SCHEME OF TEACHING AND EXAMINATION

B.E. BIOMEDICAL ENGINEERING

V SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06AL51	Management & Entrepreneurship	@	04	-	03	25	100	125
2	06BM52	8086 Microprocessors & Peripherals	BM	04	-	03	25	100	125
3	06BM53	Biomedical Transducers and Measurements	BM	04	-	03	25	100	125
4	06BM54	Digital Signal Processing & Applications	BM	04	-	03	25	100	125
5	06BM55	Clinical Instrumentation-I	BM	04	-	03	25	100	125
6	06BM56	Biomedical Equipments	BM	04	-	03	25	100	125
7	06BML57	Clinical Instrumentation Lab-I	BM	-	03	03	25	50	75
8	06BML58	8086 Microprocessor Lab	BM	-	03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

@ Any Engineering Department or department of Business Studies

SCHEME OF TEACHING AND EXAMINATION

B.E. BIOMEDICAL ENGINEERING

VI SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hours / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06BM61	Communication Systems	BM	04	-	03	25	100	125
2	06BM62	C++ & Data Structures	BM	04	-	03	25	100	125
3	06BM63	VLSI Design	BM	04	-	03	25	100	125
4	06BM64	Biomedical Digital Signal Processing	BM	04	-	03	25	100	125
5	06BM65	Clinical Instrumentation-2	BM	04	-	03	25	100	125
6	06BM66x	**Elective-I (Group A)**	BM	04	-	03	25	100	125
7	06BML67	C++ & Data Structures Lab	BM	-	03	03	25	50	75
8	06BML68	Biomedical DSP Lab	BM	-	03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

Electives-I (Group A)

06BM661 - Rehabilitation Engineering
06BM662 - Bioinformatics
06BM663 - Power Electronics
06BM664 - Computer Organization
06BM665 - Hospital Design, Planning & Management
06BM666 - Operating Systems

SCHEME OF TEACHING AND EXAMINATION

B.E. BIOMEDICAL ENGINEERING

VII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hours / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06BM71	Computer Communication & Healthcare Networks	BM	04	-	03	25	100	125
2	06BM72	Medical Imaging Systems	BM	04	-	03	25	100	125
3	06BM73	Embedded System Design	BM	04	-	03	25	100	125
4	06BM74	Medical Image Processing	BM	04	-	03	25	100	125
5	06BM75x	**Elective-II (Group B)**	BM	04	-	03	25	100	125
6	06BM76x	**Elective-III (Group C)**	BM	04	-	03	25	100	125
7	06BML77	Clinical Instrumentation Lab-II	BM	-	03	03	25	50	75
8	06BML78	Medical Image Processing Lab	BM	-	03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

Electives-II (Group B)

06BM751 - Biomechanics & Biodynamics
06BM752 - Genetic Engineering
06BM753 - Medical Informatics
06BM754 - DSP Architecture
06BM755 - Low Power VLSI Design
06BM756 - Speech Signal Processing

Electives-III (Group C)

06BM761 - Biostatistics
06BM762 - Tissue Engineering
06BM763 - Ergonomics
06BM764 - ARM Processors
06BM765 - Wavelet Transforms
06BM766 - Software Engineering

SCHEME OF TEACHING AND EXAMINATION

B.E. BIOMEDICAL ENGINEERING

VIII SEMESTER

Sl. No	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hours / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06BM81	Data Base Management System in Healthcare	BM	04	-	03	25	100	125
2	06BM82	Biomaterials & Artificial Organs	BM	04	-	03	25	100	125
3	06BM83x	**Elective-IV (Group D)**	BM	04	-	03	25	100	125
4	06BM84x	**Elective-V (Group E)**	BM	04	-	03	25	100	125
5	06BM85	Project Work	BM	-	06		100	100	200
6	06BM86	Seminar	BM		03		50	-	50
TOTAL				**16**	**09**	**12**	**250**	**500**	**750**

Electives-IV (Group-D)

06BM831 - Lasers & Optical Fibers in Medicine
06BM832 - Biosensors & Smart Sensors
06BM833 - Nanotechnology
06BM834 - Neural Networks & AI in Biomedical Engg.
06BM835 - Embedded System Programming
06BM836 - Distributed Sensor Networks

Electives-V (Group-E)

06BM841 - Bio-MEMS
06BM842 - Biological Control Systems and Modeling
06BM843 - Picture Archiving & Communication Systems
06BM844 - Pattern Recognition in Medicine
06BM845 - Digital Systems using Verilog
06BM846 - Real Time Systems

SCHEME OF TEACHING AND EXAMINATION

V SEMESTER **B.E. BIOMEDICAL ENGINEERING**

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06AL51	Management & Entrepreneurship	@	04	-	03	25	100	125
2	06BM52	8086 Microprocessors & Peripherals	BM	04	-	03	25	100	125
3	06BM53	Biomedical Transducers and Measurements	BM	04	-	03	25	100	125
4	06BM54	Digital Signal Processing & Applications	BM	04	-	03	25	100	125
5	06BM55	Clinical Instrumentation-I	BM	04	-	03	25	100	125
6	06BM56	Biomedical Equipments	BM	04	-	03	25	100	125
7	06BML57	Clinical Instrumentation Lab-I	BM	-	03	03	25	50	75
8	06BML58	8086 Microprocessor Lab	BM	-	03	03	25	50	75
Total				**24**	**06**	**24**	**200**	**700**	**900**

@ Any Engineering Department or department of Business Studies

SCHEME OF TEACHING AND EXAMINATION

VI SEMESTER **B.E. BIOMEDICAL ENGINEERING**

Sl. No	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hours / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06BM61	Communication Systems	BM	04	-	03	25	100	125
2	06BM62	C++ & Data Structures	BM	04	-	03	25	100	125
3	06BM63	VLSI Design	BM	04	-	03	25	100	125
4	06BM64	Biomedical Digital Signal Processing	BM	04	-	03	25	100	125
5	06BM65	Clinical Instrumentation-2	BM	04	-	03	25	100	125
6	06BM66x	Elective-I (Group - A)	BM	04	-	03	25	100	125
7	06BML67	C++ & Data Structures Lab	BM	-	03	03	25	50	75
8	06BML68	Biomedical DSP Lab	BM	-	03	03	25	50	75
Total				**24**	**06**	**24**	**200**	**700**	**900**

Electives-I (Group- A)		
Sl. No	**Subject Code**	**Title of the Subject**
1	06BM661	Rehabilitation Engineering
2	06BM662	Bioinformatics
3	06BM663	Power Electronics
4	06BM664	Computer Organization
5	06BM665	Hospital Design, Planning & Management
6	06BM666	Operating Systems

SCHEME OF TEACHING AND EXAMINATION

VII SEMESTER **B.E. BIOMEDICAL ENGINEERING**

Sl. No	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hours / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Pract.	Total
1	06BM71	Computer Communication & Healthcare Networks	BM	04	-	03	25	100	125
2	06BM72	Medical Imaging Systems	BM	04	-	03	25	100	125
3	06BM73	Embedded System Design	BM	04	-	03	25	100	125
4	06BM74	Medical Image Processing	BM	04	-	03	25	100	125
5	06BM75x	Elective-II (Group - B)	BM	04	-	03	25	100	125
6	06BM76x	Elective-III (Group - C)	BM	04	-	03	25	100	125
7	06BML77	Clinical Instrumentation Lab-II	BM	-	03	03	25	50	75
8	06BML78	Medical Image Processing Lab	BM	-	03	03	25	50	75
Total				**24**	**06**	**24**	**200**	**700**	**900**

Electives-II (Group- B)			Electives-III (Group- C)		
Sl. No	Subject Code	Title of the Subject	Sl. No	Subject Code	Title of the Subject
1	06BM751	Biomechanics & Biodynamics	1	06BM761	Biostatistics
2	06BM752	Genetic Engineering	2	06BM762	Tissue Engineering
3	06BM753	Medical Informatics	3	06BM763	Ergonomics
4	06BM754	DSP Architecture	4	06BM764	ARM Processors
5	06BM755	Low Power VLSI Design	5	06BM765	Wavelet Transforms
6	06BM756	Speech Signal Processing	6	06BM766	Software Engineering

