAL UNITS

9 Hrs

Haemodialysis Machines - Artificial Kidney - Dialyzers - Membranes, Peritoneal Dialysis - Portable Kidney machines. Lithotripters – First and modern lithotripter systems - Extracorporeal Shockwave Therapy, Heart Lung Machine – Oxygenators-Pumps.

UNIT 4 PULMONARY ASSIST INSTRUMENTS

9 Hrs.

Anesthesia Machine – Components - Electronics in Anesthesia machine. Ventilators – Types and classification- Modern microprocessor based ventilators, HF Ventilators, Humidifiers - Nebulizers and Aspirators

UNIT 5 DRUG DELIVERY AND NEONATAL SYSTEMS

9 Hrs.

Infusion Pumps- Components- Implantable infusion pumps - Insulin Pumps- Syringe Pumps. Incubators-Radiant Warmer – Phototherapy Units.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply the knowledge acquired to design a pacemaker and defibrillator
- CO2 - Describe about diathermy devices used for surgery and physiotherapy.
- CO3 - Assist perfusionists during dialysis and surgeries.
- CO4 - Compare the ventilator working mechanism in anesthesia machines.
- CO5 - Suggest instruments for drug delivery and neonatal care.
- CO6 - Design various therapeutic devices based on the applications learned.

TEXT / REFERENCE BOOKS

1. Khandpur R.S., Handbook of biomedical Instrumentation, Tata McGraw Hill Publication company Ltd, New Delhi, 2014.
2. Joseph J. Carr, John Michael Brown, Introduction to Biomedical Equipment Technology, 4th Edition, Pearson Education, 2012.
3. John G. Webster, Biomedical Instrumentation, Wiley Publications, 2007.
4. Geddes L.A. and L.E. Baker, Principles of Applied Biomedical Instrumentation, 3rd Edition, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA1603	MEDICAL IMAGE PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquire knowledge about the various medical imaging techniques.
- To understand the fundamental principle and working of the medical imaging systems involved in the diagnosis of health care.

UNIT 1 IMAGE FUNDAMENTALS

9 Hrs.

Introduction - Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Zooming and Shrinking of digital images - Relationships between pixels - color models

UNIT 2 IMAGE ENHANCEMENT

9 Hrs.

Enhancement by point processing - Gray level transformations - Histogram processing - Image subtraction - Image averaging. Basics of Spatial Filtering - Smoothing and Sharpening Spatial Filtering, Enhancements in Frequency Domain - low pass filtering - High pass filtering. 2D DFT and their properties.

UNIT 3 IMAGE RESTORATION

9 Hrs.

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

UNIT 4 IMAGE SEGMENTATION

9 Hrs.

Edge and Line Detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT 5 IMAGE COMPRESSION AND RECOGNITION

9 Hrs.

Fundamentals, Image compression models, Huffman, Run Length Encoding, Arithmetic coding, Lossless Predictive Coding and Lossy Predictive Coding, Boundary representation, Boundary descriptors - Fourier Descriptor, Regional Descriptors – Topological feature, Texture, Patterns and Pattern classes - Recognition based on matching.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understands the fundamental concepts of digital image processing
- CO2 - Demonstrates the suitable technique for accomplishing image preprocessing task
- CO3 - Explains the restoration process and filtering techniques
- CO4 - Illustrate the steps involved in segmentation process
- CO5 - Analyze the performance of image compression and recognition methods
- CO6 - Assess the impact of digital image processing for medical application

TEXT / REFERENCE BOOKS

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2010.
2. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using Matlab", 3rd Edition Tata McGraw Hill Pvt. Ltd., 2011.
3. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
4. William K. Pratt, "Introduction to Digital Image Processing", CRC Press, 2013.
5. Chris Solomon, Toby Breckon, "Fundamentals of Digital Image Processing – A practical approach with examples in Matlab", Wiley-Blackwell, 2010.
6. Jayaraman, "Digital Image Processing", Tata McGraw Hill Education, 2011.
7. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", 1st Edition, PHI Learning Pvt. Ltd., 2011.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks: 100

Exam Duration: 3 Hrs

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA3001	MEDICAL EQUIPMENT MAINTENANCE AND TROUBLESHOOTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand and learn the troubleshooting of instruments used for diagnosis and therapy.
- Learn how to maintain the overall working of equipment.

UNIT 1 INTRODUCTION

9 Hrs.

Testing of electrical equipments: AC, DC power supply, Grounding, shielding, Guarding, insulation testing, insulation resistance measurement, Types of Circuit Breakers, Rating - Testing of circuit breakers – Transformer testing- Earthing – Earth wires - Earthing of appliances – contactor, relay testing–CT and PT, Panel wiring- Megger-Testing equipments and instruments.

UNIT 2 TESTING AND TROUBLESHOOTING

9 Hrs.

Testing of electronic components: Troubleshooting of PCB boards, Calibration of analog and digital sensor probe, Display interface, DC Power supply design, testing, Safe electrical practice, Cables and standard, Fuse.

UNIT 3 TESTING OF MEDICAL EQUIPMENT

9 Hrs.

Testing of surgical Equipment: Functions and operating procedure-Testing and maintenance of Heart lung machine, surgical lights, ventilator, patient monitor, anesthesia machine, dialyzer, surgical tools.

UNIT 4 TROUBLESHOOTING OF MEDICAL EQUIPMENT

9 Hrs.

Troubleshooting of equipments: X-ray machines, Troubleshooting of ECG recorders, incubator, baby warmer, infusion pumps, annual maintenance, contract requirements, vendor services, and quality and safety standards.

UNIT 5 MAINTENANCE MANAGEMENT

9 Hrs.

Life cycle management of medical equipment: Cost of the medical equipment, maintenance cost, replacement analysis, managing equipment service, decision making, extracting optimal benefit from medical equipment over its life cycle. Case study.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify major reasons for equipment failure.
- CO2 - Compare general testing and troubleshooting of equipment.
- CO3 - Understand testing of OT instruments
- CO4 - Discuss about the troubleshooting of medical equipment and safety standards.
- CO5 - Analyze the management issues pertaining to medical instruments.
- CO6 - Apply the tools in design, testing and developing medical equipment

TEXT / REFERENCE BOOKS

1. Shakti Chatterjee, Aubert Miller, "Biomedical Equipment Repair", Cengage Learning Technology & Engineering, 2010.
2. David Herres, "Troubleshooting and Repairing Commercial Electrical Equipment", McGrawHill Professional, 2013.
3. Rao S, "Testing, Commissioning, Operation and Maintenance of Electrical Equipment", Khanna Publishers, New Delhi, 2014.
4. Francis Hegarty, John Amore, "Health care technology management – A systematic approach", CRC Press, USA, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

SBMA3007	FUZZY LOGIC AND NEURAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To motivate the students gain in depth knowledge of fuzzy logic systems.
- It focuses on fundamentals of biological neurons with artificial neural networks.
- It intends to bring new ideas in Algorithm implementation in artificial neural networks.

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to Fuzzy Set Theory – Basic Concepts of Fuzzy Sets – Classical Set Vs Fuzzy Set – Properties of Fuzzy Set – Fuzzy Logic Operation on Fuzzy Sets – Fuzzy Logic Control Principles – Fuzzy Relations – Fuzzy Rules – Defuzzification.

UNIT 2 FUZZY APPLICATIONS

9 Hrs.

Logic Controller – Fuzzification Interface – Knowledge Base – Decision Making Logic – Defuzzification Interface – Application Of Fuzzy Logic To Control of Blood Pressure During Anaesthesia – Cardio Vascular Signals – Fuzzy Logic Decision By Fuzzifying Boolean Rule, Fuzzy Logic Patient Deterioration Index.

UNIT 3 INTRODUCTION TO ANN

9 Hrs.

Fundamentals of ANN – Biological Neurons And Their Artificial Models – Types of ANN – Properties – Different Learning Rules – Types of Activation Functions – Training of ANN – Perceptron Model (SingleLayer) – Training Algorithm – Problems Solving Using Learning Rules And Algorithms – Linear Separability Limitation And Its OverComings

UNIT 4 ANN NETWORKS

9 Hrs.

Back Propagation Training Algorithm – Practical Difficulties – Counter Propagation Network – Structure & Operation – Training of Kohonen and Grossberg Layer – Applications Of BPN & CPN – Statistical Method – Training Application – Boltzmann Training – Cauchy Training – Hopfield Network - Applications A/D Converter – Travelling Salesman Problem

UNIT 5 ASSOCIATIVE MEMORY AND ART

9 Hrs.

Bidirectional Associative Memory– Structure – Types – Encoding And Retrieving – Adaptive Resonance Theory– Architecture of ART1 & ART2 – Implementation – Training – Characteristics – Introduction To Optical Neural Network – Cognitron & Neocognitron . Introduction to ANFIS

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Recognize the Fuzzy set theory.
- CO2 - Understand about Optical Neural Network.
- CO3 - Implementation of FLC.
- CO4 - Explain the various types Algorithms in ANN.
- CO5 - Design of ANN Architecture.
- CO6 - Evaluate ANN application.

TEXT / REFERENCE BOOKS

1. Timothy J. Ross, Fuzzy Logic with Engineering Application, 1st Edition, Tech India, 2002.
2. James A. Freeman & Davis Skapura, Neural Networks, Pearson Education, 2002.
3. Jack M. Zurada, Introduction to Artificial Neural Systems, Jaico Publishers, 1997.
4. Philip D. Wasserman, Neural Computing Theory & Practice, Van Nostrand and Reinhold.
5. Simon Haykin, Neural Networks- A Comprehensive Foundation, 2nd Edition, Pearson Education, 2005.
6. Yagnanarayana B., Artificial Neural Networks, PHI, 1999.
7. Drankov, Hallendoor and Reinfrank, An Introduction to Fuzzy Control, 2nd Edition, Springer, 1996.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each- No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA3010	TELEHEALTH TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enable the student to understand the scope and benefits of telemedicine using communication networks and their protocols.
- To learn about new healthcare needs through the applications of telemedicine.

UNIT 1 INTRODUCTION

9 Hrs.

Fundamentals of Telemedicine, Block diagram of Telemedicine, History of telemedicine: Main phases of Telemedicine, Pre electronic Telemedicine, Electronic Telemedicine, Tele-healthcare and E-medicine, Telemedicine access to health care services, Scope & Benefits and Limitation of Telemedicine.

UNIT 2 COMMUNICATION AND NETWORK

9 Hrs.

Types of information: Audio, Video, Data, Fax, Still Image. Types of Communication and Networks: Overview of PSTN, POTS, ISDN, ATM, Videoconferencing, Wireless Communication – RF, GSM Satellite and Microwave, CDPD, Mobile hand held devices and mobile communication. Internet technology and telemedicine using world wide web (www)-Video and audio conferencing

UNIT 3 DATA EXCHANGE AND NETWORK SECURITY

9 Hrs.

Basic concepts of internet, Network Configuration, Circuit and Packet Switching, H.320 series, h.324 Protocols: TCP/IP, Standards for DICOM, Security: Encryption – DES, RSA, and Cryptography.

UNIT 4 ETHICAL AND LEGAL ASPECTS AND CASE STUDIES

9 Hrs.

Confidentiality and law, Patient Right and consent, Access to medical Records, Consent treatment, jurisdictional issues, Intellectual Property Rights, Telemedicine technology and Health care delivery for rural population - Use of telemedicine technology for clinical diagnostic study - Conceptual frame work on home telemedicine

UNIT 5 APPLICATIONS OF TELEMEDICINE

9 Hrs.

Teleradiography – Basic parts of a Teleradiography System, Telepathology, Telecytology, Telecardiology, Telehome – Care Home based Applications, Teleoncology, Telesurgery, Telepsychiatry, Teledermatology, Telepediatrics, Telepharmacy.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understands the basics of telemedicine and its application in healthcare.
- CO2 - Classify the various standards and protocols related to telemedicine.
- CO3 - Discuss about protocols and security for transfer of tele medicine data.
- CO4 - Understand and apply the ethical and legal issues in telemedicine.
- CO5 - Explores the application of telehealth to modalities of medicine.
- CO6 - Compares the telehealth technologies for future challenges arising in our community.

TEXT / REFERENCE BOOKS

- 1 Olga, Ferrer – Roca, M. Sosa, Marcelo C, Handbook of Telemedicine, IOS press 2002.
- 2 Ling Guan, Multimedia image and video processing, CRC Press, 2000.
- 3 Thorsten M Buzug, Heinz Handels, Dietrich Holz, Telemedicine: Medicine and communication, Springer Verlag 2001.
- 4 Douglas V Goldstein, E Healthcare: Harness the power of internet, e – commerce and e – care, Jones and Barlett Publishers. 2000.
- 5 Norris A.C., Essentials of Telemedicine and Telecare, John Wiley & Sons, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SBMA3011	REHABILITATION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To develop assistive devices, prosthetics and orthotics for the disabled.
- To provide the basic concept so that the students can implement their knowledge for developing innovative and effective rehabilitation and assistive technologies.

UNIT 1 INTRODUCTION TO REHABILITATION

9 Hrs.

Introduction, Concepts of rehabilitation engineering, Principles of Rehabilitation Engineering - Key Engineering Principles - Key Ergonomic Principles, Principles of Assistive Technology Assessment, Rehabilitation Team.

UNIT 2 ORTHOTICS & ORTHOPROSTHETICS

9 Hrs.

Orthopedic prosthetics and orthotics in Rehabilitation Fundamentals, Applications: Computer Aided Engineering in customized component design. Intelligent prosthetic knee and hand. A self-aligning orthotic knee joint. FES System: Restoration of hand function; restoration of standing and walking. Body Powered Prosthetics, Hybrid Assistive systems (HAS) Active prostheses. Active Above knee Prosthesis. Myoelectric hand and arm prostheses. Orthotics -FO, AFO, TLSO, LSO

UNIT 3 WHEELED MOBILITY

9 Hrs.

History and Categories of Wheelchairs. Wheelchair Structure and Component Design. Ergonomics of wheel chair propulsion. Power Wheelchair Electrical System. Personal transportation. Tricycles, Lift mechanism in ambulance

UNIT 4 SENSORY AUGMENTATION AND SUBSTITUTION

9 Hrs.

Visual System: Visual augmentation. Tactual vision substitution. Auditory vision substitution: Auditory System: Auditory augmentation. Cochlear implants. Visual auditory substitution. Tactual auditory substitution. Tactual system: Tactual augmentation. Tactual substitution. Alternative and Augmentative communication, User Interface: Outputs: Acceleration Techniques, HAAT model.

UNIT 5 ADVANCED APPLICATIONS IN REHABILITATION ENGINEERING

9 Hrs.

Computer - assisted lip reading, Brain - computer interface, Haptic devices for rehabilitation, Robotic Rehabilitation, Visual Aids, Hearing Aids, Writing Aids Electronic Travel Applications (ETA) : Path Sounder, Laser Cane, Ultrasonic Torch, , Nottingham Obstacle Sensor, Polarized Ultrasonic Travel Aid.