SCHEME OF TEACHING AND EXAMINATION

VIII SEMESTER **B.E. BIOMEDICAL ENGINEERING**

Sl. No	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hours / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06BM81	Data Base Management System in Healthcare	BM	04	-	03	25	100	125
2	06BM82	Biomaterials & Artificial Organs	BM	04	-	03	25	100	125
3	06BM83x	Elective-IV (Group - D)	BM	04	-	03	25	100	125
4	06BM84x	Elective-V (Group - E)	BM	04	-	03	25	100	125
5	06BM85	Project Work	BM	-	06		100	100	200
6	06BM86	Seminar	BM		03		50	-	50
Total				**16**	**09**	**12**	**250**	**500**	**750**

Electives-IV (Group-D)			Electives-V (Group-E)		
Sl. No	**Subject Code**	**Title of the Subject**	**Sl. No**	**Subject Code**	**Title of the Subject**
1	06BM831	Lasers & Optical Fibers in Medicine	1	06BM841	Bio-MEMS
2	06BM832	Biosensors & Smart Sensors	2	06BM842	Biological Control Systems and Modeling
3	06BM833	Nanotechnology	3	06BM843	Picture Archiving & Communication Systems
4	06BM834	Neural Networks & AI in Biomedical Engg.	4	06BM844	Pattern Recognition in Medicine
5	06BM835	Embedded System Programming	5	06BM845	Digital Systems using Verilog
6	06BM836	Distributed Sensor Networks	6	06BM846	Real Time Systems

V SEMESTER

MANAGEMENT & ENTREPRENEURSHIP

Subject Code	:	**06AL51**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction: meaning-nature and characteristics of management, scope and functional areas of management-management as a science, art or profession-management and administration-Roles of management, Levels of management, Development of management Thought-early management approaches-Modern management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process-objectives-types of plans (meaning only)-design making-importance of planning-steps in planning and planning premises-hierarchy of plans.

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization-Principles of organization-Types of organization, departmentation, committees, Centralization Vs Decentralization of authority and responsibility-span and control-MBO and MBE (meaning) Nature and importance of staffing-process of selection and recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING AND CONTROLLING: Meaning and nature of directing-leadership styles, motivation theories, communication -meaning and importance-coordination, meaning and importance and techniques of Co-ordination. Meaning and steps in controlling-Essentials of sound control system-Methods of establishing control (in brief).

7 Hours

PART - B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of entrepreneur, Evolution of the concept, Functions of an entrepreneur, Types of Entrepreneur, Entrepreneur-an emerging class. Concept of Entrepreneurship-Evolution of Entrepreneurship,

Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship-its Barriers.

6 Hours

UNIT - 6

SMALL-SCALE INDUSTRY: Definition: Characteristics; Need and rationale: Objectives; scope; role of SSI in Economic Development. Advantages of SSI, Steps to start an SSI-government policy towards SSI; Different policies of SSI; government support for SSI during 5years plans. Impact of Liberalization, Privatization, Globalization on SSI, Effect of WTO/GATT supporting agencies of Government for SSI, meaning; Nature of support; Objectives; Functions; Types of help; Ancillary Industry and Tiny Industry (Definition).

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC single window Agency: SISI; NSIC; SIDBI; KSFC.

6 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of project: Project Identification; Project selection; project Report; Need and significance of Report; contents; formulation; Guidelines by planning Commission for project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities. Market Feasibility Study; Technical feasibility study; Financial Feasibility Study and social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **PRINCIPLES OF MANAGEMENT**- P.C.Tripathi, P.N.Reddy, Tata McGraw Hill.
2. **Dynamics of Entrepreneurial Development & Management**- Vasant Desai, Himalaya Publishing House.
3. **Entrepreneurship Development-Small Business Enterprises** - Poornima M Charantimath-Pearson Education-2006.

REFERENCE BOOKS:

1. **Manage Fundamentals-Concepts, Application, Skill Development -**Robert Lusier, Thomson.
2. **Entrepreneurship Development** - SS Khanka, S Chand &Co.
3. **Management -** Stephen Robbins, Pearson Education, PHI-17th Edition, 2003.

8086 MICROPROCESSOR & PERIPHERALS

Subject Code	:	**06BM52**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

THE PROCESSORS: 8086 / 8088: Register Organization of 8086, Architecture, Signal Descriptions of 8086, Physical Memory Organization, General Bus Operation, I/O addressing Capability, Special Processors Activities, Minimum Mode 8086 System and Timings, Maximum Mode 8086 System and Timings, The Processors 8088.

7 Hours

UNIT - 2 & 3

8086 / 8088 INSTRUCTION SET AND ASSEMBLER DIRECTIVES AND ASSEMBLY LANGUAGE PROGRAMMING: Machine Language Instruction Formats, Addressing Modes of 8086, Instruction Set of 8086, Assembler Directives and Operators, A Few Machine Level Programs, Programming with An Assembler, Assembly Language Example Programs.

12 Hours

UNIT - 4

SPECIAL ARCHITECTURAL FEATURES AND RELATED PROGRAMMING: Introduction to Stack, STACK Structure of 8086 / 8088, Interrupts and Interrupts Service Routines, Interrupt Cycle of 8086 / 8088, Non Mask able Interrupt, Mask able Interrupt (INTR), Interrupt Programming, MACROS and Timing and Delays.

7 Hours

PART - B

UNIT - 5

PERIPHERALS AND THEIR INTERFACING WITH 8086 / 8088: Semiconductor Memory Interfacing, Dynamic RAM Interfacing, Interfacing I/O Ports, PIO 8255 [Programmable Input – Output Port], Modes of Operation of 8255, Interfacing Analog to Digital Data Converters, Interfacing Digital to Analog Data Converters, Stepper Motor Interfacing, Control of High Power Devices Using 8255.

7 Hours

UNIT - 6 & 7

SPECIAL PURPOSE PROGRAMMABLE PERIPHERAL DEVICES AND THEIR INTERFACING: Programmable Interval Timer 8253, Programmable Interrupt Controller 8259A, The Keyboard / Display

Controller 8279, Programmable Communication Interface 8251 USART, DMA Controller, DMA Transfer and Operations, Programmable DMA Interface.

13 Hours

UNIT - 8

INTRODUCTION TO 80286 MICROPROCESSOR: Salient Features of 80286, internal architecture of 80286, Signal description of 80286, real addressing mode, protected virtual address mode.

6 Hours

TEXTBOOK:

1. **Advanced Microprocessors and Peripherals** – A.K.Ray and K.M. Bhurchandi, Tata McGraw Hill, 3rd Reprint, 2007.

REFERENCE BOOK:

1. **Microprocessor and Interfacing** - by Douglas V. Hall, 2nd Edn., Tata McGraw Hill, 21st Reprint, 2004.

BIOMEDICAL TRANSDUCERS AND MEASUREMENTS

Subject Code	:	**06BM53**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

FUNDAMENTAL CONCEPTS & BASIC TRANSDUCERS: Measurement, Signals and Noise in the measurement-Measurement, signals and noise, signal to noise ratio, different types of noise. Characteristics of Measurement system-Transducer and measurement system, static characteristics, dynamic characteristics, standard and calibration, accuracy and error.

Basic medical instrumentation system, performance requirements of medical instrumentation systems, PC based medical instruments, General constraints in design of medical instrumentation systems.

6 Hours

UNIT - 2

BIOELECTRIC SIGNALS AND ELECTRODES: Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Recording Electrodes – Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes

for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes.

6 Hours

UNIT - 3

PRESSURE MEASUREMENT: Physiological pressure ranges and measurement sites, Reference for pressure measurement, Direct pressure measurement-catheters for pressure measurement, diaphragm displacement transducers, catheter tip pressure transducers, implantable pressure transducers and pressure telemetering capsules, differential pressure measurements. Indirect pressure measurement-Indirect measurement of systolic, diastolic, and mean blood pressure, Detection of Kortokoff sounds, Mean BP measurements by Oscillometric method, BP measurement by Doppler ultrasound, indirect measurement of instantaneous arterial pressure.

7 Hours

UNIT - 4

TEMPERATURE MEASUREMENT: Requirements for measurement ranges, Temperature transducers – Thermistors, thermocouples, wire and thin film thermoresistive elements, P-N junction diodes and transistors, infrared radiation thermometers, infrared thermography. Clinical thermometer probes, tympanic thermometers, telemetering capsules, direct calorimetry.

7 Hours

PART- B

UNIT - 5 & 6

FLOW MEASUREMENT: Requirements for measurement ranges – blood flow in a single vessel, tissue blood flow, respiratory gas flow. Electromagnetic flowmeter – principle, methods of magnetic field excitation, perivascular probes, intravascular probes, use of external field excitation, square wave electromagnetic blood flowmeter. Ultrasonic blood flowmeters – propagation of ultrasound in the tissue, transit time and phase shift ultrasound flowmeters, ultrasonic Doppler flowmeters, blood flow measurement through Doppler imaging. Indicator dilution method – principle and working, thermodilution method, Fick method, thermistor velocity probe, impedance cardiography, Laser Doppler flowmeter, NMR blood flowmeter.

13 Hours

UNIT - 7 & 8

CHEMICAL MEASUREMENT AND BIOSENSORS: Objectives of chemical measurement, requirements and limitations in chemical measurement. Chemical Transducers – Electrochemical transducers, Electrode potential and reference electrodes, potentiometric sensors, amperometric sensors, electrochemical gas sensors, chemical transducers of acoustic and thermal principles. Biosensors – Enzyme based biosensors, immunosensors, microbial sensors. Continuous measurement of chemical

quantities – intravascular measurements, tissue measurements, measurement by blood drainage, measurement by microdialysis, measurement by effluent fluid analysis. Transcutaneous measurements - Transcutaneous measurement of pO_2, Transcutaneous measurement of pCO_2, Transcutaneous arterial oxygen saturation monitoring – the basic of oximetry, early oximeters, pulse oximeter, Electronic nose.

13 Hours

TEXT BOOKS:

1. **Biomedical Transducers and Instruments** – by Tatsuo Togawa, Toshiyo Tamura and P. Ake Oberg, CRC Press, 1997.
2. **Handbook of Biomedical Instrumentation** – by R.S.Khandpur, 2nd Edition, Tata McGraw Hill, 2003

REFERENCE BOOK:

1. **Biomedical Instrumentation and Measurement** – by Leslie Cromwell, Fred J Weibell and Erich A. Pfeiffer, 2nd Edition, Prentice-Hall India Pvt. Ltd., 2004.

DIGITAL SIGNAL PROCESSING & APPLICATIONS

Subject Code	:	**06BM54**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

THE DISCRETE FOURIER TRANSFORM: IT'S PROPERTIES & APPLICATION: Review of Signals & systems, Frequency domain sampling: The DFT frequency-Domain Sampling & reconstruction of Discrete Time signals. The Discrete Fourier transform: The DFT as a linear transformation, Relationship of the DFT to other transforms. Properties of DFT: Periodicity, Linearity, & Symmetry properties. Multiplication of two DFTs & Circular convolution. Additional DFT properties. Frequency analysis of signals using DFT.

14 Hours

UNIT - 3 & 4

EFFICIENT COMPUTATION OF DFT: FAST FOURIER TRANSFORM ALGORITHMS: Efficient Computation of the DFT: FFT Algorithms. Direct Computation of the DFT. Radix-2 FFT algorithms: Decimation-in-time FFT algorithm and in-place computations: Decimation-in-frequency FFT algorithm and in-place computations.

12 Hours

PART - B

UNIT - 5 & 6

DESIGN OF DIGITAL FILTERS: General considerations

DESIGN FIR FILTERS: Symmetric & Anti Symmetric FIR Filters, Design of Linear phase FIR filter using windows(Rectangular, Hamming, Hanning & Kaiser). Design of Linear phase FIR filters by Frequency sampling techniques,

DESIGN OF IIR FILTERS FROM ANALOG FILTERS: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation, Comparison of IIR & FIR Filters.

14 Hours

UNIT - 7

DIGITAL FILTER STRUCTURES: Basic FIR filter structures- Direct & cascade form structure. Basic IIR Filter Structures: Direct forms (I & II), cascade and parallel realizations, Signal flow graph & Transposed structure.

6 Hours

UNIT - 8

ANALYSIS OF FINITE WORD LENGTH EFFECTS: Quantization process errors, Analysis of co-efficient quantization effects, Analysis of co-efficient of quantization effects in FIR filters, Analysis of Arithmetic round off errors, Reduction of product round off errors, round off errors in FFT Algorithm.

APPLICATIONS: Dual tone Multi frequency signal detection, Spectral analysis using DFT, Short time Fourier Transform, Musical Sound Processing, Digital FM Stereo generation.

6 Hours

TEXT BOOKS:

1. **Digital Signal Processing** - Principles algorithm and application (3rd Edition) by John G. Proakis and D. Manolakis, Pearson Education, 2003.
2. **Digital Signal Processing: A computer based approach** - by S. K. Mitra, 4th Edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. **Modern Digital Signal Processing** - Roberto Cristi, Thomson Learning, 2004.
2. **Discrete Time Signal Processing -** Oppenheim and Schaffer, Pearson/PHI, 2003.
3. **Theory and Application of DSP** - Rabiner L. R and Gold B, PHI, 1999.

CLINICAL INSTRUMENTATION – I

Subject Code	:	**06BM55**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART- A

CARDIOLOGY

UNIT - 1

ELECTROCARDIOGRAM: Review of Heart Structure & Function, Conduction System of the heart, Electrocardiogram (ECG), Characteristics of the normal ECG, Cardiac arrhythmias and their electrocardiographic interpretation- Abnormal sinus rhythms, Abnormal rhythms by impulse conduction blocks, Premature contractions, Ventricular & Atrial fibrillation, Cardiac arrest.

6 Hours

UNIT - 2

ELECTROCARDIOGRAPH: Electrocardiograph, Vectorcardiograph, Heart sounds, Abnormal heart sounds, Phonocardiograph, Stress test, & Holter monitor, cardiac cath lab.

7 Hours

UNIT - 3

CARDIAC PACEMAKERS: Need, Types, External, Implantable Pacemakers-Types, Ventricular synchronous demand pacemaker, Programmable pacemaker, Rate-responsive pacemakers, Packaging, Power sources, Leads & electrodes and their problems, Reliability aspects, Recent developments, Pacing system analyzers.

Defibrillators- Need, DC defibrillator, Electrodes, DC defibrillator with synchronizer, Automatic external defibrillator, Implantable defibrillator, Defibrillator analyzer.

7 Hours

UNIT - 4

Echocardiography, Intra-Aortic Balloon Pump, CVP & Swan Ganz catheter, Open Heart Surgery & Bypass Surgery, Angioplasty, Cardiac stents.

6 Hours

TEXT BOOKS:

1. **Textbook of Medical Physiology** - by Guyton & Hall, 10th Edition, Reed Elsvier Pvt., Ltd., 2006.
2. **Hand book of Biomedical Instrumentation -** by R. S. Khandpur, 2nd Edition, Tata McGraw Hill, 2003.

PART - B

OPHTHALMOLOGY & ENT

UNIT - 5

ANATOMY AND PHYSIOLOGY OF HUMAN EYE: Aqueous Humor production, Anatomy of Normal Fundus, Study of Different Refractive Errors Vision Testing Equipment (Computerized and Manual): Snellen's Chart-Procedure for determining both distant & near vision, Keratometer- Principle, Types and procedure, Refractometer- Types & Procedure, Retinoscope-Principle, Procedure & Types, Colour Vision

Techniques of Ocular Examination: Loupe & Lens Examination, Slit-Lamp Examination, Gonioscopy, Ophthalmoscopy-Direct & Indirect.

7 Hours

UNIT - 6

EQUIPMENT USED TO MEASURE IOP: Tonometry & its Different types, Fundus Fluorescein Angiography.

METHODS OF ESTIMATING VISUAL FIELDS: Peripheral Field Charting, Central Field Charting, Strabismus & Nystagmus. Examination using various tests & Treatment: Cover – uncover test, Maddox rod test, Maddox wing test, Hess chart, Diplopia Charting and Lee screen

6 Hours

UNIT - 7

SPECIALIZED EQUIPMENT: Used in treatment: Lasers in Ophthalmology, Cryotherapy in Ophthalmology, Vitrectomy, Vitreous Liquefaction, Vitreous Opacities, Vitreous Haemorrhage, Vitrectomy – Open Sky, Pars Plana, Contact Lenses, Cataract & Surgical Techniques for Cataract Extraction, Glaucoma & Surgical Procedure for Glaucoma

6 Hours

UNIT - 8

ANATOMY & PHYSIOLOGY OF- EAR, NOSE & THROAT, MECHANICS OF HEARING & EQUILIBRIUM: Audiology & Acoustics, Audiometer-Principle, Assessment of hearing, Hearing Loss. Rehabilitation technology for the Hearing impaired, Characteristics & use of hearing Aids, cochlear implants, electronystagmography, Radiotherapy and chemotherapy in Head & Neck cancer.