Max. 45 Hs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply the various principles involved in rehabilitation.
- CO2 - Support rehab engineers in designing orthotic and prosthetic devices. CO3 - Compare the types of wheelchairs and assist disabled persons.
- CO4 - Discover new augmentation and substitution devices for visual and hearing impaired. CO5 - Assess the merits of support aids designed for the disabled.
- CO6 - Develop and design rehabilitation devices cost effectively and purposefully.

TEXT / REFERENCE BOOKS

1. Bronzino J.D., The Biomedical Engineering Hand Book, Volume 1, Academic Press, 2000.
2. Textbook of rehabilitation, Sunder, Jaypee Publications, 2010.
3. Handbook of Physical Medicine & Rehabilitation, W.B.Saunders Publication, 2003.
4. Marion A. Hersh, "Assistive Technology for Visually Impaired and Blind People", CRC Press, 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



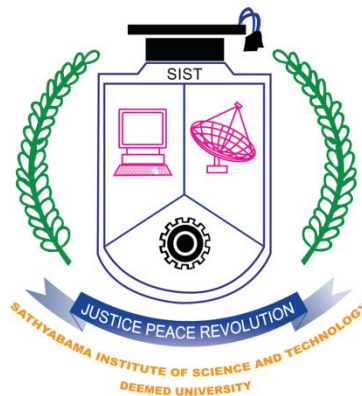
SATHYABAMA

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SCHOOL OF BIO & CHEMICAL ENGINEERING

DEPARTMENT OF BIOMEDICAL ENGINEERING



CRITERION 1.1.3
2015 Regulations

**PROGRAMME: B. TECH
BIOMEDICAL ENGINEERING
CURRICULUM
SEMESTER- 1**

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SCH1101	Environmental Science and Engineering	3	0	0	3	5
2.	SPH1101	Physics of Engineering Materials	3	0	0	3	6
3.	SCY1101	Engineering Chemistry	3	0	0	3	7
4	SMT1101/ SMT1102	Engineering Mathematics I / Statistics	3	1	0	4	8
5	SCS1102	Fundamentals of Programming	3	0	0	3	9
6	SBT1101	Cell and Molecular Biology	3	0	0	3	10
PRACTICAL							
7.	SPH4051	Engineering Physics Lab	0	0	2	1	11
8.	SCY4051	Engineering Chemistry Lab	0	0	2	1	11
9.	SCS4101	Programming in C Lab	0	0	4	2	12

TOTALCREDITS: 23

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

SEMESTER- 2							
S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SHS1101	English for Science and Technology	3	0	0	3	13
2.	SMT1105	Engineering Mathematics II /	3	1	0	4	14
	SMT1106	Engineering Mathematics II	3	1	0	4	
3.	SBT1102	Biochemistry /	3	0	0	3	15
	SCY1103	Chemistry of Industrial Materials /	3	0	0	3	
	SCY1104	Bio Organic Chemistry /	3	0	0	3	
	SCY1105	Physical Chemistry	3	0	0	3	
4.	SBT1103	Microbiology	3	0	0	3	16
5.	SBT1104	Genetics	3	0	0	3	17
6.	SEE1102	Basic Electrical Engineering	3	0	0	3	18
PRACTICAL							
7.	SBT4053	Microbiology and Biochemistry Lab	0	0	4	2	19
8.	SME4053	Engineering Graphics	0	0	6	2	20

TOTALCREDITS: 23

SEMESTER- 3

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SMT1201	Engineering Mathematics III /	3	1	0	4	
	SMT1202	Engineering Mathematics III	3	1	0	4	21
2.	SEC1217	Basic Electronic Devices	3	0	0	3	22
3.	SBM1201	Bioinstrumentation and Measurements	3	0	0	3	23
4.	SBM1202	Bio Sensors and Transducers	3	0	0	3	24
5.	SBM1203	Human Anatomy and Physiology	3	0	0	3	25
6.	SBT1202	Immunology	3	0	0	3	26

PRACTICAL

7.	SBM4051	Human Anatomy and Physiology Lab	0	0	4	2	27
8.	SBM4052	Electrical Circuits and Electronic Devices Lab	0	0	4	2	27

TOTAL CREDITS: 23

SEMESTER- 4

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SEC1218	Fundamental of Digital Systems.	3	0	0	3	28
2.	SEC1219	Linear Electronic Circuits	3	0	0	3	29
3.	SBM1204	Biofluids and Biomechanics	3	0	0	3	30
4.	SBM1205	Radio Imaging and Therapeutics	3	0	0	3	31
5.	SBM1206	Medical Pathology	3	0	0	3	32
6.	SBM1207	Biosignals and Systems	3	1	0	4	33

PRACTICAL

7.	SBM4053	Digital Systems and Biotransducers Lab	0	0	4	2	34
8.	SBM4054	Immunology and Pathology Lab	0	0	4	2	35
9.	S24PT1	Professional Training-I	0	0	10	5	

TOTAL CREDITS: 28

SEMESTER- 5

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SEC1320	Fundamental of Microprocessor and Microcontroller	3	0	0	3	36
2.	SEC1321	Digital Signal Processing and Its Applications	3	0	0	3	37
3.	SBM1301	Diagnostic Instrumentation	3	0	0	3	38
4.	SBM1302	Analytical Instrumentation	3	0	0	3	39
5.	SBM1303	Biosignal Conditioning	3	1	0	4	40
6.	SBM1304	Biomaterials	3	0	0	3	41

PRACTICAL

7.	SBM4055	Medical Electronics Lab	0	0	4	2	42
8.	SBM4056	Microprocessor and Microcontroller Lab	0	0	4	2	43

TOTAL CREDITS: 23

SEMESTER- 6							
S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SBM1305	Biological Control Systems	3	1	0	4	44
2.	SBM1306	Artificial Organs and Tissue Engineering	3	0	0	3	45
3.	SBM1307	Rehabilitation Engineering	3	0	0	3	46
4.	SBM1308	Medical Image Processing	3	0	0	3	47
5.	SBA1101	Principles of Management and Professional Ethics	3	0	0	3	48
6.		Elective-I	3	0	0	3	
PRACTICAL							
7.	SBMSBM4057	Diagnostic Instrumentation Lab	0	0	4	2	49
8.	SBM4058	Medical Image and Signal Processing Lab	0	0	4	2	50
9.	S24PT2	Professional Training-II	0	0	10	5	
TOTAL CREDITS: 28							
SEMESTER- 7							
S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SBM1401	Biotelemetry	3	0	0	3	51
2.	SBM1402	Virtual Bioinstrumentation	3	0	0	3	52
3.		Elective II	3	0	0	3	
4.		Elective III	3	0	0	3	
PRACTICAL							
5.	SBM4059	Virtual Instrumentation Lab	0	0	4	2	53
6.	SBM4060	Therapeutic Instrumentation Lab	0	0	4	2	54
7.		PROJECT WORK PHASE-I					
TOTAL CREDITS: 16							
SEMESTER- 8							
S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SBM1403	Therapeutic Instrumentation	3	0	0	3	55
2.	SBM1404	Hospital Management	3	0	0	3	56
3.		Elective IV (University Choice Based)	3	0	0	3	
4.		PROJECT WORK PHASE-I & II	0	0	30	15	

TOTAL CREDITS: 24

TOTAL CREDITS FOR THE PROGRAMME: 190

SCS1102	FUNDAMENTALS OF PROGRAMMING (Common to ALL Branches of B.E/ B. Tech.)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- ☐ To understand the basic programming concepts.
- ☐ To understand the concept of arrays, functions and pointers.
- ☐ To gain knowledge about memory management.

UNIT 1 INTRODUCTION

9 Hrs.

Introduction: Algorithms, Pseudocodes & flowcharts, Overview of C, features of C, Structure of C program, Compilation & execution of C program. Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, and local and global variables. Operators: arithmetic, logical, relational, conditional and bitwise operators. Special operators: sizeof () & comma (,) operator. Precedence and associativity of operators & Type conversion in expressions. Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche() & putchar(). Formatted input/output: printf() and scanf().

UNIT 2 CONTROL STRUCTURES AND FUNCTIONS

9 Hrs.

Control structures: Conditional control (if, nested if, switch case), Loop control (for, while, do while) and Unconditional control structures (goto) Functions: The Need of a function, user defined and library function, prototype of a function, calling of a function, function argument, passing arguments to function, return values, nesting of function, recursion. Library Functions: Concepts, mathematical and string functions.

UNIT 3 ARRAYS AND STRINGS

9 Hrs.

Arrays: Single and multidimensional arrays, array declaration and initialization of arrays, array as function arguments. Strings: Declaration, initialization and string handling functions. Structure and Union: Defining structure, declaration of structure variable, accessing structure members, nested structures, array of structures, structure assignment, structure as function argument, function that returns structure, union.

UNIT 4 STORAGE CLASSES AND POINTERS

9 Hrs.

Storage class specifier - auto, extern, static & register Pointers: The '&' and '**' operators, pointers expressions, pointers Vs arrays

UNIT 5 MEMORY MANAGEMENT

9 Hrs.

Pointer to functions, Function returning pointers Direct Memory Access functions: malloc(), calloc(), sizeof(), free() and realloc(). Preprocessor directives. Command line arguments

Max. 45 Hours

Course Outcomes:

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

- CO1:** Comprehend fundamental concepts of programming, design algorithm and flowchart for any given problem and evaluate expressions based on precedence
- CO2:** Develop Modular Programming and formulate recursive solutions for given problems
- CO3:** Construct programs using array, structure and union data representations
- CO4:** Decide on suitable techniques like Storage Classes and Pointers for a relevant problem.
- CO5:** Apply preprocessor directives for Memory Management
- CO6:** Create programs to implement File concept for various applications

TEXT / REFERENCE BOOKS

1. Balaguruswami. E., Programming in C, TMH Publications, 1997
2. Yashavant P. Kanetkar., Let us C, Fifth Edition, .2013
3. Gottfried , Programming with C, Schaums Outline Series, TMH publications, 1997
4. Mahapatra , Thinking in C, PHI publications, 2nd Edition, 1998.
5. Subburaj . R , "Programming in C" , Vikas Publishing, First Edition, 2000

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SEE1102	BASIC ELECTRICAL ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	50

UNIT 1 D.C.CIRCUITS 9 Hrs.

Basic electrical quantities: Current, Voltage, Power, Energy, Ohm's Law, Resistors - Series and parallel combinations-Kirchoff's laws- Node and Mesh Analysis for simple resistive circuit- Star-Delta Transformation.

UNIT 2 A.C.CIRCUITS 9 Hrs.

Sinusoidal functions - RMS (effective) and Average values- Phasor representation - J operator - Sinusoidal excitation applied to purely resistive, inductive and capacitive circuits - RL, RC and RLC series and parallel circuits - Power and power factor.

UNIT 3 NETWORK THEOREMS (DC CIRCUITS) 9 Hrs.

Superposition Theorem - Reciprocity Theorem - Thevenin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem.

UNIT 4 MAGNETIC CIRCUITS 9 Hrs.

Definition of MMF, Flux and reluctance - Leakage factor - Reluctances in series and parallel (series and parallel magnetic circuits) - Electromagnetic induction - Fleming's rule - Lenz's law - Faraday's laws - Statically and dynamically induced EMF - Self and mutual inductance- Analogy of electric and magnetic circuits.

UNIT 5 INTRODUCTION TO MACHINES 9 Hrs.

Construction and principle of DC Generator - Emf equation - Types, Principle of DC Motor - Types, Construction and principle of single phase Transformer, Stepper motor, AC and DC servomotor.

Max. 45 Hours

Course Outcomes:

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

- CO1:** Apply basic principles to solve D.C Circuits
- CO2:** Analyze AC circuits with sinusoidal input
- CO3:** Solve Complex DC circuits using network theorem
- CO4:** Solve Series and parallel magnetic circuits
- CO5:** Analyse the operation of Electrical machines.
- CO6:** Justify an Electrical machine for real time applications

TEXT / REFERENCE BOOKS

1. B.N.Mittle, Aravind Mittle, "Basic Electrical Engineering", Tata McGraw Hill", 2nd Edition Sep 2011.
2. B.L.Theraja & A.K.Theraja, "A Text Book of Electrical Technology, VOL II", S.Chand & Company Ltd., 2009.
3. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, PHI Learning Private Ltd, 2010.
4. Wadhwa. C.L, "Basic Electrical Engineering", 4th Edition, New Age International, 2007.
5. Sivanagaraju S, G.Kishor & Srinivasa Rao. C, "Electrical Circuit Analysis", 1st Edition, Cengage Learning, 2010.
6. Nitin Saxena, "Electrical Engineering", 2nd Edition, Laxmi Publications Pvt Ltd, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN:

Max. Marks: 80

PART A: 10 questions of 2 marks each- No choice

PART B : 2 questions from each unit of internal choice, each carrying 12 marks
(Distribution may be 40% Theory & 60 % Numerical)

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1201	BIOINSTRUMENTATION AND MEASUREMENTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- ☐ To study the static and dynamic behavior of analog and digital instruments and basic construction and working of AC and DC instruments for measurement of Voltage and Current.
- ☐ To obtain basic knowledge of digital instruments for measurement of voltage and current.
- ☐ To study signal generator and signal analysis. Also to study the different output devices analog and digital recorders.

UNIT 1 INTRODUCTION

9 Hrs.

Function elements of measuring instrument, Error in Measurement, Sources of Error, Static Characteristics: Accuracy, Sensitivity, Reproducibility, Drift, Static error types and Dead zone, Dynamic Characteristics: Speed of Response, Fidelity, Lag and Dynamic Error, Dynamic response of different order systems, Statistical Analysis: Mean, Deviation, Average deviations and Standard deviations, Measurement Standards, Bridge Circuits: Wheatstone bridge, Maxwell's bridge and Wein's bridge.

UNIT 2 BASICSOFANALOG INSTRUMENTS

9 Hrs.

D'arsonval Galvanometer, Moving coil Instruments: Permanent magnet moving coil instrument, PMMC ammeter and PMMC voltmeter, Ohmmeter: Shunt type and Series type. Moving iron instruments: Attraction type, Repulsion type, MI Ammeter and MI Voltmeter, Electrodynamometer type instruments: Basic Electrodynamometer type instrument, Electrodynamometer type Ammeter and Electrodynamometer type voltmeter - Construction and working principle.

UNIT 3 BASICS OF DIGITAL INSTRUMENTS

9 Hrs.

Comparison between analog and digital instruments, Basic building block of a digital instrument, Ramp type digital voltmeter, Digital frequency meter, Digital phase meter and Digital storage oscilloscope.

UNIT 4 SIGNAL GENERATION AND SIGNAL ANALYSIS

9 Hrs.

Standard signal generator, AF Sine and square wave generator, Function generator, RF generator, Basic Wave Analyzer, Heterodyne wave analyzer Spectrum analyzer and Harmonic distortion analyzer.

UNIT 5 DISPLAY DEVICES AND RECORDERS

9 Hrs.

Digital Display System and Indicators: Classification of display devices, DOT MATRIX display, LED Seven Segment display, LED matrix display, LCD seven segment display, Recorders: Graphic Recorders - Strip chart recorders, Galvanometer type recorders and Self balancing type potentiometric recorders, Magnetic tape recorders and Disc recorders.

Max. 45 Hours

Course Outcomes:

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

CO1: Analyze the different characteristics of measuring instruments

CO2: Compare the working of few analog instruments that are used measure current, voltage and resistance

CO3: Apply the knowledge of working of digital instruments to measure digital parameters.

CO4: Choose proper device to generate or analyze signals.

CO5: Select instruments suitable for display and recording.

CO6: Choose a device for measuring a parameter or analyze a signal or display a measurement.

TEXT / REFERENCE BOOKS

1. A. K. Sawhney, A course in electronic Measurements and Instruments, Dhanpat Rai sons, 1991.
2. H.S. Kalsi, Electronic Instrumentation & Measurement, Tata McGraw HILL, 1995
3. W.D cooper and A. D. Helfrick, Electronic Instruments and Measurements Techniques, Prentice Hall of India-1991
4. E. O. Doebelin, Measurement System - Application & Design, Mc Graw Hill, 1990

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1202	BIOSENSORS AND TRANSDUCERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- ☐ To enable the student to gain knowledge about the measuring instruments and the methods of measurements
- ☐ To know about the types of transducers available and their applications in different fields.

UNIT 1 INTRODUCTION

9 Hrs.

General measurement system - purpose, structure and elements-Transducers - Definition, Classification. Resistance type- strain gauges, thermometers, potentiometers. Capacitive type, Inductive type- variable reluctance and LVDT. Biomedical Applications.

UNIT 2 TRANSDUCERS

9 Hrs.

Temperature transducers, Piezoelectric transducers, Piezo resistive transducers, Photoelectric transducers, Pressure transducers, Magnetostrictive transducers Biomedical applications.

UNIT 3 BIOPOTENTIAL ELECTRODES

9 Hrs.

Half cell potential (or) Electrode potential, Types of Electrodes - Micro electrodes, Depth and needle electrodes, Surface electrodes, and Chemical electrodes. Catheter type electrodes, stimulation electrodes, electrode paste, electrode material.

UNIT 4 BIOSENSORS

9 Hrs.

Introduction, biological elements, immobilization of biological components. Micro machined biosensor - cantilever based chemical sensors - Biosensors for diabetes mellitus, FAB. Biochip - introduction, gene chip.

UNIT 5 APPLICATIONS OF BIOSENSORS

9 Hrs.

ISFET for glucose and urea. IMFET, MOSFET biosensors, affinity biosensor (catalytic biosensor), Enzyme electrodes, Ion exchange membrane electrodes.

Max. 45 Hours

Course Outcomes:

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

CO1: Attain adequate knowledge about the measuring instruments used for measurement and detection of physical quantities

CO2: Identify the characteristics of various transducers and classify transducers

CO3: Attain adequate knowledge about the various electrodes and chemical sensors used for measurement and detection of physical quantities.

CO4: Apply the suitable design criteria for developing a Biosensor for a particular application.

CO5: Demonstrate the appropriate sensor approach which is most likely to meet a specific biosensor application

CO6: Predict the qualitative performance of advanced medical sensor.

TEXT / REFERENCE BOOKS

1. H.S. Kalsi, Electronic Instrumentation & Measurement, Tata McGraw HILL, 1995.
2. Brain R Eggins, Biosensors: An Introduction", John Wiley Publication.1996.
3. A. K.Sawhney, A course in Electronic Measurements and Instruments, Dhapat Rai & sons, 1991
4. John G Webster, Medical Instrumentation: Application and design, John Wiley Publications.2007.
5. John P Bentley, Principles of Measurement Systems, 3rd Edition, Pearson Education Asia, (2000 Indian reprint)
6. Geddes and Baker, Principles of Applied Biomedical Instrumentation, John Wiley Publications. 1975.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks: 80

PART A: 10 questions of 2 marks each- No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1204	BIOFLUIDS AND BIOMECHANICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To enable the student gain knowledge about the structure and function of biological systems such as humans, animals, plants, organs, and cells by means of the methods of mechanics and their applications in different fields.

UNIT 1 BIOMECHANICS

9 Hrs.

Biomechanics- Definition and perspective, Fundamental Mechanical Concepts- Kinetics and Kinematics, Newton's Laws, Mechanical Properties -Stress, Strain, Elasticity, Shear, Tension, Compression, Plastic Deformation, Creep, and Fatigue. Mechanical testing of biomaterials-UTM- Basic Engineering mechanics, Force - Resolution of forces,

UNIT 2 FLUID MECHANICS

9 Hrs.

Viscosity-Definition, properties. Types of fluids- Newtonian fluid, Non- Newtonian fluid, Types of fluid flow. Hagen-Poiseuille's equation. Viscoelasticity-Viscoelastic Models, Vascular tree, Flow properties of Blood, Physical, Chemical and Rheological properties of blood, Apparent and Relative and viscosity, Fahraeus-Lindqvist Effect

UNIT 3 HUMAN LOCOMOTION

9 Hrs.

Anthropometric Characteristics of human body. Types of motion in humans, Gait analysis. Goniometry. Accelerometer, Foot Pressure Measurements-Pedobarograph-Force platform. Mechanics of foot.

UNIT 4 HARD AND SOFT TISSUE MECHANICS

9 Hrs.

Biomechanics of upper extremities-Elbow, Shoulder. Biomechanics of lower extremities-Hip and Knee.-Tissue Mechanics-Mechanical Properties of Tissues, Biological materials, Properties of Cortical, Cancellous Bone. Soft Tissue properties Mechanical testing of Soft tissue.

UNIT 5 SPORTS MECHANICS

9 Hrs.

Application of biomechanics to neuromuscular fitness, gymnastics, Application of aerodynamics in sports, hydrodynamics in swimming. Analysis of throw and push patterns. Sports Medicine

Max. 45 Hours

Course Outcomes:

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

CO1: understands the principles of mechanics to the analysis of biological systems CO2:

remembers the engineering features of complex problems involving living systems

CO3: interrelates the appropriate problem-solving approach for biomechanical investigations CO4:

analyses and interpret raw data, e.g. motion analysis outputs and experimental flow fields CO5:

describes how mechanics plays a role in basic physiological processes in the human body CO6:

employs kinematic and kinetic principles to describe human locomotion

TEXT / REFERENCE BOOKS

1. Susan J Hall, Basic Biomechanics, Mc Graw Hill, 1999.
2. Y. G. Fung, Biomechanics, Springer-verlag New York Inc, 1990
3. Ellen Kreighbaum, Barthels, Biomechanics - A qualitative approach for studying human movement, Macmillan, 2nd Edition, 1985.
4. Joseph Bronzino Hand book of Biomedical Engineering, Springer, 2nd Edition, 2000.
5. Buddy Ratner et al., Biomaterials Science - An Introduction to Materials in Medicine, Academic Press, San Diego, 1996.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1205	RADIO IMAGING AND THERAPEUTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To obtain the knowledge about the specialty of medicine those deals with the study and application of imaging technology and enable the students to understand about radiation therapy and effects of radiation.

UNIT 1 ELEMENTS OF RADIATION

9 Hrs.

Radioactive elements and Radioisotopes in medicine, Radioactivity, General properties of alpha, beta and gamma rays - Laws of radioactivity, Radioactive decay - alpha decay, beta decay, positron decay, decay energy and half-life. Radiation units-Roentgen, Rad - rem - sievert. Radiation sources - Natural and artificial radioactive sources.

UNIT 2 RADIATION GENERATORS

9 Hrs

Particle Accelerators- Cyclotron, Klystron, Magnetron, Cascade generator, Van De Graff generator
X ray films, X ray film processing, X Ray cassettes, Intensifying screens-New phosphor technology, Photostimulable phosphor imaging.

UNIT 3 RADIO DIAGNOSIS

9 Hrs.

Fluoroscopy, Digital radiography, Angiography, Image intensifier, PET, SPECT, collimators, grids - bucky grids, Body section radiography, Xeroradiography

UNIT 4 RADIOTHERAPY

9 Hrs

COBALT-60, Linac, Gamma camera, Nuclear scintigraphy, Brachytherapy, Cyber Knife, Gamma knife, Intraoperative radiotherapy

UNIT 5 RADIATION SAFETY MEASURES

9 Hrs.

Radiation Protection, Protective barrier-primary & secondary, Equivalent Dose, Biological effects of radiation, Somatic & genetic effects of radiation-LD 50/30, Effect of radiation on skin, blood forming organs, Personnel and area monitoring systems, Radiation measuring devices -dosimeter, survey meter.

Max. 45 Hours

Course Outcomes:

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

- CO1: Understanding the elements of radiation and radioactive decay involved in radiation therapy
- CO2: Illustrate the working principle of radiation generators with the processing of X ray machine and its application
- CO3: Understanding the technique of fluoroscopy and various radio diagnosis techniques
- CO4: Demonstrate the applications of radiotherapy
- CO5: Attain the adequate knowledge about radiation measurements and effect of radiation on body
- CO6: Outline the methods of radiation safety.

TEXT / REFERENCE BOOKS

1. Thomas S. Curry, III, James E. Dowdey, Robert C. Murry J R., Christensen The Physics of Diagnostic Radiology Lea & Febiger 4th edition 1990.
2. Faiz M.Khan, The Physics of Radiation Therapy, 4th edition, 2009.
3. Gopal, B.Saha, Physics & Radiology of nuclear medicine, Springer 2nd Edition, 2006.
4. R.S Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw-Hill Publishing company Ltd, New Delhi, 1997.
5. K Thayalan, Basic Radiological Physics, Jaypee Brothers Medical Publishers (P) Ltd., 2001

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1207	BIOSIGNALS AND SYSTEMS	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

- It helps to understand the basic definition and classification of continuous time and discrete time signals and to study its analysis and its relevance to physiological signals

UNIT-1 CLASSIFICATION OF SIGNALS & SAMPLING

9 Hrs.

Continuous time signals (CT Signals) and Discrete time signals (DT Signals)- Step, Ramp, Pulse, Impulse, Exponential - Classification of CT and DT signals - Periodic, aperiodic and Random signals - Real and complex signals - Energy and power signals - Sampling theorem - Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling - Aliasing, Introduction to Band Pass sampling- Examples related to physiological signals.

UNIT-2 ANALYSIS OF CONTINUOUS TIME SIGNALS

9 Hrs.

Definition - Continuous time Fourier transform and Laplace transform analysis with examples - Decaying exponential - Rising exponential - Double exponential - Basic properties - Linearity - Parseval's relation - Convolution in time and frequency domain - Time shifting & Time reversal - Relation between Fourier transform and Laplace transform.

UNIT-3 LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS

9 Hrs.

CT systems - Linear time invariant systems - Basic properties of continuous time systems - Linearity, Causality, Time invariance, Stability - Frequency response of LTI systems - Analysis and characterization of LTI systems using Laplace transform - computation of impulse response and transfer function using Laplace transform - Differential equation - Impulse response - Convolution integral and frequency response.

UNIT-4 ANALYSIS OF DISCRETE TIME SIGNALS

9 Hrs.

Spectrum of DT signals, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT) - Basic principles of Z-Transform - Z-Transform definition - Region of convergence - Properties of ROC - Properties of Z-Transform - Poles and zeros - Inverse Z-Transform using contour integration, Residue theorem, power series expansion and Partial fraction expansion.

UNIT-5 LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS

9 Hrs.

LTI-DT systems - Characterization using difference equation - properties of convolution and interconnection of LTI systems - Causality and Stability of LTI Systems - Impulse response, convolution sum and Frequency Response - Computation of Impulse response and Transfer function using Z-Transform.

Max. 60 Hours

Course Outcomes:

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

CO1: Understand the basics of analog and discrete signals and systems

CO2: Acquire knowledge about the types of signals and systems

CO3: Apply the acquired knowledge in understanding the signal operations

CO4: Analyze the various signals using different tools and techniques

CO5: Investigate the results of various signals in their time and frequency domain

CO6: Develop the systems which can analyze the real time biosignals

TEXT / REFERENCES:

1. Allan V. Oppenheim et al, Signals and Systems, 2nd Edition., Prentice Hall of India Pvt. Ltd., 1997
2. P. Ramesh Babu et al, Signals and Systems, 4th Edition, Scitech Publishers, 2010.
3. Haykin. S and Van Been. B., Signals and Systems, 2nd Edition, John Wiley & Sons, 2003.
4. Roberts, M. J., Fundamentals of signals and Systems, 1st Edition, Tata McGraw Hill, 2007.
5. S. Salivahanan et al., Digital signal processing, 2nd Edition, Tata McGraw Hill, 2009
6. J.S. Chtod, Signals & Systems, Technical Publication, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SEC1320	FUNDAMENTALS OF MICROPROCESSOR AND MICROCONTROLLER	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- ☐ The prime objective of this course is to introduce to the students the fundamentals of microprocessor and microcontroller.
- ☐ The students will be equipped with the basic knowledge of microprocessor and microcontroller interfacing and their applications.

UNIT1 INTRODUCTION TO INTEL 8085

9Hrs.

Evolution of Microprocessor-Architecture of 8085-Instruction format-Addressing modes-Basic timing diagram of op code fetch, memory read, memory write, I/O read and I/O write-Interrupts of 8085-Software interrupts, Hardware interrupts, Priorities of interrupts 8085 based system design.

UNIT2 INTEL 8085 INTERFACING

9Hrs

Interfacing devices-8255 Programmable Peripheral Interface-Architecture & various modes of operation-8251 USART Architecture and programming features-8237, DMA Controller Architecture & Programming features. Interfacing with ADC and DAC, LCD, keyboard Interface.

UNIT3 INTRODUCTION TO 8086

9Hrs

Architecture of 8086-Registers set of 8086-Special function of general purpose register-Addressing modes of 8086-Instruction set-pipeline diagram of 8086-Timing diagram-memory read, memory write, I/O read and I/O write-Minimum and Maximum mode of operation Interrupts of 8086.

UNIT4 MICROCONTROLLER

9Hrs.

Introduction to 8-bit Microcontrollers-8051 Microcontroller Architecture-Registers set of 8051-modes of operation-Serial Port operation-Interrupt Structure of 8051-Memory and Input/Output Interfacing of 8051.

UNIT5 APPLICATIONS

9Hrs

Application of microprocessors: Stepper Motor Control, Temperature control, TTL to RS232 Conversion - RS232 to TTL Conversion-Interfacing EPROMs & SRAMs with 8085. Interfacing Bio signal to Microprocessor-block diagram.

Max. 45 Hours

Course Outcomes:

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

On completion of the course, student will be able to

CO1-Analyze the Architecture of 8085, addressing mode and instruction set to program 8085 microprocessor

CO2-Develop the assembly language programming for interfacing application using 8085 microprocessor

CO3-Describe the fundamentals of 8086, addressing mode and instruction set to program 8086 microprocessor

CO4-Develop the assembly language programs using 8051 microcontroller

CO5-Design and develop the computational complexity of assembly language program written using 8051 microcontroller

CO6-Design and develop the computational complexity of assembly language program written using 8085 microprocessor

TEXT / REFERENCE BOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 4th Edition, Publishing, New Delhi, 2000
2. Kenneth J. Ayala, 8051 Microcontroller, Thomson, 2005.