7 Hours

TEXT BOOKS:

1. **Ophthalmology** - by A.K. Khurana, 3rd Edition, New Age International Pub.
2. **Parson's Diseases of Eye-** by Ramanjit Sihota & Radhika Tandon, 20th Edition, Elsevier India, 2007.

3. **Handbook of Clinical Audiology** - by Jack Katz, 4th Edition, Lippincott Wilkins Pub., 2002.
4. **A short textbook on E.N.T. Diseases** - by K.B.Bhargav, S.K.Bhargava & T.M.Shah, 6th Edition, Usha Publications, 2002.

REFERENCE BOOK:

1. **Hand book of Biomedical Instrumentation** - by R. S. Khandpur, 2nd Edition, Tata McGraw Hill, 2003.

BIOMEDICAL EQUIPMENTS

Subject Code	:	**06BM56**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

RESPIRATORY MONITORS & APNEA ALARMS: Disease states requiring artificial respiratory therapy, Respiratory impedance plethysmography, Pneumotachometers, Measurement of Volume, Pulmonary Function Analyzers, Respiratory Gas Analyzers, Alarm Circuits.

6 Hours

UNIT - 2 & 3

PATIENT MONITORING SYSTEMS, ICU/CCU/LABOUR & NEONATAL ICU: Special care units, ICU/CCU Equipments, Bed side patient monitoring systems-multiparameters, Measurement of Heart rate & Pulse rate, Recording system, Oximeters: Principle, Intravascular Oximeter. Cardiotacograph, Methods of Monitoring Foetal Heart Rate, Monitoring Labour Activity, Baby Incubator.

ELECTRO SURGERY MACHINES: Principle of Surgical Diathermy, Surgical Diathermy Machine, Safety Aspects in Electro- Surgical Units, Surgical Diathermy Analyzers, RF Power Generators for Electro surgery, Measuring RF Power Output from the ESM, Testing Electro-surgery units (Dummy Loads).

14 Hours

UNIT - 4

THERAPEUTIC EQUIPMENT: Lithotripsy- The Stone Disease Problem, Extra- corporeal Shock- wave Therapy, Automated Drug delivery devices. Radiotherapy equipment: use of HV X-Ray Machines, Development of betatron, Cobalt-60 machine, Medical Linear Accelerator machine.

6 Hours

PART - B

UNIT - 5

PHYSIOTHERAPY & ELECTROTHERAPY EQUIPMENT: High Frequency Heat Therapy, Short Wave Diathermy, Microwave Diathermy, Ultrasonic Therapy Unit, Electro diagnostic / therapeutic apparatus, pain relief through electrical stimulation, Bladder stimulators, neuro stimulators.

7 Hours

UNIT - 6

CLINICAL LABORATORY INSTRUMENTS: Colorimeters, Spectrophotometers, Clinical Flame Photometers, Electrophoresis, Electronic devices for measuring blood characteristics, Chromatography-GC & HPLC, Blood cell counters.

7 Hours

UNIT - 7

ELECTROMAGNETIC INTERFERENCE TO MEDICAL ELECTRONIC EQUIPMENT: Types & Sources of EMI, EMI effects, dealing with signal overload problems, EMI to biomedical sensors, Internode Problems, Some Solutions, Dealing with TVI/ BCI, Medical Equipment & EMI.

6 Hours

UNIT - 8

ELECTRICAL SAFETY: Physiological Effects of Electricity, Importance susceptibility parameters, Distribution of Electric power, Macro shock hazards, Microshock hazards, Electrical -Safety codes & standards, Basic approaches to protection against shock, Protection: Power distribution, Protection: Equipment design, Electrical-Safety Analyzers, Testing electric system, Tests of Electric Appliances, Problems.

6 Hours

TEXT BOOKS:

1. **Biomedical Equipment**- Use, Maintenance & Management - Joseph J. Carr, Prentice Hall, 1991.
2. **Introduction to Biomedical Equipment Technology**-J. J. Carr, 4th Edition, 7th Indian Reprint, Pearson Education, 2004.
3. **Medical Instrumentation Application & Design**- John G. Webster, 3rd Edition, John Wiley & Sons/Wiley Student Edition, 2001.
4. **Handbook of Biomedical Instrumentation**- R S Khandpur, 2nd edition, Tata McGraw Hill, 2003

CLINICAL INSTRUMENTATION LABORATORY – I

Subject Code	:	**06BML57**	IA Marks	:	25
No of Practical Hrs./week	:	03	Exam Hours	:	03
Total No of Practical Hrs.	:	42	Exam Marks	:	50

1. Measurement of Op-amp parameters (I/P Offset current, I/P bias current, Slew rate, I/P offset Voltage, PSRR, CMRR & offset nulling.
2. Inverting amplifier & attenuator, non-inverting amplifier& voltage follower.
3. Adder, substractor, integrator, differentiator.
4. Half wave & full wave precision rectifiers, Schmitt trigger.
5. Design of Active band pass & notch filters.
6. Astable & Monostable Multivibrators using Op-amp.
7. Instrumentation amplifier- Design for Different gains.
8. Design of Astable and Monostable Multivibrator using 555 timer..
9. Plot the characteristics of following transducers
   (a) Thermistor (b) LVDT (c) LDR
10. Measurement of blood pressure using sphygmomanometer & stethoscope and digital BP meter.
11. Measurement of strain using strain gauge for (i) Quarter bridge (ii) Half bridge (iii) Full bridge
12. Measurement of body temperature using AD590 / LM34

8086 MICROPROCESSOR LAB

Subject Code	:	**06BML58**	IA Marks	:	25
No of Practical Hrs./week	:	03	Exam Hours	:	03
Total No of Practical Hrs.	:	42	Exam Marks	:	50

PART - A

PROGRAMMING

1. ALP for multiplication of two numbers (16 bit, 32 bit)
2. ALP to sort a set unsigned integer numbers in ascending /descending order using different algorithm.
3. ALP to find the G.C.D. & LCM of two unsigned integers.
4. ALP to find the sum & average of unsigned integers.
5. Develop and execute ALP that implements Binary search algorithm.
6. Develop and execute an ALP to compute factorial of a positive integer number using recursive procedure.
7. ALP for conversion of 16 bit
   (i) BCD to HEX (ii) HEX to BCD numbers (iii) BCD number to 7-segment
8. ALP to copy the string of successive memory locations from one memory to other with and without using string instructions.

PART B

INTERFACING

1. Generate a square wave on PC_0 pin of 8255 in the add-on-card.
2. Generate different waveforms Sine, Square, Triangle, Ramp, etc using DAC interface.
3. Seven segment display interface.
4. Stepper motor interface
5. 8-bit ADC interface
6. Matrix keypad interface/ simulation of calculator.
7. Implement a programmable 4-bit binary/decade counter using the I/O lines in the Add-on-card
8. Using the 8255 in the Add-on-card realize an 8 to1 multiplexer

VI SEMESTER

COMMUNICATION SYSTEMS

Subject Code	:	**06BM61**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

AMPLITUDE MODULATION: Introduction. Amplitude modulation: Time-Domain description, Frequency-Domain description, Generation of AM wave: square law modulator, switching modulator, Detection of AM waves: square law detector, envelope detector, Double side band suppressed carrier modulation (DSBSC): Time -Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator, Coherent detection of DSBSC modulated waves, Costas loop, Quadrature carrier multiplexing.

6 Hours

UNIT - 2

SINGLE SIDE BAND MODULATION: Frequency-Domain description of SSB modulated signals, Frequency discrimination method for generating an SSB modulated wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB wave. Vestigial side band modulation, Frequency-Domain description, Generation of VSB modulated wave, Time domain description, Envelop detection of VSB wave plus carrier, Comparison of amplitude modulation techniques, Frequency translation, Frequency division multiplexing.

7 Hours

UNIT - 3

ANGLE MODULATION: Basic definitions, frequency modulation, narrow band frequency modulation, wide band frequency modulation, transmission band width of FM waves, generation of FM Waves: indirect FM and direct FM.

6 Hours

UNIT - 4

DEMODULATION OF FM WAVES: FM stereo multiplexing, Phase-locked loop, Nonlinear model of phase-locked loop. Linear model of phase-locked loop. Nonlinear effects in FM systems. Pre-emphasis and De-emphasis.

7 Hours

PART - B

UNIT - 5

DIGITAL COMMUNICATION: Introduction to Digital Communication, Sources and signals, basic signal processing operations in digital communication, channels for digital communication. PCM, DPCM, DM, Adaptive DPCM.