Edition, Penram International

3. Douglas V. Hall, Microprocessor and Interfacing, Tata McGraw Hill Publication, 2nd Edition, 1992.
4. Charles M. Gilmore, "Microprocessor Principle and application, McGraw Hill publication, 1995.
5. A. Nagoor Kani, Microprocessor & Microcontroller, Tata McGraw Hill, 3rd Edition, 2012
6. B. Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications, 2001

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:80

Exam Duration:3Hrs.

PART A:10 questions of 2 marks each-No choice

20 Marks

PART B:2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SEC1321	DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- This course will introduce the basic concepts and techniques for processing signals on a computer.
- By the end of the course, the student will be familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.
- The course emphasizes intuitive understanding and practical implementation of the theoretical concepts.

UNIT1 INTRODUCTION TO DISCRETE TIME SIGNALS & SYSTEMS

9Hrs.

Representations-Classification of DT Signals & DT Systems-Concepts of Signal processing-Advantages of digital signal processing compared with analog processing-Typical applications-Analysis of DT-LT Systems-Z-Transform and its properties-Inverse Z-Transform-Long division method-Partial fraction method-Residue or Contour integration method-Convolution method.

UNIT2 FREQUENCY ANALYSIS OF SIGNALS

9Hrs.

Discrete Fourier Transform and its properties - Relationship of the DFT to other transforms -General computation of DFT-convolution-Linear convolution,Circular convolution-Introduction to Fast Fourier Transform- Radix-2 FFT Algorithms-Decimation in time (DIT), Decimation in Frequency (DIF) algorithms.

UNIT3 FIR FILTER DESIGN

9Hrs.

Introduction-Digital filters Linear phase FIR filters-Designing of FIR Filters-Fourier series method of designing FIR filters-Design of FIR filters using windows-Rectangular window-Hamming Window-Hanning Window functions-Frequency sampling method of designing of FIR filters-Frequency response and Design.

UNIT4 IIR FILTER DESIGN

9Hrs.

Introduction-Frequency selective filters-Digital versus Analog filters-Advantages & disadvantages of digital filters- Butterworth and Chebyshev Filters-Frequency Transformation in analog & Digital domain-Low pass to Low pass-Low pass to High pass-Low pass to Band pass-Low pass to Band stop-Realization of digital filters-Direct form I & II.

UNIT5 DSP APPLICATION

9Hrs.

Multirate signal processing: Decimation-Efficient transversal structure & Polyphase structure of Decimator-- Interpolation-Efficient transversal structure & Polyphase structure of Interpolator-Polyphase Decimation & Interpolation using Z-Transform - Adaptive Filters: Introduction, Applications of adaptive filtering to equalization - Medical applications-ECG, EEG analysis.

Max. 45 Hours

Course Outcomes:

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

- On the completion of the course, the student will be able to,
- CO1-Understand the basics of discrete time signals and systems.
- CO2-Acquire knowledge to process the signals using different mathematical tools.
- CO3- Apply the acquired knowledge to process the discrete signals through different filters.
- CO4-Analyse the discrete time signals through time and frequency domain.
- CO5-Evaluate the polyphase and traversal structure of discrete time signals.
- CO6-Develop the system to analyse the real time bio signals for medical applications.

TEXT / REFERENCE BOOKS

1. John G. Proakis & Dimitris G. Manolakis, Digital Signal Processing - Principles, Algorithms & Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Allan V. Oppenheim et al., Signals and Systems, 2nd Edition, Prentice Hall of India Pvt. Ltd., 1997.
3. Haykin. S. and Van Beek. B., Signals and Systems, 2nd Edition, John Wiley & Sons, 2003.
4. Emmanuel C. Ifeakor, & Barrie W. Jervis, Digital Signal Processing, Second Edition, Pearson Education / Prentice Hall, 2002.
5. Sanjit K. Mitra, Digital Signal Processing-A Computer Based Approach, Tata McGraw Hill, 2007.
6. A.V. Oppenheim, R.W. Schaffer and J.R. Buck, Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
7. Andreas Antoniou, Digital Signal Processing, Tata McGraw Hill, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each-No choice

PART B: 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration: 3Hrs.

20 Marks

60 Marks

SBM1301	DIAGNOSTIC INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To gain basic knowledge about Biopotentials, Bioelectrodes and bioamplifiers and to give a complete exposure of various recording mechanisms and to understand the basic principles, working of biomedical instruments

UNIT1 BIOMEDICAL RECORDER 9Hrs.

Basic Measurement system, ECG-Lead configuration-Instrumentation set-up-effects of artifacts. EEG-10-20 Electrodes configuration-Instrumentation-recording of Evoked potentials, EMG-Measurement of nerve conduction velocity. ERG, EOG, PCG, Echocardiography.

UNIT2 IMAGING EQUIPMENTS 9Hrs.

X-Ray machine, CT-Scanning system, processing unit, viewing part & storage unit. MRI-The magnet, RF transmitter system, Gradient system, imager system, Advantages. Ultrasonic imaging systems-A Scan, B Scan, TM Mode Scan, Biomedical Applications Thermographic Equipment, PET Scan.

UNIT3 FLOWMETERS 9Hrs.

Flowmeters and CO₂ Measurement, Electromagnetic flowmeters, Ultrasonic Blood flowmeters, Laser Doppler Blood flowmeters, NMR Blood flowmeters. Indicator Dilution method, Dyedilution method, Thermal dilution method.

UNIT4 PATIENT MONITORING SYSTEMS 9Hrs.

BP measurement- Direct and indirect method, pulse rate analysis, temperature measurement, Respiration Rate, Biomedical applications, Central monitoring system. Endoscope, Laparoscopy, Oximetry.

UNIT5 GENERAL PURPOSE EQUIPMENTS 9Hrs.

Basic Audiometer-Pure tone & speech, Conventional hearing aids, Basic Spirometry. Auto Refractometer, Diopticon, Retinoscope.

Max. 45 Hours

Course Outcomes:

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

- CO1-Characterize the sources of biomedical signals and their application in biomedical recorders.
- CO2-Understand and discuss about the various image acquisition machines.
- CO3-Illustrate the working concepts of different flowmeters and dilution methods for cardiac output measurement.
- CO4-Discuss about the instruments associated with patient monitoring and its need in health care.
- CO5-Analyze the performance of instruments related to hearing and vision.

CO6-Apply the knowledge acquired to design diverse diagnostic equipment.

TEXT / REFERENCE BOOKS:

1. Alan.H.Tumadadiffe, Introduction to Visual Optics, 1987.
2. David.B.Henson, Optometric Instrumentation, 1983.
3. John G. Webster, Medical Instrumentation, John Wiley & Sons, 2007.
4. Cromwell, Biomedical Instrumentation & Measurements Prentice-hall of India private limited, 2011.
5. Carr & Brown, Introduction to Biomedical Equipment Technology, 2001.
6. Guyton & Hall, Textbook of Medical Physiology, 2010.
7. R.S. Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill Publication, 2005.
8. R. Ananda Natarajan, Biomedical Instrumentation & Measurements, PHI Publication, 2011.

END SEMESTER EXAMINATION QUESTION PAPER P A T T E R N

Max. Marks:80

PART A: 10 questions of 2 marks each-No choice

PART B: 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration: 3Hrs.

20 Marks

60 Marks

SBM1302	ANALYTICAL INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- ☐ The course offers a wide portfolio of study programs in the areas of technology, engineering and other application fields.
- ☐ It provides an introduction to the fundamental principles of chemical measurement used in medical diagnosis, quality assurance and control and research studies.
- ☐ It helps understand and appreciate the role of instruments in solving problems in physical, chemical and Biological source and discover the impact of the relevant scientific and technological advancements.

UNIT1 SPECTROPHOTOMETER

9 Hrs

Analytical methods and instrumentation types, Electromagnetic spectrum, Interaction of radiation with matter, Absorption spectra, Beer-Lambert's Law. Spectrophotometers: UV and visible ranges, single and Double Beam Instruments, FTIR and Raman Spectra- Basic principles, biomedical applications.

UNIT2 MASS SPECTROPHOTOMETER AND RADIOCHEMICAL INSTRUMENTS

9 Hrs.

Spectrofluorimeter, Flame photometry-flame emission spectrometer, atomic absorption spectrometer, Mass Spectrometer - Magnetic deflection - Time of flight - quadrupole - GCMS - Basic Principles and biomedical applications. Radiochemical Analytical Instruments - Radiation types - Ionization chamber - GM Counter - Proportional counter.

UNIT3 AUTOMATED BIOCHEMICAL ANALYZER AND ELECTROPHORESIS

9 Hrs.

System concepts-system components-sampler control units-sampling mechanisms, dialyzer-sam-II, Principles of Electrophoresis, Paper electrophoresis, Agarose Gel Electrophoresis, Isoelectric focusing, SDS PAGE, Pulse Field Electrophoresis

UNIT4 MICROSCOPIC TECHNIQUES AND GAS ANALYZER

9 Hrs.

Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic force Microscopy (AFM) and Scanning Tunneling Microscopy (STM), X-ray Diffraction (XRD)- Basic Principles and Applications, Gas Analyzers: Paramagnetic Oxygen Analyzer, Flow Analyzer- Ultrasound & NMR Blood flow analyzer.

UNIT5 CHROMATOGRAPHY

9 Hrs.

Principles, Types of chromatography- Paper Chromatography, Thin Layer Chromatography, Column Chromatography, Ion exchange Chromatography, Gel permeation Chromatography, Gas Chromatography - High Pressure Liquid Chromatography- applications in biomedical field.

Max. 60 Hours.

Course Outcomes:

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

- CO1- Understands the elements of UV visible radiation and to characterize their spectrum analysis
- CO2- Illustrates the working principle emission of mass spectrum and radiation chamber
- CO3- Explore the knowledge of electrophoresis and analyser to separate the constituents from a complex mixture
- CO4- Analyse the working mechanism and correlate it with types of electron microscope
- CO5- Determines the oxygen level using gas analyser by applying both electrostatic and magnetic properties.
- CO6- Compares the types of chromatography and their importance and applications in biomedical field

TEXT / REFERENCE BOOKS

1. D.A. Skoog, F.J. Holler & T.A. Nieman, Principles of Instrumental Analysis, 5th Edition, 1998.
2. Williard H.H., Merrit, Dean J.A, Seattle F.L, CBS, Instrumental Methods of Analysis, 1995.
3. Ewing G.W., Instrumental Methods of Analysis, McGraw Hill, 1992.
4. Robert D. Braun Introduction to Instrumental Analysis, McGraw Hill, 1987.
5. R.S. Khandpur, A Handbook of Analytical Instrumentation, 2nd Edition Tata McGraw Hill Publication, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each- No choice

PART B: 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SBM1303	BIOSIGNAL CONDITIONING	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

- To gain in depth knowledge of fundamentals of operational amplifier circuits and to study the various applications using operational amplifiers.

UNIT1 INTRODUCTION TO OPAMP

9 Hrs.

Introduction, Signal conditioning, 741 General purpose OPAMP: ideal characteristics, offset voltages and currents. Open & Closed Loop Configuration. Inverting, Non-Inverting, Summing, Voltage Follower, Integrator, differentiators, Log & Anti-Log Amplifiers, Differential Amplifiers, CMRR.

UNIT2 APPLICATION OF OPAMPS

9 Hrs.

Comparator-Zero crossing detector, Inverting and non-inverting comparator, Schmitt Trigger, Precision rectifiers- Half wave and Full wave rectifiers, Peak detectors, Monostable, Astable multivibrators, Saw tooth generator, Triangular wave form generator, Sine Wave Generators-RC Phase Shift Oscillator, Wein Bridge oscillator.

UNIT3 FILTERS

9 Hrs.

Introduction-Analog Filters, Active Filters and Passive Filters, First order and Second order Low Pass Filters, High Pass Filters, Band Pass Filters-Narrow Band Pass, Wideband Pass Filters, Band Reject Filters-Notch Filter, All Pass filters and higher order filters-Design and applications.

UNIT4 A/D AND D/A CONVERTERS

9 Hrs.

Sample and Hold circuit-D/A converters: Resistive divider and R-2R ladder networks, A/D converters: Counting type, Successive approximation, parallel comparator. Voltage to Current Converter, 555 Timer and its applications-Astable multivibrators and Monostable Multivibrator.

UNIT5 AMPLIFIERS

9 Hrs.

Instrumentation amplifiers, Bridge Amplifiers. Bioelectric Amplifiers: -Properties desired, Isolation Amplifiers: - Battery Powered, Carrier, Optically Coupled, Current Loading, Chopper Stabilized amplifier, Input Guarding.

MAX. 60 Hrs.

Course Outcomes:

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

- CO1-Understand the basic concepts, definitions of signal conditioning and characteristics of op-amps.
- CO2-Design op-amp circuit for various applications like performing math operations on signals, filtering and amplification of signals and conversion of signals from analog to digital and vice-versa
- CO3-Design op-amp circuit for various applications like performing math operations on signals, filtering and amplification of signals and conversion of signals from analog to digital and vice-versa
- CO4-Analyze the various applications and circuits based on particular linear integrated circuit.
- CO5-Compare the performances of various filters, converters and amplifiers
- CO6-Design and investigate the working of the integrated circuit for medical applications

TEXT / REFERENCE BOOKS

1. Ramakant A Gayakwad, Operational Amplifiers & Linear Integrated Circuits. Prentice Hall, 2000.
2. Joseph J. Carr & John M. Brown, Introduction to Biomedical Equipment Technology, 4th edition, Pearson Education Pvt. Ltd, 2001.
3. Roy Choudhary, Linear Integrated Circuits 2nd edition, New Age International (P) Ltd, 2004.
4. John P. Bentley, Principles of Measurement System, 3rd edition, Longman Science & Technology, 1995.
5. Jacob Millman, Micro Electronics, McGraw-Hill, 1987.
6. Robert Coughlin and Fredrer, Operational Amplifiers & Linear Integrated Circuits, Prentice Hall, 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each-No choice

PART B: 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

60 Marks

SBM1304	BIOMATERIALS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The course provides an intriguing insight in chemistry, engineering, biology and medicine that has a significant impact on biomaterials.
- It highlights the way in which modern biology and medicine is inextricably linked to scientific discipline and helping to understand the complex world of biomaterials.

UNIT1 INTRODUCTION AND METALS

9Hrs

Biomaterials-Overview, Classification of biomaterials, Interfacial Phenomena and tissue response to biomaterials, Metals and alloys for orthopedic implants-Stainless steel, Cobalt chromium alloy, Titanium and its alloys, Precious metal alloys, Other metal alloys. Dental implants-materials, types and designs

UNIT2 REPLACEMENT AND FIXATION DEVICES

9Hrs

Bioelectric effect, Wolff's Law, Types of orthopedic fixation devices-pins, screws and plates, Intra Medullary and spinal nails. Interface Problems with artificial joints and various fixation methods, hard tissue replacements - total hip and knee joint replacements. Soft tissue replacements-Sutures-Tapes, Staples, Adhesives. Maxillofacial Implants

UNIT3 POLYMERS AND APPLICATIONS

9Hrs.