6 Hours

UNIT - 6

SAMPLING PROCESS: Sampling Theorem, quadrature sampling of Band Pass signals, reconstruction of a message from its samples, practical aspects of sampling and signal recovery, PAM, TDM.

6 Hours

UNIT - 7

METHODS OF DIGITAL DATA TRANSMISSION: Discrete PAM signals, correlative coding, eye pattern, base-band M-array, PAM systems, Digital Modulation Techniques.

7 Hours

UNIT - 8

BIOMEDICAL TELEMETRY AND TELEMEDICINE: Single channel Telemetry systems, multichannel wireless Telemetry systems, Implantable Telemetry systems, Transmission of Analog Physiological signals over Telephone, Telemedicine.

7 Hours

TEXT BOOKS:

1. **An Introduction to Analog & Digital Communications** - Simon Haykin, John Wiley 2004.
2. **Digital Communications** – Simon Haykin, John Wiley, 2006.
3. **Handbook of Biomedical Instrumentation -** by R.S.Khandpur, 2nd Edition, Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. **Principles of communication systems** - Taub and Schilling, 2nd Edition, TMH.
2. **Digital Communications** – Proakis, 4th Edition, McGraw Hill.
3. **Electronic Communication Systems** – George Kennedy and Davis, 4th Edition, 28th Reprint, Tata McGraw Hill, 2005.

C++ AND DATA STRUCTURES

Subject Code	:	**06BM62**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO C++: A Review of Structures, Procedure-Oriented Programming Systems, Object-Oriented Programming Systems, Comparison of C++ with C, Console Input/Output in C++, Variables in C++, Reference Variables in C++, Function Prototyping, Function Overloading, Default Values for Formal Arguments of Functions, Inline Functions.

CLASS AND OBJECTS: Introduction to Classes and Objects, Member Functions and Member Data

6 Hours

UNIT - 2

CLASS AND OBJECTS CONTD: Objects and Functions, Objects and Arrays, Namespaces, Nested Classes.

DYNAMIC MEMORY MANAGEMENT: Introduction, Dynamic Memory Allocation, Dynamic Memory Deallocation.

6 Hours

UNIT - 3

DYNAMIC MEMORY MANAGEMENT CONTD: The set_new_handler() function, **Constructors and Destructors:** Constructors, Destructors, The Philosophy of OOPS.

INHERITANCE: Introduction to Inheritance, Base Class and Derived Class Objects, Accessing Members of the Base Class in the Derived Class. The Protected Access Specifier, Deriving by Different Access Specifiers.

7 Hours

UNIT - 4

OPERATOR OVERLOADING: Operator Overloading, Overloading the Various Operators – Overloading the Increment and the Decrement Operators (Prefix and Postfix), Overloading the Insertion and Extraction Operators, Overloading the new and the delete Operators.

TEMPLATES: Introduction, Function Templates, Class Templates, The Standard Template Library (STL)

EXCEPTION HANDLING: Introduction, C-Style Handling of Error generating Codes, C++ Style Solution – the try/throw/catch Construct, Limitation of Exception Handling

7 Hours

PART - B

UNIT - 5

DATA REPRESENTATION: Introduction, Linear list, Formula based representation, Linked representation, Indirect Addressing, Simulating Pointers, Applications.

6 Hours

UNIT - 6

STACKS: The abstract data types, Derived Classes and inheritances, Formula based representation, Linked representation, Applications.

6 Hours

UNIT - 7

QUEUES: The abstract data Types, Formula based Representation, Linked Representation, Priority Queues, Applications.

7 Hours

UNIT - 8

BINARY AND OTHER TREES: Trees, Binary Trees, Properties of binary Trees, Representation of Binary trees, Common binary tree operations Binary Tree traversal, The ADT Binary Tree, The Class Binary Tree, ADT and Class Extensions, Application

ARRAYS AND MATRICES: Arrays, Matrices, Special Matrices.

7 Hours

TEXT BOOKS:

1. **Object-Oriented Programming with C++ -** by Sourav Sahay, Oxford University Press, 2006.
2. **Data Structure, Algorithms, and Applications in C++ -** by Sartaj Sahani, McGraw-Hill, 2000.

REFERENCE BOOKS:

1. **Object-Oriented Programming with C++** by E Balaguruswamy, 2nd Edition, Tata McGraw Hill, 2004.
2. **The Waite Group's Object** – Oriented Programming in C++ by Robert Lafore, 3rd Edition, Glagotia Pub.
3. **Data Structures and Algorithms in C++** - by Adam Drozdek, Vikas Publishing House, 2004.
4. **Data Structures and Algorithms in C++ -** by Michael T. Goodrich, Roberto Tamassia, David M. Mount, Wiley Pub., 2007.
5. **Introduction to Data structures and algorithm with C++** - by Glenn.W.Rowe, PHI, 2000.
6. D**ata structure and algorithm analysis in C++** - by Mark Allen Weiss, Addison Wesley.

VLSI DESIGN

Subject Code	:	**06BM63**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

A REVIEW OF MICROELECTRONICS AN INTRODUCTION TO MOS TECHNOLOGY: Introduction to integrated circuit technology. The integrated circuit (IC) era, Metal-oxide-semiconductor (MOS) and related VLSI technology. Basic MOS transistors. Enhancement mode transistor action. Depletion mode transistor action, nMOS fabrication CMOS fabrication. Thermal aspects of processing. BICMOS technology.

7 Hours

UNIT - 2 & 3

BASIC ELECTRICAL PROPERTIES OF MOS & BICMOS CIRCUITS: Drain-to-source current l_{ds} versus voltage V_{ds} relationships. Aspects of MOS transistor threshold voltage Vt. MOS transistor transconductance gm and output conductance gds. MOS transistor figure of merit ω0. The pass transistor. The nMOS inverter. Determination of pull-up to pull-down ratio (zp.u zp.d) for an nMOS inverter, driven by another nMOS inverter. Pull-up to pull-down ratio for an nMOS inverter driven through one or more pass transistors. Alternative forms of pull-up. The CMOS inverter MOS transistor circuit model, some characteristics of npn bipolar transistors, Latch-up in CMOS circuits. BICMOS latch-up susceptibility.

12 Hours

UNIT - 4

MOS & BICMOS CIRCUIT DESIGN PROCESSES: MOS layers. Stick diagrams. Design rules and layout General observations on the design rules. 2µm double metal. double poly. CMOS BIC CMOS rules 1.2µm double metal. single poly. CMOS rules, layout diagrams - a brief introduction. Symbolic diagram translation to mask form.

7 Hours

PART - B

UNIT - 5

BASIC CIRCUIT CONCEPTS: Sheet resistance Rs, sheet resistance concept applied to MOS transistors and inverters. Area capacitances of layers. Standard unit of capacitance ZCg some area capacitance calculation.

The delay unit τ inverter delays. Driving large capacitive loads, propagation delays, wiring capacitance. Choice of layers.

7 Hours

UNIT - 6

SCALING OF MOS CIRCUITS: Scaling models and scaling factors. Scaling factors for device parameters. Some discussion on and limitations of scaling.

SUBSYSTEM DESIGN & LAYOUT: Some architectural issues. Switch logic, Gate (restoring) logic, Examples of structured design (combinational logic).

6 Hours

UNIT - 7

SUBSYSTEM DESIGN PROCESSES: Some general considerations. An illustration of design processes.

ILLUSTRATION OF THE DESIGN PROCESS COMPUTATIONAL ELEMENTS: Some observations on the design process, regularity, Design of an ALU subsystem.

7 Hours

UNIT - 8

PRACTICAL ASPECTS & TEST ABILITY: Some thoughts on performance, further thoughts on floor plans / layout, input / output pads, further thoughts on system delays. Ground rules for successful design. CAD tools for design and simulation, aspects of design tools, test and testability.

6 Hours

TEXT BOOK:

1. **Basic VLSI Design**- Douglas A. Pucknell Kamran Eshraghian, 3rd Edition, 14th Indian Reprint, PHI.

REFERENCE BOOKS:

1. **Introduction to VLSI Systems**- Mead & Conway, Addison Wesley, 1980.
2. **VLSI Engineering** - Thomas Dillinger, 1st Edition, Prentice Hall, 1998.
3. **Principles of CMOS VLSI Design. A System Perspective** - N.Weste, K.Weste, K. Eshraghian, 2nd Edition, 4th Indian Reprint, Addison-Wesley Publishing Co., 2000.
4. **Modern VLSI Design – Systems on Silicon** - Wayne Wolf, 2nd Edition, Pearson Education Asia, 2003.