Polymers in biomedical use, Hydrogels, silicone rubber, biodegradable polymers, Polymer Sterilization, Deterioration of polymers

UNIT4 BIOCERAMICS AND COMPOSITES

9Hrs

Bioceramics, types and bioactive resorbable, non-resorbable, bioceramic coatings on metallic and implants and bone bonding reactions on implantation. Hydroxyapatite-properties and applications. Composites-Types and Applications, Bioglass

UNIT5 OPHTHALMOLOGY, CORROSION AND TESTS

9Hrs

Ophthalmology-Introduction, Contact lenses, Eye shields, Viscoelastic solutions, Vitreous implants, Acrylate adhesives, Scleral buckling materials for retinal detachment, artificial tears. Corrosion, Biocompatibility and Hemocompatibility, Biological Tests. Materials surface characterization

Max. 45 Hours

Course Outcomes:

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

- CO1-Identify different types of biomaterials used to replace/restore the human tissue/organ for specific function
- CO2-Understand the hard tissue replacement and soft tissue replacement for various fixation devices
- CO3-Explain how polymers, ceramics and composites used for organ replacement technology
- CO4-Explores the knowledge how to rectify eye diseases using various biomaterials
- CO5-Apply suitable methods to test biocompatibility and hemo compatibility of biomaterials
- CO6-Implement various characterization methods to identify biomaterials

TEXT / REFERENCE BOOKS

1. Sujata VBhat, Biomaterials, Narosa Publishing House, New Delhi, 2002.
2. Rolando Barbucci, Integrated Biomaterials Science, Plenum Publishers, New York, 2002.
3. A.F. Von Recum, Handbook of Biomaterials Evaluation-Scientific, Technical and Clinical Testing of Implant Materials, 1998.
4. 2nd Edition, Taylor & Francis, Philadelphia, 1999.
5. 4.J.B Park and R.S. Lakes, Biomaterials: An Introduction, Second Edition, Plenum press, New York, 1992.
6. 5. Joseph D Bronzino, The Biomedical Engineering Hand Book, Vol-11, CRC press, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:80

PART A: 10 questions of 2 marks each-No choice

PART B: 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration: 3Hrs.

20 Marks

60 Marks

SBM1306	ARTIFICIAL ORGANS AND TISSUE ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To provide a general introduction to the use of artificial materials in the human body for the purpose of aiding healing, correcting deformities and restoring lost function.
- It is expected that the student will have successfully completed elementary course in the mechanics of deformable bodies and an introductory course to material science prior to undertake a course in biomaterials.

UNIT 1 ORGAN REPLACEMENT

9 Hrs

Evolution of organ replacement technology. Organ replacement outlook, Biology of transplantation of tissue products matching. Types of tissue grafts, design considerations, evaluation process.

UNIT 2 ARTIFICIAL ORGANS

9 Hrs

Artificial heart valves, Heart valve prosthesis - mechanical and tissue valves, Cardiac pace makers, Pacemaker Implantation, Artificial Lung, Artificial skin, Artificial pancreas, Artificial kidney, Dialysis - The Nephron and Mass Transfer, Dialysis Procedure and the Dialysis System, Dialyzer Cartridge Reuse.

UNIT 3 TRANSPLANTS

9 Hrs

Transplants types, immunological considerations, blood transfusions. Individual organs - Kidney, liver, heart, lung, bone, skin, and pancreas. Regeneration and ethical considerations

UNIT 4 TISSUE ENGINEERING

9 Hrs

Tissue engineering - Basic principles and considerations, Bioreactor - design and applications, Biomaterials - Protein surface interaction, Protein adsorption, Engineering Biomaterials for Tissue Engineering - 10 to 100 micron size scale

UNIT 5 STEM CELLS

9 Hrs

The Biology of Stem cells - Embryonic stem cells, adult stem cells, aging of stem cells, The importance of Stromal cells, Tissue engineering of Bone marrow

Max. 45 Hours

Course Outcomes:

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

- CO1: Understand organ replacement technology and evaluation process of various artificial organs.
CO2: Acquire knowledge about different types of artificial organs and their implantation.
CO3: Recognize the immunological complications of organ transplantation and graft rejection.
CO4: Demonstrate principles of stem cells and biomaterials used for tissue engineering.
CO5: Apply tissue engineering to produce biomolecules.
CO6: Implement the artificial organs to replace malfunctioning of natural organs

TEXT / REFERENCE BOOKS

- Gerald E. Miller, Artificial organs, 1st edition, A Publication in the Morgan & Claypool Publishers series, United States of America, 2006.
- J.B. Park and R.S. Lakes, Biomaterials: An Introduction 2nd Edition, Plenum press, New York, 1992.
- Joseph D Bronzino, The Biomedical Engineering hand Book Vol-11, CRC press, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1307	REHABILITATION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The course is designed to provide a brief and basic knowledge to understand musculoskeletal, neuromuscular, sensory disorders, prosthetics and orthotics and their applications.
- The main aim is to provide the basic concept so that the students can implement their knowledge for higher studies in developing innovative and effective rehabilitation and assistive technologies.

UNIT 1 INTRODUCTION TO REHABILITATION

9 Hrs.

Introduction Concepts and principles of rehabilitation engineering, Ergonomics - Positioning anatomical site, simplicity and intuitive operation, adaptability and flexibility, mental and chronological age appropriateness. Knowledge of disability act 1995 for physically disabled, visually impaired, hearing impaired and others. Rehabilitation Team.

UNIT 2 ORTHOTICS & ORTHOPROSTHETICS

9 Hrs.

Orthopedic prosthetics and orthotics in Rehabilitation Fundamentals, Applications: Computer Aides Engineering in customized component design. Intelligent prosthetic knee and hand. A self-aligning orthotic knee joint. FES System: Restoration of hand function; restoration of standing and walking. Hybrid Assistive systems (HAS) Active prostheses. Active Above knee Prosthesis. Myoelectric hand and arm prostheses. Orthotics - FO, AFO, TLSO, LSO

UNIT 3 WHEELED MOBILITY

9 Hrs.

History and Categories of Wheelchairs. Wheelchair Structure and Component Design. Ergonomics of wheel chair propulsion. Power Wheelchair Electrical System. Personal transportation. Tricycles.

UNIT 4 SENSORY AUGMENTATION AND SUBSTITUTION

9 Hrs.

Visual System: Visual augmentation. Tactual vision substitution. Auditory vision substitution: Auditory System: Auditory augmentation. Cochlear implantation. Visual auditory substitution. Tactual auditory substitution. Tactual system: Tactual augmentation. Tactual substitution. Alternative and Augmentative communication, User Interface: Outputs: Acceleration Techniques.

UNIT 5 ADVANCED APPLICATIONS IN REHABILITATION ENGINEERING

9 Hrs.

Interfaces in Compensation for visual perception. Improvement of orientation and mobility. Computer - assisted lip reading. Brain - computer interface. Electronic Travel Applications (ETA) : Path Sounder, Laser Cane, Ultrasonic Torch, Sonic Guide, Light Probes, Nottingham Obstacle Sensor, Electro-cortical Prosthesis,. Polarized Ultrasonic Travel Aid.

Max. 45 Hours.

Course Outcomes:

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

- CO1: Apply the various principles involved in rehabilitation.
- CO2: Support rehab engineers in designing orthotic and prosthetic devices.
- CO3: Compare the types of wheelchairs and assist disabled persons.
- CO4: Discover new augmentation and substitution devices for visual and hearing impaired.
- CO5: Assess the merits of support aids designed for the disabled.
- CO6: Develop and design rehabilitation devices cost effectively and purposefully.

TEXT / REFERENCE BOOKS

- Bronzino, Biomedical Engineering, Hand Book IEEE Press Volume 1.
- Robinson C. J, Rehabilitation Engineering, CRC Press. 1995.
- Ballabio E. et al, Rehabilitation Technology, IOS Press. 1993.
- Handbook of Physical Medicine & Rehabilitation, W.B.Saunders Publication, 2003.
- Hanfredclynes, Biomedical Engineering System, McGraw Hill, 1999

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1308	MEDICAL IMAGE PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To acquire knowledge about the various medical imaging techniques and to understand the fundamental principle and working of the medical imaging systems involved in the diagnosis of health care

UNIT 1 IMAGE FUNDAMENTALS

9 Hrs.

Structure of Human Eye - Image formation in eye. Fundamental steps on Image processing - components of image processing system. Basic relationship between pixels Image sensing and acquisition. Image formation model, Image sampling and quantization, aliasing, Zooming and shrinking of digital images. File Formats.

UNIT 2 IMAGE ENHANCEMENT

9 Hrs.

Enhancement by point processing - Simple intensity transformation - Histogram processing - Image subtraction - Image averaging. Spatial filtering - Smoothing filters, sharpening filters. Enhancements in frequency domain - Low pass filtering - High pass filtering. 1D DFT, 2D DFT and their properties.

UNIT 3 IMAGE RESTORATION

9 Hrs.

Model of Image degradation / restoration process. Restoration using spatial filtering - Mean filter-Medium filter - Max and Min filter - Midpoint filter. Wiener filter. Noise reduction using Frequency domain filtering - band Reject Filter, Band pass filter - Notch filter. Inverse filtering, least mean square filter.

UNIT 4 IMAGE SEGMENTATION AND COLOR IMAGE

9 Hrs.

Detection of discontinuities, Edge and Line Detection, region-based segmentation. Color image processing - Color models, Pseudo color image processing, full color image processing. Morphological Image Processing: Preliminaries, dilation, erosion process.

UNIT 5 IMAGE COMPRESSION

9 Hrs.

Data Redundancy, Image compression model - Source Encoder and Decoder, Channel encoder and decoder Information channel - Fundamental coding theorems - Noiseless coding - Noisy coding theorem.

Max. 45 Hours

Course Outcomes:

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

- CO1:** understands the fundamental concepts of digital image processing
- CO2:** demonstrates the suitable technique for accomplishing image preprocessing task
- CO3:** explains the restoration process and filtering techniques
- CO4:** Illustrate the steps involved in segmentation process
- CO5:** Analyze the performance of image compression and recognition methods
- CO6:** Assess the impact of digital image processing for medical application

TEXT / REFERENCE BOOKS

1. Raphael C. Gonzalez and Richard E. Woods, Digital Image Processing, 2nd Edition, 2001.
2. Anil K.Jain, Fundamentals of Digital Image Processing, 4th Edition, 1989.
3. William K.Pratt, Digital Image Processing, 4th Edition, 2007.
4. B. Chandra and Durtta Mujamdar, Digital Image Processing and Analysis, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1402	VIRTUAL BIOINSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- ☐ To enlighten the student on the concepts in programming, automation and measurement.
- ☐ To inculcate the theory and to develop expertise in behind data acquisition and interfacing to a computer.

UNIT 1 INTRODUCTION

9 Hrs.

Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming

UNIT 2 PROGRAMMING TECHNIQUES

9 Hrs.

VIS and sub-VIS, loops & charts, arrays, clusters, graphs, case & sequence structures, formula modes, local and global variable, string & file input. Publishing measurement data in the web.

UNIT 3 DATA ACQUISITION

9 Hrs.

Data acquisition basics: Introduction to data acquisition on PC, Sampling fundamentals, Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

UNIT 4 INSTRUMENT INTERFACES

9 Hrs.

Current loop, RS 232C/RS 485, GPIB, System basics, interface basics: USB, PCMCIA, networking basics for office & industrial application VISA & IVI, image acquisition & processing, Motion Control. ADC, DAC, DIO, DMM, waveform generator.

UNIT 5 APPLICATION OF VI

9 Hrs.

Fourier Transforms, Power spectrum, Correlation methods, windowing & flittering. Application in Process Control projects, Major equipments - Oscilloscope, Digital Multimeter, Pentium Computers, temperature data acquisition system, motion control employing stepper motor, Image acquisition and processing.

Max. 45 Hour

Course Outcomes:

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

CO1: Understand the basic concepts of virtual instrumentation

CO2: Acquire knowledge about the programming techniques in LabVIEW

CO3: Apply the knowledge in acquiring real time data

CO4: Analyse the integrated real time design of biomedical systems using LabVIEW

CO5: Explore the techniques used to process and analyse bio signals

CO6: Develop LabVIEW based real time biomedical devices

TEXT / REFERENCE BOOKS

- Gary Johnson, LABVIEW Graphical Programming, 2nd Edition, McGraw Hill, 1997.
- Lisa K. Wells and Jeffrey Travis, LABVIEW for Everyone, PHI, 1997.
- Skolkoff, Basic concepts of LABVIEW 4, PHI, 1998.
- Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.
- S. Gupta, J.P. Gupta, PC Interfacing for Data Acquisition and Process Control, ISA, 2nd Edition, 1994.
- Technical Manuals for DAS Modules of Advantech and National Instruments.
- Jerome, Virtual Instrumentation Using LabView, PHI, 2010.
- Virtual Bio-Instrumentation: Biomedical, Clinical, and Healthcare Applications in LabVIEW BY By Jon B. Olansen, Eric Rosow, 2001

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A : 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1403	THERAPEUTIC INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To acquire an adequate knowledge about measurement of various physiological parameters and to understand the fundamental principle and working of the biomedical instruments involved in the measurements.

UNIT 1 INSTRUMENTS FOR CARDIOLOGY

9 Hrs

Cardiac Pacemakers - Need for Cardiac Pacemaker - External Pacemakers - implantable Pacemakers - Recent Developments in Pacemaker system analyzer. Cardiac Defibrillators - Need for a Defibrillator - DC Defibrillator - Implantable Defibrillators - Pacer-cardio vector - defibrillator analysis.

UNIT 2 INSTRUMENTS FOR SURGERY

9 Hrs.

Instruments for surgery - principle of surgical diathermy - surgical diathermy machine - safety aspects in Electro-Surgical diathermy Units. Physiotherapy and electrotherapy equipment - High frequency heat therapy - short wave Diathermy - Microwave diathermy - Ultrasonic therapy unit - Pain relief through Electrical Stimulation - Bladder Stimulators - Cerebellar Stimulators.

UNIT 3 HAEMODIALYSIS

9 Hrs

Haemodialysis Machines - Function of the kidneys - Artificial Kidney - Dialyzers - Membranes of haemodialyzers - Haemodialysis machines - Portable Kidney machines. Lithotripters - The stone disease problem - First lithotripter machine - modern lithotripter systems - Extracorporeal Shockwave Therapy

UNIT 4 PULMONARY AND RADIOTHERAPY INSTRUMENTS

9 Hrs.

Anesthesia Machine - Need for Anesthesia - Anesthesia machine - Electronics in Anesthesia machine. Radiotherapy Equipment - Development of Betatron, chemotherapy, Heart lung Machine.

UNIT 5 VENTILATORS

9 Hrs.

Ventilators: Mechanics of Respiration - Artificial Respiration - Ventilators - Types of ventilators - Classification of Ventilators - Pressure - volume - flow Diagrams - Modern ventilators - High frequency ventilators. Humidifiers - Nebulizers and Aspirators.

Max. 45 Hours.

Course Outcomes:

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

- CO1: Apply the knowledge acquired to design a pacemaker and defibrillator
- CO2: Describe about diathermy devices used for surgery and physiotherapy.
- CO3: Assist perfusionists during dialysis and surgeries.
- CO4: Compare the ventilator working mechanism in anesthesia machines.
- CO5: Suggest instruments for drug delivery and neonatal care.
- CO6: Design various therapeutic devices based on the applications learned.