BIOMEDICAL DIGITAL SIGNAL PROCESSING

Subject Code	:	**06BM64**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

INTRODUCTION TO BIOMEDICAL SIGNALS: The nature of biomedical signals, The action potential, objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, computer aided diagnosis.

NEUROLOGICAL SIGNAL PROCESSING: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis, Linear prediction theory, The Autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination- The case of epileptic patients, overall performance.

13 Hours

UNIT - 3 & 4

SLEEP EEG: Data acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of sleep-wake transitions, Hypnogram model parameters, Event history analysis for modeling sleep.

ADAPTIVE INTERFERENCE/NOISE CANCELLATION: A review of Wiener filtering problem, Principle of an Adaptive filter, The steepest-descent algorithm, the Widrow-Hoff least mean square adaptive algorithm, Adaptive noise canceller, Cancellation of 60Hz interference in ECG, Canceling Donor-heart interference in Heart-transplant electrocardiography, Cancellation of ECG signal from the electrical activity of the chest muscles, canceling of maternal ECG in fetal ECG, Cancellation of High frequency noise in Electro-surgery.

13 Hours

PART - B

UNIT - 5

CARDIOLOGICAL SIGNAL PROCESSING: Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, The use of multi-scale analysis for parameter estimation of ECG waveforms.

7 Hours

UNIT - 6 & 7

CARDIOLOGICAL SIGNAL PROCESSING (CONTD…): Arrhythmia analysis monitoring, long term continuous ECG recording.

ECG DATA REDUCTION TECHNIQUES: Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Other data compression techniques, Data compression techniques comparison.

12 Hours

UNIT - 8

PRONY'S METHOD: Exponential modeling, Exponential parameter estimation, The original Prony problem, Least squares prony method, The covariance method of linear prediction, Prony's method in the presence of noise, clinical application of prony's method.

7 Hours

TEXT BOOKS:

1. **Biomedical Signal Processing Principles and Techniques by** - D. C. Reddy, Tata McGraw-Hill, 2005.
2. **Biomedical Signal Analysis A case study approach** - by Rangaraj M. Rangayyan, John Wiley, 2002.

REFERENCE BOOK:

1. **Biomedical Digital Signal Processing** - by Willis J. Tompkins, Prentice Hall of India publications/ Eastern Economy Edition, 2nd Print, 2000.

CLINICAL INSTRUMENTATION – II

Subject Code	:	**06BM65**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

NEUROLOGY & ORTHOPAEDICS

UNIT - 1

Functional Topography of Brain, Higher Functions of Nervous System- Learning, Memory, Judgement, Language, Consciousness.

Neurologic Examination- Testing of higher cortical functions, cranial nerves, motor function, reflex function, sensory function, Gait and stance, Lumbar puncture & examination of CSF- Indications & Technique.

Radiological Examination (in brief applied to neurology) - Computed Tomography, MRI, Angiography, PET, SPECT, Ultrasound Scanning.

6 Hours

UNIT - 2

Electroencephalography, EEG Electrodes and 10-20 System, EEG Amplitude and frequency bands, EEG diagnostic uses- Sleep patterns & abnormalities, Epilepsy, Multichannel EEG recording systems and typical external controls, EEG system, Preamplifiers and EEG system specifications, EEG telemetry system. Typical EEG system artifacts, troubleshooting and maintenance.

Visual and auditory evoked potentials, Somatosensory evoked potentials, Motor paralysis- Definition, Patterns of paralysis & their diagnosis, Neuromuscular junction and its disorder, Electromyography, EMG System, Studies of nerve conduction, H-reflex, F-wave, Blink response, Jolly test, Needle examination of muscle, Neuromuscular Stimulation (NMS).

7 Hours

UNIT - 3

Pathology of Fractures and Fracture healing- Classification, Closed and open fractures, Patterns of fracture, Healing of fractures, Repair of tubular bone, Rate of union, Fatigue or stress fractures, Pathological fractures. Clinical and Radiological features of fractures- Clinical examination, Radiographic examination, Tests of union.

Principles of Fracture treatment- Initial management, Reduction, Methods of reduction, Immobilization, Methods of immobilization, External fixation- Indications, Types. Internal Fixation- Indications, Types. Complications of fractures (list only), Bone grafting for delayed union and non-union, Electromagnetic stimulation.

7 Hours

UNIT - 4

SYNOVIAL FLUID & MEMBRANE: Synovial fluid composition, Basic functions of synovial fluid, Synovial joint lubrication- Fluid film, boundary, weeping & boosted lubrication. Arthritis- Types, Rheumatoid arthritis, Osteoarthritis. Joint replacement- Hip & Knee.

HUMAN GAIT: Definition, Divisions of gait cycle, Functional tasks in gait, Phases of gait, Temporal parameters, Abnormal gaits-Cerebellar gait, Hemiplegic & Paraplegic gaits, Gaits of the mentally retarded, Principle of Tendon transport, Spinal deformities- Scoliosis, types, diagnosis, Spinal deformity correction & spinal implants.

6 Hours

TEXT BOOKS:

1. **Adams & Victor's Principles of Neurology** - by Allan H. Ropper and Robert H. Brown, 8th Edition, McGraw Hill, 2005.
2. **Concise Medical Physiology**- by Sujit K. Chaudhuri, 5th Edition, New Central Book Agency Pvt. Ltd, 2004.
3. **Ross & Wilson's Anatomy and Physiology in Health and Illness** – by Anne Waugh and Allison Grant, 9th Edition, Churchill Livingstone, Publications, 2003.

4. **Introduction to Biomedical Equipment Technology** - by Joesh J Carr and John M. Brown, 4th Edition, PHI / Pearson Education Asia, 2001.
5. **Outline of Fractures -** by John Crawford Adams & David Hamblen, 11th Edition, Churchill Livingstone, 1999.
6. **Outline of Orthopaedics -** by John Crawford Adams & David Hamblen, 13th Edition, Churchill Livingstone
7. **Physical Rehabilitation** - by Susan B O'Sullivan, Thomas J Schmitz. 5th Edition, Jaypee Pub., 2007.

PART - B

ANESTHESIA

UNIT - 5

PHYSICAL PRINCIPLES, MEASUREMENT OF GAS FLOW AND VOLUME: Introduction & Gas Laws, Differential Pressure Flowmeters, Variable-Area Flowmeters, Anemometry, Spirometers.

VAPORIZERS & HUMIDIFIERS: Introduction, Vaporizing Systems (Draw-Over Systems), Other Factors Affecting Vapour Concentration, Summary of Vaporizer Performance, Calibration of Vaporizers, Examples of Vaporizers: Boyle's Vapourisers & its use. Definitions of Humidifiers, Importance of Humidification, Examples of Humidification Equipment.

7 Hours

UNIT - 6

THE CONTINUOUS FLOW ANESTHETIC MACHINE: Introduction, Machine Framework, Pin Index System for Gas Cylinders, Other Types of Gas-Tight Connections Within the Machine, Pressure Gauges, Pressure Regulators, (Reducing Valves), The Back Bar, Safety Features, The Common Gas Outlet, Auxiliary Gas Sockets. Maintenance of Anesthetic Machines.

6 Hours

UNIT - 7

ELECTRONICS IN THE ANESTHETIC MACHINE: Introduction, Ergonomics, Control Engineering, New Components, An Electronically Controlled Anesthetic Machine, Servo-controlled Anesthesia.

BREATHING SYSTEMS & NONBREATHING SYSTEMS: Definitions, Classification of Breathing Systems, Classification of Systems with Potential for Rebreathing- Mapleson A breathing system, Mapleson A & controlled ventilation. Mapleson D system with spontaneous respiration, Mapleson D system with controlled ventilation, Non-Rebreathing Systems- Anesthetic non Rebreathing system which include CO_2 absorption.

6 Hours

UNIT - 8

MONITORING OF GASES: Introduction, Inspired Oxygen Concentration (working principle of Galvanic Oxygen fuel cell, Servomex paramagnetic oxygen analyzer, Nitrous Oxide and the Volatile Agents: The Riken gas indicator, Bruel & Kjaer Anesthetic gas monitor, Raman anesthetic gas monitor, Hewlett- Packard main stream carbon dioxide gas analyzer.

Anesthetic Room: Introduction, Layout of the Anesthetic Room, Contents of the Anesthetic Room.