TEXT / REFERENCE BOOKS

- R. S. Khandpur, Handbook of biomedical Instrumentation, Tata McGraw Hill Publication company Ltd, New Delhi, 1997.
- Joseph J. Carr, John Michael Brown, Introduction to Biomedical Equipment Technology 4th edition, Pearson Education. 2001.
- John G. Webster, Biomedical Instrumentation, Wiley Publications. 2007.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1404	HOSPITAL MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The paper provides opportunities for training and research in all aspects of hospital / health administration. It helps to promote scientific management of hospital and advancement of health care systems so as to make it rational, responsive and cost efficient.
- The student is thus educated in the development of high quality of hospital care in the community and the country so as to provide a satisfactory environment to the patient and clinical research

UNIT 1 STANDARD OF HOSPITAL 9 Hrs
 Concept of Hospital Management - Role of Administrator - Responsibilities of Administrator - Hospital Design
 - Outlines for establishing Departmental Zones - Hospital Engineering

UNIT 2 HOSPITAL ORGANIZATION 9-Hrs.
 Organization of Out-Patient Services - Problems encountered in functioning of O.P Department - Organization of In-Patient Services-Casualty&Emergency Services-Organization and management of Operation theatres

UNIT 3 SERVICES IN HOSPITAL 9 Hrs
 Organization of Ancillary Services: Lab Services - Department of Physiotherapy & Occupational Therapy -
 Organization of Blood Transfusion Services - Department of Radio - diagnosis - Hospital Pharmacy

UNIT 4 STERILIZATION AND HOSPITAL SAFETY 9 Hrs
 Disease transmission, Sterilization and disinfection methods, Hospital safety - Radiation Safety, hazardous safety, safety disposal of biological waste - Maintenance of Equipments & Instruments.

UNIT 5 SUPPORTIVE SERVICES IN HOSPITAL 9 Hrs
 Organization and management of Nursing services and Dietary Services in hospital - House-keeping and maintenance -Medical Records -Staffing the hospital - Human resources management in hospital - Management Assisted by Computers: Reservation, Admission, Registration & Discharge Module

Max.45 Hours

Course Outcomes:

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

- CO1: Understands the principles of Hospital administration.
 CO2: Outline the problem encountered during outpatient and inpatient services.
 CO3: Recognize the importance of ancillary services in healthcare based upon the patient's perceived need
 CO4: Demonstrate the types of waste disposal and its process to dispose
 CO5: explains the safety procedures followed for hospitals equipment and precautionary about disease transmission.
 CO6: Identify the importance of Human resource management in organizing the hospital

TEXT / REFERENCE BOOKS

1. Dr. L.L. Rao, Hospital Management. Annamalai University Press
2. R. D. Lele, Computers in Medicine, Tata McGraw Hill, 2008
3. Mohan Bansal, Medical informatics, Tata McGraw Hill, 2005

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 80

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1601	TELEMEDICINE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To enable the student to understand the scope and benefits of telemedicine using communication networks and their protocols.

To learn about new healthcare needs through the applications of telemedicine.

UNIT 1 INTRODUCTION

9 Hrs.

Fundamentals of Telemedicine, Block diagram of Telemedicine, History of telemedicine: Main phases of Telemedicine, Pre electronic Telemedicine, Electronic Telemedicine. Scope & Benefits and Limitation of Telemedicine.

UNIT 2 COMMUNICATION AND NETWORK

9 Hrs.

Types of information: Audio, Video, Data, Fax, Still Image. Types of Communication and Networks: Overview of PSTN, POTS, ISDN, ATM, Videoconferencing, Wireless Communication – RF, GSM Satellite and Microwave, CDPD.

UNIT 3 DATA EXCHANGE AND NETWORK SECURITY

9 Hrs.

Basic concepts of internet, Network Configuration, Circuit and Packet Switching, H.320 series, h.324 Protocols: TCP/IP, Standards for DICOM, Security: Encryption – DES, RSA, Cryptography.

UNIT 4 ETHICAL AND LEGAL ASPECTS

9 Hrs.

Confidentiality and law, Patient Right and consent, Access to medical Records, Consent treatment, jurisdictional issues, Intellectual Property Rights.

UNIT 5 APPLICATIONS OF TELEMEDICINE

9 Hrs.

Teleradiography – Basic parts of a Teleradiography System, Image acquisition and display system, Communication, Interpretation. Telepathology: Applications, Requirements, Security and Confidentiality tools, Telecytology: Applications, Telecardiology, Telehome – Care Home based Applications, Teleoncology: Applications, Telesurgery, Telepsychiatry, Teledermatology: Techniques.

Max. 45 Hours

Course Outcomes:

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

CO1: Understand the basics of telemedicine and its application in healthcare.

CO2: Classify the various standards and protocols related to telemedicine.

CO3: Discuss about protocols and security for transfer of tele medicine data.

CO4: Understand and apply the ethical and legal issues in telemedicine.

CO5: Application of telehealth to modalities of medicine.

CO6: Compare the telehealth technologies for future challenges arising in our community.

TEXT / REFERENCE BOOKS

1. Olga (EDT), Ferrer – Roca, M. Sosa (EDT), Marcelo C, Handbook of Telemedicine, IOS press 1998.
2. Ling Guan, Multimedia image and video processing, CRC Press, 2000.
3. Thorsten M Buzug, Heinz Handels, Dietrich Holz, Telemedicine: Medicine and communication, Springer Verlag 2001.
4. Douglas V Goldstein, E Healthcare: Harness the power of internet, e – commerce and e – care, Jones and barlett Publishers. 2000.
5. A. C Norris, Essentials of Telemedicine and Telecare, John Wiley & Sons 2002

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBM1607	PHARMACOLOGY AND TOXICOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

Pharmacology is the backbone of present biomedical sciences. The student will be expected to have an introduction to the basic chemical structures and the mechanism of action of drugs in the system. This will enable the undergraduate student to implement this in their dissertation work.

UNIT 1 SYSTEMIC PHARMACOLOGY 9 Hrs.

Introduction to pharmacology; pharmacognosy, pharmacokinetics. Analgesic, antipyretic and anti-inflammatory agents, drug in rheumatoid arthritis and gout, drug in bronchial asthma, drug in allergic disorders. Chemical and biological aspects of respiratory drugs, diuretics & prostaglandins.

UNIT 2 DRUG FORMULATIONS 9 Hrs.

A fundamental introduction to solid, semisolid and liquid dosage forms, including powders, true solutions, colloids, suspensions and emulsions.

UNIT 3 PARENTAL PREPARATION 9 Hrs.

Tablets-wet granulation – dry granulation or slugging –coating of tablets. Capsules Sustained action dosage forms-parental solutions-oral liquids – injections-ointments-topical Applications-ointments preservation .Packing – Packing Techniques.

UNIT 4 DRUG DEVELOPMENT PROCESS 9 Hrs.

Methods involved in the development of new drugs. Preclinical toxicological studies. Calculation of LD50 & ED50. High throughput screening (invitro and invivo) for pre-clinical pharmacokinetic and pharmacodynamic studies. Regulatory aspects in drug development, Role of FDA, Important amendments in drugs regulation. Indian drugs and cosmetic act.

UNIT 5 ENVIRONMENTAL TOXICOLOGY 9 Hrs.

Environmental toxicants-classification - occurrence-sources-effects on plants. Heavy metal toxicity – lead and Chromium bioaccumulation. Atmospheric toxicants - Carbon monoxide, Sulphur oxides. Pollution indicators definition of indicator plants, algae. Toxins of biological origin - botulins, aflatoxins.

Max. 45 Hours

Course Outcomes:

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

CO1: Understand the basic concepts of drugs and diseases.

CO2: Learn about preparing different drugs in various forms.

CO3: Prepare various conventional drugs and its forms.

CO4: Carry out various tests for studies and learn about FDA.

CO5: Observe the effects of drugs on the environment.

CO6: Design and evaluate dosage regimens of the drugs using pharmacokinetic and biopharmaceutical parameters.

TEXT / REFERENCE BOOKS

1.K. D. Tripathi, Essential of Medical Pharmacology 6th edition, Jaypee Brothers medical Publisher(p)Ltd, 2008

2. Howland et Al, Pharmacology, Lippincott's Illustrated Reviews, ISBN Number:0-7817-4118-1, Third edition, 2006

3. Sharma P.D, Environmental Biological and Toxicology, Rastogi & co, Meerat, 1993

4. Goodman Gillman's The Pharmacological basis of therapeutics. Ed. Hardman JG, Limbird LE (Tenth Edition) McGraw Hill press New York.2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

PART A : 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBM1608	MEDICAL WASTE MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

The study would ensure safe practices and proper management of medical waste, in order to safeguard the patient, health care, community and the environment.

UNIT 1 INTRODUCTION & WASTE SEGREGATION 9 Hrs.

General Introduction, Definition of Biomedical Waste, General and Hazardous health care waste – Colour Coding and types of containers for disposal of medical waste, Segregation, Collection & Disposal.

UNIT 2 TYPES OF BIOMEDICAL WASTE 9 Hrs.

Infectious waste, Genotoxic waste, Waste Sharps – Categories, Categorization and composition of Biomedical waste. Liquid Biomedical Waste - Radioactive wastes, Metals, Chemicals & drugs

UNIT 3 HOSPITAL GENERATED WASTE 9 Hrs.

Human Blood and Blood Products, pathological wastes, Contaminated sharps, Contaminated animal carcasses, body parts, and bedding Basic information about infection, Infectious agents on organizations spread of infection, Basic information about Hospital acquired infection.

UNIT 4 TYPES OF WASTE DISPOSAL 9 Hrs.

Disinfections unit container for Autoclaving, Sharp waste containers for storage & transportation, autoclaving, Incineration, Plasma Pyrolysis /Gasification systems, Composting.

UNIT 5 BIOETHICS AND RECENT TRENDS 9 Hrs.

Modern Technology for handling Biomedical Wastes – Monitoring & Controlling of Cross Infections, Protective Devices – Bioethics and Handling of Waste Management.

Max. 45 Hours

Course Outcomes:

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

- CO1: Understand the importance colour coding for waste segregation and collection
- CO2: Attain the adequate knowledge about types of biomedical waste and the severity of hazardousness
- CO3: Understand the amount of waste generated in hospital and quantify for discard
- CO4: Demonstrate the types of waste disposal and its process to dispose
- CO5: Learn about modern technology and protective devices for handling biomedical waste
- CO6: Outline the methods of bioethics and environment safety.

TEXT / REFERENCE BOOKS

- 1.V. J. Landrum, Medical Waste Management and disposal, Elsevier, 1991, ISBN: 978-0-8155-1264-6
- 2.S A Tabish, Principles of Hospital Management, OUP, Jaypee Publishers.6th Edition 2000.
3. S L Goel, Dr. R. Kumar, Encyclopedia of Hospital Management - Text and Case Studies Hospitals in Community Health Care, ISBN(Hardbound): 8184502273, 9788184502275. 2010.
4. J. Glyn Hendry & Gary W Heinke, Environmental Science and Engineering, Prentice Hall India, 2004
5. Shyam Divan, Environmental law and policy in India, Oxford India Press, 2004.
6. Charles A Wentz, Hazardous Waste Management, McGraw Hill Inc, Newyork, 1995

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks



SATHYABAMA

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SCHOOL OF BIO & CHEMICAL ENGINEERING

DEPARTMENT OF BIOMEDICAL ENGINEERING



CRITERION 1.1.3

2010 Regulations

**B.Tech. – BIOMEDICAL ENGINEERING
REGULATIONS 2010 - CURRICULUM**

SEMESTER I

S.No	SUBJECT CODE	NAME OF THE SUBJECT	L	T	P	C	Page No.
1	SCHX1001	Environmental Science & Engineering	3	0	0	3	1
2	SMTX1003	Statistics	3	1	0	4	2
3	SPHX1001	Physics of Materials	3	0	0	3	3
4	SCYX1001	Engineering Chemistry	3	0	0	3	4
5	SCSX1002	Programming in C	3	0	0	3	5
6	SBTX1001	Cell Biology	3	0	0	3	6
7	SBTX1002	Basic Microbiology	3	0	0	3	7
8	SPHY4001	Physics Lab – I	0	0	2	1	8
9	SCYX4001	Chemistry Lab – I	0	0	2	1	8
10	SCSX4002	Programming in C Lab	0	0	4	2	8

TOTAL CREDITS 26

		SEMESTER II					
THEORY							
1	SHSX1001	English for Science and Technology	3	0	0	3	9
2	SMTX1004	Engineering Mathematics	3	1	0	4	10
3	SPHX1002	Applied Physics	3	0	0	3	11
4	SCYX1004	Applied Bioorganic Chemistry	3	0	0	3	12
5	SBTX1003	Genetics	3	0	0	3	13
6	SMEX1001	Engineering Graphics	3	0	0	3	14
7	SEEX1003	Electrical Engineering	3	0	0	3	15
8	SPHX4002	Physics Lab – II	0	0	2	1	16
9	SCYX4002	Chemistry Lab – II	0	0	2	1	16
10	SBMX4001	Microbiology Lab & Biochemisrty Lab	0	0	4	2	16

TOTAL CREDITS 26

L - Lecture hours; T - Tutorial hours; P - Practical hours; C - Credits

SEMESTER III

Sl.No.	SUBJECT CODE	NAME OF THE SUBJECT	L	T	P	C	Pg.No
1	SMTX1009	Engineering Mathematics – III	3	1	0	4	17
2	SBTX1007	Introduction to Immunology	3	0	0	3	18
3	SBMX1001	Bioinstrumentation & Measurements	3	0	0	3	19
4	SECX1001	Electronic Devices	3	0	0	3	20
5	SBMX1002	Human Anatomy & Physiology	3	0	0	3	21
6	SECX1004	Signals & Systems	3	1	0	4	22
7	SBMX1003	Biosensors & Transducers	3	0	0	3	23
8	SBMX4002	Biotransducers Lab	0	0	2	1	24
9	SECX4016	Electronic Devices Lab	0	0	2	1	24
10	SBMX4003	Human Anatomy & Physiology Lab	0	0	4	2	24

TOTAL CREDITS 27

THEORY	SEMESTER IV						
1	SECX1014	Electronic Circuit	3	0	0	3	25
2	SCSX1003	Programming in C++	3	0	0	3	26
3	SBMX1004	Medical Pathology	3	0	0	3	27
4	SECX1002	Digital Systems	3	0	0	3	28
5	SBMX1005	Biofluids & Biomechanics	3	0	0	3	29
6	SBMX1006	Digital Signal Processing & its Application	3	1	0	4	30
7	SCSX4007	Programming Lab in C++ Lab	0	0	2	1	31
8	SECX4045	Digital System Lab	0	0	2	1	31
9	SBMX4004	Immunology & Pathology Lab	0	0	4	2	31