7 Hours

TEXT BOOK:

1. **Ward's Anaesthetic Equipment -** by Andrew Davey, John T. B. Moyle & Crispian S. Ward, 3rd Edition, W.B. Saunders Company Ltd.

REFERENCE BOOKS:

1. **Principles of Measurement & monitoring in Anaesthesia & intensive care -** by M. K. Sykes, M.D. Vickers, C. J. Hull, 3rd Edition, Blackwell Scientific Pub.
2. **A Text book of Anaesthesia -** by R. D. Miller, 5th Edition, Vol-2, Churchill Livingston, 2000.
3. **Introduction to Biomedical Equipment Technology** - by J. J. Carr J.M.Brown, 4th Edition, Pearson Education.

ELECTIVE-I (GROUP A)

REHABILITATION ENGINEERING

Subject Code	:	**06BM661**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO REHABILITATION & REHABILITATION TEAM: What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Physiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Effects of prolonged inactivity & Bed rest on body system.

6 Hours

UNIT - 2

REHABILITATION TEAM: Classification of members, The Role of Physiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist-Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer.

6 Hours

UNIT - 3

THERAPEUTIC EXERCISE TECHNIQUE: Coordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

7 Hours

UNIT - 4

PRINCIPLES IN MANAGEMENT OF COMMUNICATION: Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids.

7 Hours

PART - B

UNIT - 5

ORTHOTIC DEVICES IN REHABILITATION ENGINEERING: General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Biomechanics of orthoses, merits & demerits of

orthotics, Material design consideration in orthotics, Calipers-FO, AFO, KAFO, HKAFO. Spinal Orthosis, Cervical, Head cervical thoracic orthosis, Thoraco lumbar sacral orthosis, Lumbo sacro orthosis, Splints-its functions & types.

7 Hours

UNIT - 6

AMPUTATION LEVELS OF AMPUTATION – Surgical process, Expected Outcomes, Post operative dressings – Rigid dressings, Semi rigid dressings, Soft dressings, Examination- Range of Motion, Muscle Strength, Status of Residual Limb, Status of the un involved limb, Functional status, emotional status.

6 Hours

UNIT - 7

PROSTHETIC DEVICES

INTRODUCTION, PARTIAL FOOT PROSTHESES- Foot-ankle assembly, Trans femoral Prostheses – Knee unit, Axis system, Friction Mechanisms, Extension aid, Stabilizers, Socket. Disarticulation Prostheses-Knee Disarticulation Prostheses, Hip Disarticulation Prostheses.

7 Hours

UNIT - 8

MOBILITY AIDS: Walking frames, Parallel bars, Rollators, Quadripods, Tripods & walking sticks, Crutches, Wheel chairs.

6 Hours

TEXT BOOKS:

1. **Rehabilitation Medicine -** By Dr. S. Sunder, 2nd Edition, Jaypee Medical Publications, Reprint 2004.
2. **Physical Rehabilitation** - by Susan B O'Sullivan, Thomas J Schmitz. 5th Edition, Jaypee Pub., 2007.

BIOINFORMATICS

Subject Code	:	**06BM662**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

OVERVIEW, INTRODUCTION & INFORMATION NETWORKS: Information networks, protein & genome information resources, DNA sequence analysis, pairwise alignment techniques, multiple sequence

alignment, secondary database searching, building a sequence search protocol, analysis packages.
Introduction, dawn sequencing, bioinformatics, biological sequence, genome projects, human genome project, importance of bioinformatics, pattern recognition & prediction, folding problem, role of chaperones, sequence analysis, homology & analogy. Introduction, internet, computer network, facilities in internet, world wide web, web browser, HTTP, HTML, & URL, EMBnet, NCBI, virtual tourism.

7 Hours

UNIT - 2

PROTEIN & GENOME INFORMATION RESOURCES: Introduction, biological databases, primary sequence databases, composite protein sequence databases, secondary databases, structure classification databases. Introduction to genome information resources, DNA sequence databases, specialized genomic resources.

7 Hours

UNIT - 3

DNA SEQUENCE ANALYSIS: Introduction, why to analyze DNA, gene structure and DNA sequences, features of DNA sequence analysis, issues in the interpretation of EST searches, two approaches to gene hunting, expression profile of a cell, cDNA libraries and ESTs, different approaches to EST analysis, effects of EST data on DNA databases, a practical example of EST analysis.

6 Hours

UNIT - 4

PAIRWISE ALIGNMENT TECHNIQUES: Introduction, database searching, alphabets and complexity, algorithms and programs, comparing two sequences-a simple case, sub-sequences, identity and similarity, Dotplot, local and global similarity, global alignment-Needleman & Wunsch algorithm, local alignment-Smith-Waterman algorithm, dynamic programming, pairwise database searching.

6 Hours

PART - B

UNIT - 5

MULTIPLE SEQUENCE ALIGNMENT & SECONDARY DATABASE SEARCHING: Introduction, goal of multiple sequence alignment & definition, consequences, computational complexity, manual methods, simultaneous methods, progressive methods, databases of multiple alignments & searching. Introduction to secondary database searching, why secondary databases & its contents.

6 Hours

UNIT - 6

BUILDING A SEQUENCE SEARCH PROTOCOL & ANALYSIS PACKAGES: Introduction, practical approach, when believe the result, structural and functional interpretation. Introduction & what is an analysis package, commercial databases & software, comprehensive packages, packages for DNA analysis, intranet & internet packages

6 Hours

UNIT - 7

GENOMICS AND GENE RECOGNITION: Prokaryotic genomes & gene structure, GC content in prokaryotic genomes, prokaryotic gene density, Eukaryotic genomes & gene structure, open reading frames, GC content in eukaryotic genomes, gene expression, transposition, repetitive elements, eukaryotic gene density.

7 Hours

UNIT - 8

PROTEOMICS: Brief review on protein structure, from genomes to proteomes, protein classification, experimental techniques, inhibitors and drug design, ligand screening, x-ray crystal structures, NMR structures, empirical methods and prediction techniques, post-transnational modification prediction.

7 Hours

TEXT BOOKS:

1. **Introduction to Bioinformatics** - by T. K. Attwood & D.J.Parry-Smith, Pearson Education Low Price Edition, 2004
2. **Fundamental Concepts** - of Bioinformatics by Dan E. Krane & Michael L. Raymer, Pearson Education Low Price Edition, 2004

REFERENCE BOOKS:

1. **Bioinformatics -** Concepts, Skills & Applications by S.C.Rastogi, Namita Mendiratta & Parag Rastogi, CBS Publications, 2004.
2. **Bioinformatics** - by Andreas D. Boxevanies, Wiley Interscience, 1998.
3. **Bioinformatics** - Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor, 2001.

POWER ELECTRONICS

Subject Code	:	**06BM663**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

INTRODUCTION: Power Semiconductor devices Applications of Power Electronics, power semiconductor devices, Control characteristics, Types of Power Electronic circuits, peripheral effects.

POWER TRANSISTORS: Power BITs, switching characteristics, switching limits, base-drive control Power MOSFETs, switching characteristics, gate drive. IGBTs, di/dt and dv/dt limitations, Isolation of gate and base drives.

THYRISTORS: Introduction, characteristics, two transistor model, turn-on and turnoff, di/dt and dv/dt protection, Thyristor types, series and parallel operation of thyristors, Thyristor firing circuits.

14 Hours

UNIT - 3

COMMUTATION TECHNIQUES: Introduction, Natural commutation, Forced commutation: self commutation, Impulse commutation, Resonant pulse commutation and complementary commutation.

6 Hours

UNIT - 4

AC VOLTAGE CONTROLLERS: Introduction, Principle of ON-OFF and phase control, single phase bi-directional controllers with resistive and inductive loads.

6 Hours

PART - B

UNIT - 5 & 6

CONTROLLED RECTIFIERS: Introduction, Principle of phase controlled converter operation, single phase semi converters, full converters and dual converters, three phase half wave converters, three-phase full converter (with R & RL load).

12 Hours

UNIT - 7 & 8

DC CHOPPERS: Introduction, Principle of step-down and step-up choppers, step-down chopper with RL loads, Performance parameters. Chopper classification, Analysis of Impulse commutated thyristor chopper (only qualitative analysis).

INVERTERS: Introduction, Principle of operation, performance parameters, single phase bridge inverters, voltage control of single phase inverters, current source inverter.

14 Hours

TEXTBOOK:

1. **Power Electronics: Circuits, Devices and Applications** - by M. H. Rashid, 2nd Edition, Prentice Hall of India Pvt. Ltd.,/Pearson (Singapur -Asia)) New Delhi, 2006.