TOTAL CREDITS 27

SEMESTER V

S.No	Subject Code	NAME OF THE SUBJECT	L	T	P	C	Pg No
1	SMTX1013	Discrete Mathematics & Numerical Methods	3	1	0	4	32
2	SBMX1007	Radiology	3	0	0	3	33
3	SBMX1008	Artificial Organs & Prosthesis	3	0	0	3	34
4	SBMX1009	Analytical Instrumentation	3	1	0	4	35
5	SECX1015	Microprocessor & Microcontroller	3	0	0	3	36
6	SECX1030	Biosignal Conditioning	3	1	0	4	37
7	SBAX1001	Principles of Management & Professional Ethics	3	0	0	3	38
8	SBMX4005	Medical Electronics Lab	0	0	4	2	39
9	SECX4010	Microprocessor & Microcontroller Lab	0	0	4	2	39

TOTAL CREDITS 28

THEORY	SEMESTER VI							
1	SMEX1017	Resource Management Techniques		3	0	0	3	40
2	SEEX1029	Biological Control System		3	1	0	4	41
3	SECX1067	Medical Image Processing		3	0	0	3	42
4	SBMX1010	Diagnostic Instrumentation		3	0	0	3	43
5		Elective – I	3	0	0	3		
6		Elective – III	3	0	0	3		
7	SBMX4006	Diagnostic Instrumentation Lab		0	0	4	2	44
8	SECX4040	Medical Image Processing Lab		0	0	2	1	44
9	SECX4041	Digital Signal Processing Lab		0	0	2	1	44

TOTAL CREDITS 23

SEMESTER VII

THEORY

1	SBMX1011	Biomaterials	3	0	0	3	45
2	SECX1068	Biotelemetry	3	0	0	3	46
3	SBMX1012	Rehabilitation Engineering	3	0	0	3	47
4	SBMX1013	Therapeutic Instrumentation	3	0	0	3	48
5		Elective – III	3	0	0	3	
6		Elective – IV	3	0	0	3	
7	SBMX4007	Therapeutic Instrumentation Lab	0	0	4	2	52

TOTAL CREDITS 21

THEORY		SEMESTER VIII					
1	SCSX1055	Fuzzy Logic & Neural Networks	3	0	0	3	49
2	SBMX1027	Virtual BioInstrumentation	3	0	0	3	50
3	SBMX1014	Hospital Management	3	0	0	3	51
4	SBMX4008	Virtual Instrumentation Lab	0	0	4	2	52
5	S24XPROJ	Project Work	0	0	30	15	52

TOTAL CREDITS 26

TOTAL CREDITS FOR THE COURSE 200

SBMX1007	RADIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION

10 hrs.

Radioactive elements, Radioactive decay, alpha decay, beta decay, positron decay, decay energy and half-life. Heisenberg uncertainty principle-Radiation units-Roentgen, Rad - rem - sievert-X ray film processing, Intensifying screens.

UNIT II RADIATION IMAGING TECHNIQUES

10 hrs.

Fluoroscopy, Angiography, Image intensifier, PET, SPECT, collimators, grids - bucky grids.

UNIT III RADIATION THERAPY INSTRUMENTS

10 hrs.

Radioisotopes in medicine – COBALT-60, linac, gamma camera, Nuclearscintigraphy, ISODOSE Chart.

UNIT IV INTRODUCTION TO LASERS

10 hrs.

Laser chart - Einsten's coefficient's – its significance-population inversion - NdYAG – He - NeLASER – Holography –Recording & Reconstruction.

UNIT V EFFECTS OF RADIATION

10 hrs.

Protective barrier-primary & secondary somatic & genetic effects of radiation-LD 50/30 effect of radiation on skin, blood forming organs, Radiation carcinogenic, permissible, occupation alldoses, dosimetry.

TEXT BOOKS:

1. Thomas S. Curry, III, James E. Dowley, Robert C. Murry JR., Christensen, "The Physics of Diagnostic Radiology", 4th Edition, Lea&Febiger, 1990

REFERENCE BOOKS:

1. Gopal,B.Saha , "Physics & Radiology of Nuclear Medicine", 2nd Edition, Springer, 2006
2. R.S Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1997.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1008	ARTIFICIAL ORGANS AND PROSTHESIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION

10 hrs.

Evolution of organ replacement technology. Organ replacement outlook, Biology of transplantation of tissue products matching. Types of tissue grafts, design considerations, evaluation process.

UNIT II ARTIFICIAL ORGANS

10 hrs.

Artificial heart and lung assist devices, Cardiac pace makers, Pacemaker Implantation, cardioverter. Artificial blood, artificial skin, artificial pancreas.

UNIT III ARTIFICIAL KIDNEY AND DEVICES

10 hrs.

The Nephron and Mass Transfer, artificial kidney, dialysis membrane, Dialysis Procedure and the Dialysis System, Dialyzer Cartridge Reuse.

UNIT IV TRANSPLANTATION

10 hrs.

Transplants types, immunological considerations, blood transfusions. Individual organs – Kidney, liver, heart, lung, bone, skin, hair and pancreas. Regeneration and ethical considerations.

UNIT V PROSTHETIC DEVICES

10 hrs.

Engineering concerns-pressure gradient, effective orifice area. Regurgitation, flow, patterns and turbulent shear stresses. Heart valve prosthesis – mechanical and tissue valves, orthotic devices, fundamentals and engineering principles of limb prosthesis.

TEXT BOOK:

1. Gerald E. Miller, "Artificial Organs", 1st Edition, A Publication in the Morgan & Claypool Publishers series, United States of America, 2006.

REFERENCE BOOKS:

1. J.B. Park and R.S. Lakes, "Biomaterials: An Introduction" 2nd Edition, Plenum press, New York, 1992.
2. Joseph D Bronzino, "The Biomedical Engineering hand Book" Vol-11, CRC press, 2000.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1009	ANALYTICAL INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO ANALYTICAL INSTRUMENTS

10 hrs.

Analytical methods and instrumentation types, Electromagnetic spectrum, Interaction of radiation with matter, Absorption spectra, Beer-Lambert's Law. Spectrophotometers: UV and visible ranges, single and Double Beam Instruments, FTIR and Raman Spectra – Basic principles, biomedical applications.

UNIT II AUTOMATED BIOCHEMICAL ANALYSIS

10 hrs.

System concepts – System Components - sampler control units - sampling mechanisms, dialyzer - samac-II. Gas Analyzers: Paramagnetic Oxygen Analyzer.

UNIT III MASS SPECTROMETER

10 hrs.

Magnetic deflection - Time of flight - quadrupole - Basic Principles and biomedical applications. RadioChemical Analytical Instruments: Radiation types - Ionization chamber - GM Counter - Proportional counter.

UNIT IV MICROSCOPIC TECHNIQUES

10 hrs.

Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM) and Scanning Tunneling Microscopy (STM) – Basic Principles and Applications.

UNIT V CHROMATOGRAPHY

10 hrs.

Principles, Types of chromatography - Liquid Chromatography - High Pressure Liquid Chromatography – applications in biomedical field.

TEXT BOOK:

1. R.S. Khandpur, "A Handbook of Analytical Instrumentation", 2nd Edition, Tata McGraw Hill Publication, 2009.

REFERENCE BOOKS:

1. D.A. Skoog, F.J. Holler & T.A. Nieman, "Principles of Instrumental Analysis", 5th Edition, Saunders College Publishing 1998
2. Ewing G.W., "Instrumental Methods of Analysis", McGraw Hill, 1992
3. Robert D. Braun "Introduction to Instrumental Analysis", McGraw Hill, 1987.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SECX1015	MICROPROCESSOR AND MICROCONTROLLER	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO INTEL 8085

10 hrs.

Evolution of Microprocessor – Architecture – Instruction format – Addressing modes – Basic timing diagram – Input – Output – Interrupt System – 8085 based system design

UNIT II INTEL 8085 INTERFACING

10 hrs.

8255 Programmable Peripherals Interface Architecture & various modes of operation – 8251 USART Architecture and programming features – 8237 DMA Controller Architecture & Programming features

UNIT III 16 – BIT MICROPROCESSOR

10 hrs.

Architecture of 8086 – Registers set of 8086 – Special function of general purpose register – Addressing modes – Instruction set – pin diagram of 8086 – Timing diagram – Minimum and Maximum mode of operation

UNIT IV MICROCONTROLLER

10 hrs.

Introduction to 8-bit Microcontrollers – 8051 Microcontroller Architecture – Registers set of 8051 – modes of Timer operation – Serial port operation – Interrupt Structure of 8051 – Memory and Input/Output Interfacing of 8051

UNIT V APPLICATIONS

10 hrs.

Analog to Digital Converter Interfacing – Digital to Analog Converter Interfacing – Stepper motor interfacing – TTL to RS232 Conversion – RS232 to TTL Conversion – Interfacing EPROMs & SRAMs.

TEXT BOOKS:

1. Ramesh Goankar, "Microprocessor Architecture, Programming and its applications with 8085", Pentam International Publications, 2007.
2. Kenneth J. Ayala, "Microcontroller", 3rd Edition, Thomson Delmar Learning, 2005.

REFERENCE BOOKS:

1. Douglas V. Hall, "Microprocessor and Interfacing", 2nd Edition, Tata MC Graw Hill Publication, 2006.
2. Charles M. Gilmore, "Microprocessor Principle and application", 2nd Edition, Mc Graw Hill Publication, 2007.
3. Nagoorkani, "Microprocessor & Applications", 2nd Edition, RBA Publication, 2010.
4. Renu Singh and B.P Singh, "Microprocessor Interfacing & Applications", 2nd Edition, New Age, 2006.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SECX1030	BIOSIGNAL CONDITIONING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I BIO-SIGNALS

10 hrs.

Introduction, Signal conditioning, 741 General purpose OPAMP: ideal characteristics, offset voltages and currents. Open & Closed Loop Configuration. BASIC OP-AMP APPLICATIONS: Inverting, Non-Inverting, Summing, Voltage Follower, Integrator, differentiators, Log & Anti-Log Amplifiers, Differential Amplifiers, CMRR.

UNIT II AMPLIFIERS

10 hrs.

Power Amplifiers, Three OPAMP Systems, and Instrumentation amplifiers, Bridge Amplifiers. Biopotential Amplifiers; Properties desired, Isolation Amplifiers: Battery Powered, Carrier, optically Coupled, Current Loading, Chopper Stabilized amplifier, Input Guarding.

UNIT III OSCILLATORS AND SIGNAL GENERATORS

10 hrs.

Comparator, Schmitt Trigger, Linear Half-wave Rectifiers, Precision rectifiers, Peak detectors, RC phase shift oscillator, Wein Bridge oscillator, Signal generators: Monostable, Astable multivibrators, Sawtooth, Triangular, Sine Wave, Square Wave Generators.

UNIT IV FILTERS

10 hrs.

Introduction, Analog Filters, Active filters, Low Pass Filters, High Pass Filters, Band Pass Filters, Band Reject Filters, All Pass filters and high Order filters and their Design.

UNIT V A/D AND D/A CONVERTERS

10 hrs.

Sample and Hold circuit - D/A converters: Resistive divider and ladder networks, A/D converters: Counting type, Successive approximation, parallel comparator. Voltage to Current Converter, 555 Timer and its applications: Astable and Monostable multivibrator.

TEXT BOOKS:

1. Ramakant A. and Gayakward, "Operational Amplifiers & Linear Integrated Circuits", 4th Edition, Prentice Hall of India, 2006
2. Joseph J. Carr & John M. Brown, "Introduction to Biomedical Equipment Technology", 4th Edition, Pearson Education Pvt. Ltd, 2001.

REFERENCE BOOKS:

1. Roy Choudhary, "Linear Integrated Circuits", 3rd Edition, New Age International Publishers, 2009
2. John P. Bentley, "Principles of Measurement System", 3rd Edition, Longman Science & Technology, 1995.
3. Jacob Mill man, "Micro Electronics", McGraw-Hill, 1987.
4. Robert Coughlin and Fredrer, "Operational Amplifiers & Linear Integrated Circuits", 5th Edition, Prentice Hall, 1997.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SECX1067	MEDICAL IMAGE PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I IMAGE FUNDAMENTALS

10 hrs.

Structure of Human Eye - Image formation in eye. Fundamental steps on Image processing – components of image processing system. Basic relationship between pixels Image sensing and acquisition. Image formation model, Image processing, Image sampling and quantization, aliasing, Zooming and shrinking of digital images.

UNIT II IMAGE TRANSFORMS AND COLOR IMAGE

10 hrs.

1D DFT, 2D DFT, Cosine, Sine Hadamard, KL transform and their properties. Color image processing – Color models, Pseudo color image processing, full color image processing

UNIT III IMAGE ENHANCEMENT

10 hrs.

Enhancement by point processing – Simple intensity transformation – Histogram processing – Image subtraction – Image averaging. Spatial filtering – Smoothing filters, sharpening filters. Enhancement in frequency domain – Low pass filtering – High pass filtering

UNIT IV IMAGE RESTORATION

10 hrs.

Model of Image degradation / restoration process. Restoration using spatial filtering – Mean filter-Medium filter – Max and Min filter – Midpoint filter. Noise reduction using Frequency domain filtering – Band Reject Filter, Band pass filter – Notch filter. Inverse filtering, least mean square filter. Edge and Line Detection

UNIT V IMAGE COMPRESSION

10 hrs.

Data Redundancy, Image compression model - Source Encoder and Decoder, Channel encoder and decoder Information channel – Fundamental coding theorems – Noiseless coding – Noisy coding theorem.

TEXT BOOK:

1. Raphael C. Gonzalez / Richard E. Woods, "Digital Image Processing", Prentice Hall India, 2nd Edition, 2002.

REFERENCE BOOKS:

1. Anil K.Jain, "Fundamentals of Digital Image Processing", 2nd Edition, Prentice Hall India, 1995.
2. William K.Pratt, "Digital Image Processing" 3rd Edition, John Wiley, 2004
3. B. Chanda and Durtta Mujamdar, "Digital Image Processing and Analysis", 1st Edition Prentice Hall of India, 2000

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1010	DIAGNOSTIC INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I BIOMEDICAL RECORDER

10 hrs.

Basic Measurement system, ECG-Lead configuration-Instrumentation set-up – effects of artifacts. EEG – 10-20 Electrodes configuration – Instrumentation – recording of Evoked potentials, EMG – Measurement of nerve conduction velocity. ERG, EOG, PCG, Holter Monitoring.

UNIT II IMAGING EQUIPMENTS

10 hrs.

X-Ray machine, CT – Scanning system, processing unit, viewing part & storage unit. MRI – The magnet, RF transmitter system, Gradient system, imager system, Advantages. Ultrasonic imaging systems – A Scan, B Scan, TM Mode Scan, Biomedical Applications Thermographic Equipment.

UNIT III FLOW METERS

10 hrs.

Flow meters and CO₂ Measurement, Electromagnetic flow meters, Ultrasonic Blood flow meters, Laser Doppler Blood flow meters, NMR Blood flow meters. Indicator Dilution method, Dye dilution method, Thermal dilution method.

UNIT IV PATIENT MONITORING SYSTEMS

10 hrs.

BP measurement – Direct and indirect method, pulse rate analysis, temperature measurement, Respiration Rate, Biomedical applications, Central monitoring system. Endoscope, Foetal Monitor, Oximetry.

UNIT V GENERAL PURPOSE EQUIPMENT

10 hrs.

Basic Audiometer – Pure tone & speech, Conventional hearing aids, Basic Spirometry. Test Standard, Trial case lense, Auto Refractometer, Diopticon, Retinoscope, Optometric Instrument.

TEXT BOOKS:

1. Khandpur R.S., "Handbook of Biomedical Instrumentation" Tata McGraw Hill Publication Company Ltd, New Delhi, 1997
2. R. AnandaNatarajan, "Biomedical Instrumentation & Measurements", PHI Publication, 2010.

REFERENCE BOOKS:

1. John G. Webster, "Medical Instrumentation", 3rd Edition, John Wiley & Sons, 2004.
2. Cromwell, "Biomedical Instrumentation & Measurements" 2nd Edition, Prentice-hall of India private limited, 2009.
3. Carr & Brown, "Introduction to Biomedical Equipment Technology", 7th Edition, Pearson Education, 2004.
4. Alan. H. Tunnacliffe, "Introduction to Visual optics", ABDO College of Education, 1993
5. David. B. Henson, "Optometric Instrumentation", 2nd Edition, Butterworth Heinemann, 1996

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1011	BIOMATERIALS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION

10 hrs.

Biomaterials – Overview, Classification of biomaterials, Interfacial Phenomena and tissue response to biomaterials, Metals and alloys for orthopedic implants-Stainless steel, Cobalt chromium alloy, Titanium and its alloys. Types of orthopedic fixation devices-pins, screws and plates, Intra Medullary and spinal nails.

UNIT II REPLACEMENT AND FIXATION

10 hrs.

Bioelectric effect, Interface Problems with artificial joints and various fixation methods, Hard tissue replacements – total hip and knee joint replacements. Dental implants – materials, types and designs

UNIT III USES AND APPLICATIONS OF POLYMERS

10 hrs.

Polymers in biomedical use, Hydrogels, silicone rubber, biodegradable polymers, Composites – Types and Applications.

UNIT IV INTRODUCTION TO OPHTHALMOLOGY

10 hrs.

Ophthalmology- introduction, contact lenses, eye shields and artificial tears. Corrosion, Biocompatibility, Biological Tests. Material surface characterization

UNIT V BIOCERAMICS

10 hrs.

Bioceramics, types and – bioactive resorbable, non – resorbable, bioceramic coatings on metallic and implants and bone bonding reactions on implantation. Hydroxyapatite – properties and applications.

TEXT BOOKS:

1. Sujata V Bhat, "Biomaterials", Narosa Publishing House, New Delhi, 2002.
2. F. Silver and C. Dillon, "Biocompatibility: Interactions of Biological and Implantable Materials" Vol. 1, VCH Publishers, New York, 1989

REFERENCE BOOKS:

1. A.F. Von Recum, "Handbook of Biomaterials Evaluation – Scientific, Technical and Clinical Testing of Implant Materials", 1st Edition, Taylor & Francis, Philadelphia, 1999.
2. J.B Park and R.S Lakes "Biomaterials: An Introduction" 2nd Edition, Plenum press, New York, 1992.
3. Joseph D Bronzino, "The Biomedical Engineering Hand Book", Vol – 11, CRC press, 2000.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1012	REHABILITATION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO REHABILITATION

10 hrs.

Introduction Concepts and principles of rehabilitation engineering, Ergonomics - Positioning anatomical site, simplicity and intuitive operation, adaptability and flexibility, mental and chronological age appropriateness. Basics and Fundamentals in Rehabilitation and its applications. Knowledge of disability act 1995 for physically disabled, visually impaired, hearing impaired and others.

UNIT II MOTOR REHABILITATION

10 hrs.

Orthopedic prosthetics and orthotics in Rehabilitation Fundamentals, Applications: Computer Aided Engineering in customized component design. Intelligent prosthetic knee. A hierarchically controlled prosthetic hand. A self-aligning orthotic knee joint. Externally powered and controlled orthotics and prostheses. **EEES System:** Restoration of hand function; restoration of standing and walking. Hybrid Assistive systems (HAS) Active prostheses. Active Above knee Prosthesis. Myoelectric hand and arm prostheses. The MARCUS Intelligent Hand Prosthesis

UNIT III WHEELED MOBILITY

10 hrs.

History and Categories of Wheelchairs. Wheelchair Structure and Component Design. Ergonomics of wheel chair propulsion. Power Wheelchair Electrical System. Personal transportation. Auxiliary drives and system.

UNIT IV SENSORY AUGMENTATION AND SUBSTITUTION

10 hrs.

Visual System: Visual augmentation, Tactual vision substitution **Auditory vision substitution:** Auditory System; Auditory augmentation, Cochlear implantation, Visual auditory substitution, Tactual auditory substitution **Tactual system:** Tactual augmentation, Tactual substitution, Augmentative communication **Control and Computer Access:** AAC; User Interface: Outputs: Acceleration Techniques.

UNIT V COMPUTER APPLICATIONS IN REHABILITATION ENGINEERING

10 hrs.

Interfaces in Compensation for visual perception. Improvement of orientation and mobility. Computer – assisted lip reading. Brain – computer interface. Computer – Aided Engineering in customized component design. Cost Effectiveness of High Vs Low – Technology Approaches; Intervention and other Issues; Environmental Control and Access to computers.

TEXT BOOK:

1. Bronzino, "Biomedical Engineering" Hand Book, 2nd Edition, Volume 1, IEEE Press, 2000

REFERENCE BOOKS:

1. Robinson C.J, " Rehabilitation Engineering", CRC Press. 1995
2. Ballabio E. et al, " Rehabilitation Technology", IOS Press. 1993.
3. Handbook of "Physical Medicine & Rehabilitation", W.B.Saunders Publication, 2003.
4. Hanfredclynes, "Biomedical Engineering System", McGraw Hill, 1999

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1013	THERAPEUTIC INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I PACEMAKER AND DEFIBRILLATORS

10 hrs.

Cardiac Pacemakers - Need for Cardiac Pacemaker - External Pacemakers - Implantable Pacemakers – Recent Developments in Pacemaker system analyzer. Cardiac Defibrillators -Need for a Defibrillator - DC Defibrillator - Implantable Defibrillators – Pacer-cardio vector - Defibrillator analysis.

UNIT II INSTRUMENTS FOR SURGERY AND TREATMENT

10 hrs.

Instruments for surgery - principle of surgical diathermy - surgical diathermy machine - safety aspects in Electro-Surgical diathermy Units. Physiotherapy and electrotherapy equipment - High frequency heat therapy - shortwave Diathermy - Microwave diathermy - Ultrasonic therapy unit – Pain relief through Electrical Stimulation – Bladder Stimulators – Cerebellar Stimulators.

UNIT III HAEMODIALYSIS MACHINE AND LITHOTRIPTERS

10 hrs.

Haemodialysis Machines - Function of the kidneys - Artificial Kidney – Dialyzers - Membranes of haemodialyzers - Haemodialysis machines - Portable Kidney machines. Lithotripters – The stone disease problem - First lithotripter machine – modern lithotripter systems - Extracorporeal Shockwave Therapy

UNIT IV ANESTHESIA MACHINE AND RADIO THERAPY EQUIPMENTS

10 hrs.

Need for Anesthesia – Anesthesia machine - Electronics in Anesthesia machine. Radiotherapy Equipment - Use of High voltage X-Ray machines - Development of Betatron, Heart lung Machine.

UNIT V VENTILATORS

10 hrs.

Mechanics of Respiration - Artificial Respiration – Ventilators - Types of ventilators - Ventilator terms - Classification of Ventilators – Pressure – volume - flow Diagrams - Modern ventilators - High frequency ventilators. Humidifiers - Nebulizers and Aspirators.

TEXT BOOK:

1. R. S. Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill Publication company Ltd, New Delhi, 1997

REFERENCE BOOKS:

1. Joseph. J Carry and John. J. Brown, "Introduction to Biomedical Equipment Technology" 4th Edition, Pearson Education, 2003
2. John G Webster, "Medical Instrumentation: Application and Design" John Wiley & Sons, 1998
3. John G Webster, "Bioinstrumentation", John Wiley & Sons, 2004

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1014	HOSPITAL MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO ADMINISTRATION

10 hrs.

Evolution of health care systems – Concept of Hospital Management – Role of Administrator – Responsibilities of Administrator – Hospital Design – Outlines for establishing Departmental Zones – Hospital Engineering.

UNIT II OUTPATIENT SERVICES

10 hrs.

Organization of Out-Patient Services – Problems encountered in functioning of O.P Department – Organization of In-Patient Services – Casualty & Emergency Services.

UNIT III ANCILLARY SERVICES

10 hrs.

Organization of Ancillary Services: Lab Services – Department of Physiotherapy & Occupational Therapy – Organization of Blood Transfusion Services – Department of Radio – diagnosis.

UNIT IV MANAGEMENT OF DIETARY SERVICES

10 hrs.

Organization and management of Dietary Services – House-keeping and maintenance – Medical Records-Staffing the hospital.

UNIT V RESOURCE MANAGEMENT

10 hrs.

Resource Mobilization - Management Assisted by Computers: Reservation, Admission, Registration & Discharge Module – Medical Record Index Module – Personnel Registration Module – Employee Registration Module – Patient Care Module – Human Resources Management Systems – Diet Planning – Pharmacy Module – Maintenance of Equipments & Instruments.

TEXT BOOK:

1. Dr. L L Rao, "Hospital Management"

REFERENCE BOOKS:

1. Dr. R. D. Lele, "Computers in Medicine", McGraw Hill, 2005.
2. Bansal, "Computers in Management"

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

PART A : 2 Questions from each unit, each carrying 2 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

Exam Duration: 3 hrs.

20 marks

60 marks

SBMX1017	COMPUTERS IN MEDICINE	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION

10 hrs.

Introduction – Historical review of development of computers and informatics – Use of internet in medicine – Online learning – Internet Vs Online services – computer based medical information retrieval – Prospectus of Medical informatics.

UNIT II HARDWARE AND NETWORKING

10 hrs.

Hardware – Microcontroller – Motherboard & its logic – RS232C and IEEE bus standards. PC based video, cards, modems and networking. System design – ECG, EMG, EEG data acquisition, storage and retrieval, transmission of signals and images.

UNIT III MANAGEMENT INFORMATION SYSTEMS

10 hrs.

Database Management – Data from patients, Coding and Classification, Computer based Patient Records, Patient Centered Information systems – Clinical departmental system, Nursing Information system. Decision support system – Artificial Intelligence – Need for expert system, Architecture and Computer based Medical diagnosis with example.

UNIT IV MONITORING AND MODELING

10 hrs.

Patient Monitoring – Physiological Monitoring, Information flow in clinical lab, Interfacing to HIS. Medical systems modeling – computer assisted drug discovery and development, Molecular modeling, pharmacophores. Radiotherapy – Role of PET and SPECT in drug discovery.

UNIT V INFORMATION SYSTEM

10 hrs.

Protein database, Patient database. Hospital Information System – Human Computer interaction in health care – Cost and benefit of information system – security in medical information system.

TEXT BOOK:

1. R. D. Lee, "Computers in Medicine", Tata McGraw – Hill, New Delhi, 1999.

REFERENCE BOOKS:

1. Mohan Bansal, "Medical Informatics" Tata McGraw Hill, 2002
2. Douglas V.Hall, "Microprocessors and Interfacing: Programming and hardware", McGraw – Hill, Singapore, 1999.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1023	PHARMACOLOGY AND TOXICOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION

10 hrs.

Preclinical studies, Clinical trials, Regulatory aspects in drug development, Role of FDA, Important amendments in drugs regulation. Indian drugs and cosmetic act.

UNIT II PHARMACEUTICS

10 hrs.

A fundamental introduction to solid, semisolid and liquid dosage forms, including powders, true solutions, colloids, suspensions and emulsions.

UNIT III PHARMACOLOGY

10 hrs.

Analgesic, antipyretic and anti-inflammatory agents, drug in rheumatoid arthritis and gout, drug in bronchial asthma, drug in allergic disorders. Chemical and biological aspects of certain drugs, respiratory drugs, diuretics & prostaglandins.

UNIT IV INDUSTRIAL PHARMACEUTICS

10 hrs.

Tablets-wet granulation – dry granulation or slugging –coating of tablets. Capsules Sustained action dosage forms-parental solutions-oral liquids – injections-ointments-topical Applications-ointments preservation .Packing –Packing Techniques.

UNIT V TOXICOLOGY

10 hrs.

Environmental toxicants-classification - occurrence-sources-effects on plants. Heavy metal toxicity – lead and Chromium bioaccumulation. Atmospheric toxicants - Carbon monoxide, Sulphur oxides. Pollution indicators definition of indicator plants, algae. Toxins of biological origin - botulins, aflatoxins.

TEXT BOOKS:

1. Tripathi, "General Pharmacology", 5th Edition, Jaypee Brothers, 2003.

REFERENCE BOOKS:

1. "Howland et Al" Lippincott's Illustrated Reviews, "Pharmacology", ISBN Number:0-7817-4118-1, 4th Edition, 2006
2. Duffous J.H, "Environmental Toxicology", Edward Arnold Publication, London, 1980.
3. Sharma P.D, "Environmental Biological and Toxicology", Rastogi & co, Meerat, 1993.
4. Leon Lachmanetal, "Theory and practice of Industrial Pharmacy", Lea and Feiger, 1986.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks

SBMX1020	MEDICAL WASTE MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION

10 hrs.

General Introduction, Definition of Biomedical Waste, General and Hazardous health care waste – Colour Coding and types of containers for disposal of medical waste, Segregation, Collection & Disposal,

UNIT II BIOMEDICAL WASTES

10 hrs.

Infectious waste, Genotoxic waste, Waste Sharps – Categories, Categorization and composition of Biomedical waste. Liquid Biomedical Waste - Radioactive wastes, Metals, Chemicals & drugs

UNIT III BLOOD PRODUCTS

10 hrs.

Human Blood and Blood Products, pathological wastes, Contaminated sharps, Contaminated animal carcasses, body parts, and bedding Basic information about infection, Infectious agents on organizations spread of infection, Basic information about Hospital acquired infection.

UNIT IV STERILISATION

10 hrs.

Disinfections unit container for Autoclaving, Sharp waste containers for storage & transportation, autoclaving, Incineration, Plasma Pyrolysis /Gasification systems, Composting.

UNIT V MODERN TECHNOLOGY FOR MEDICAL WASTES

10 hrs.

Modern Technology for handling Biomedical Wastes – Monitoring & Controlling of Cross Infections, Protective Devices – Bioethics and Handling of Waste Management.

TEXT BOOK:

1. V. J. Landrum, Medical Waste Management and disposal, Elsevier, 1991

REFERENCE BOOKS:

1. Malhotra A., Hospital Management : An Evaluation, Global India Publications, 2009.
2. S L Goel, "Hospital Management", Deep and Deep Publications, 2010.
3. J Glyn Hendry & Gary W Heinke, "Environmental Science and Engineering", Prentice Hall India, 2004
4. Shyam Divan, "Environmental law and policy in India", Oxford India Press, 2004.
5. Charles A Wentz, "Hazardous Waste Management", McGraw Hill Inc, Newyork, 1995

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 marks