REFERENCE BOOKS:

1. **Thyristorised Power Controllers** - by G. K. Dubey, S. R. Doradla, A. Joshi & R.M.K. Sinha, New Age International (P) Ltd. Publishers, 9th Reprint, 1999.
2. **Power Electronics -** by M. D. Sing and Khanchandani K. B., Tata McGraw Hill, 1st Reprint 2007.
3. **Power Electronics** - by Cyril W.Lander, 3rd Edition, McGraw Hill, 1993.
4. **Power Electronics Principles and Applications** - by J. M. Jacob, Thomson- Vikas Publications, 1st Indian Reprint 2006.

COMPUTER ORGANIZATION

Subject Code	:	**06BM664**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

COMPUTING AND COMPUTERS: The nature of computing, Evolution of Computers- Mechanical era, electronic computers, later generations, VLSI Era- Integrated circuits, Processor architecture, system architecture.

6 Hours

UNIT - 2

DESIGN METHODOLOGY: System design, The Register Level – registers level components, programmable logic devices, register level design, The processor level – Processor level components, processor level design.

7 Hours

UNIT - 3

PROCESSOR BASICS: CPU organization, Data Representation- Basic formats, Fixed-point numbers, floating point numbers, Instruction sets- Instruction formats, instruction types, programming considerations.

6 Hours

UNIT - 4

DATAPATH DESIGN: Fixes-point arithmetic- addition, subtraction, multiplication and division, Arithmetic logic units- combinational ALU, sequential ALU, Floating-point arithmetic, pipeline processing.

7 Hours

PART - B

UNIT - 5 & 6

CONTROL DESIGN: Introduction, Hardwired control, Microprogrammed control- concepts, Multiplier control unit, CPU Control unit, Pipeline Control – Instruction pipelines, performance, superscalar processing.

12 Hours

UNIT - 7

MEMORY ORGANIZATION: Memory technology, Memory systems- Multilevel memories, address translation, memory allocation, Caches- main features, address mapping.

7 Hours

UNIT - 8

SYSTEM ORGANIZATION: Communication methods, IO and System control-programmed IO, DMA and interrupts, IO processors, operating systems, Parallel processing-processor level parallelism, multiprocessors, fault tolerance.

7 Hours

TEXT BOOK:

1. **Computer Architecture and organization -** by John P. Hayes 3rd Edition, McGraw Hill, 1998.

REFERENCE BOOKS:

1. **Computer Organization** - by Carl Hamacher Z Vranesic & S Zaky, 5th Edition, McGraw Hill, 2002.
2. **Computer system Architecture** - by Morris Mano , 2nd Edition, Pearson Education, 2003.
3. **Computer system design & Architecture** - by V Heuring & H Jordan, 2nd Edition, Pearson Education, 2004.

HOSPITAL DESIGN, PLANNING & MANAGEMENT

Subject Code	:	**06BM665**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

PLANNING & BUILDING A NEW HOSPITAL: Role of Hospital in Health Care, Hospital Planning & Design, Guiding principle in Hospital facilities & services, Functional Plans for Hospital construction, Design items, Functional program & design stage, Planning the Hospital building.

EFFECTIVE HOSPITAL MANAGEMENT: Planning, Organization, Directing & Leading, Controlling, Financial Management

12 Hours

UNIT - 3

ADMINISTRATIVE SERVICE: Medical Record, Hospital Infection, Hospital Utilization Statistics, Material Management, Evaluation of Hospital services.

7 Hours

UNIT - 4

PLANNING & DESIGNING MEDICAL SERVICES: Out Patient service, Emergency service, Clinical laboratories, Radiology services, Radiation Therapy Department, Surgical Department, Nursing Department, Operation Theater, CSSD Nursing services.

7 Hours

PART - B

UNIT - 5 & 6

PLANNING & DESIGNING ENGINEERING SERVICES: Engineering Department, Maintenance management, Clinical [Bio-medical] Engineering, Electrical System, Air Condition System, Water supply & sanitary system, Centralized Medical Gas System, Telecommunication System, Environmental Control, Safety & Security System, Fire Safety & Bomb threat alarm system, Disposal of Hospital Wastes.

13 Hours

UNIT - 7 & 8

PLANNING & DESIGN OF SUPPORTIVE SERVICES: Admitting Department, Medical Record Department, Centralized Sterilization & Supply department, Pharmacy Material Management, Food service Department, Laundry & Linen Services, House Keeping & Val entry Department.

13 Hours

TEXT BOOKS:

1. **Principles of Hospital Administration & Planning -** by B. M. Sakharkar, Jaypee Publications, 1998.
2. **Hospital Facilities, Planning & Management** - by G. D. Kunders, Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. **Hospital Administration & Management** - by S. L. Goel & R. Kumar Deep & Deep Publications
2. **Applied Clinical Engineering** - by Barry N. Feinberg, Prentice Hall, 1984.
3. **Clinical Engineering Principle & Practices** - By John G. Webster & Albert M. Cook, Prentice Hall.

OPERATING SYSTEMS

Subject Code	:	**06BM666**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO OPERATING SYSTEMS & THEIR CLASSIFICATION: What is an operating system, Mainframe systems, Desktop systems, Multiprocessor system, Distributed system, Clustered system, Real time system, Handheld system, Feature migration, Computing environments.

OPERATING SYSTEM STRUCTURES: System components, OS Services, System calls, System programs, System structure, Virtual machines.

7 Hours

UNIT - 2

PROCESS, INTER PROCESS COMMUNICATION, THREADS & CPU SCHEDULING: Process concept, Process scheduling, Operation on processes, Cooperating processes, Inter process communication. **Threads –** Overview, Multithreading models, Threading issues, Pthreads, Java threads. **CPU SCHEDULING:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Real time scheduling.

7 Hours

UNIT - 3

PROCESS SYNCHRONIZATION AND HANDLING DEADLOCKS: The Critical section problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, monitors.

6 Hours

UNIT - 4

PROCESS SYNCHRONIZATION AND HANDLING DEADLOCKS: Deadlock – System model, Deadlock characterization, Methods for handling deadlocks – Deadlock prevention, deadlock avoidance, Deadlock detection and recovery from deadlock.

6 Hours

PART - B

UNIT - 5

STORAGE MANAGEMENT: Main memory management – Background, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with paging.

6 Hours

UNIT - 6

VIRTUAL MEMORY: Background, Demand paging, Process creation, Page replacement algorithms, Allocation of frames, Thrashing.

6 Hours

UNIT - 7

FILE SYSTEM INTERFACE: File concept, Access methods, Directory structure, File system mounting, File system implementation, Directory implementation, Allocation methods, free space management.

MASS STORAGE STRUCTURES: Disk structure, Disk scheduling methods, Disk management, Swap space management

7 Hours

UNIT - 8

PROTECTION AND SECURITY: Goals of protection, Domain of protection, Access matrix, implementation of access matrix, Revocation of access rights. The security problem, Authentication, Program threats, System threats, Securing systems and facilities, Intrusion detection, Cryptography.

CASE STUDY – LINUX OPERATING SYSTEM: Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and output, Interprocess communication.

7 Hours

TEXT BOOK:

1. **Operating System Concepts** by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 6th Edition, John Wiley & Sons, 2003.

REFERENCE BOOKS:

1. **Operating system concepts and design** - by Milan Milankovic 2nd Edition, Pearson Education, 1996.
2. **An Introduction to Operating Systems** - by Harvey M Deital, 2nd Edition, Pearson Education,1990.
3. **Operating Systems** - A concept based Approach, D.M Dhamdhere Tata McGraw-Hill, 2002.

C++ AND DATA STRUCTURES LABORATORY

Subject Code	:	**06BML67**	IA Marks	:	25
No of Practical Hrs./week	:	03	Exam Hours	:	03
Total No of Practical Hrs.	:	42	Exam Marks	:	50

1. Write a C++ program to demonstrate the initialization of structure variables.
2. Write a C++ program to demonstrate the use of pointer to and address of operator.
3. Write a C++ Program to create a file with at least five records, each record with following fields.

University Seat Number	:	Non Zero Positive Integer
Name	:	Twenty-Five Characters
Marks1, Marks2, Marks3	:	Positive Integer

4. Write a C++ Program to demonstrate working of stack of size N using an array. The elements on stack can be integer or real. The operation should be PUSH and POP.
5. Write a C++ Program to demonstrate the working of Queue using arrays.
6. Write a C++ Program to implement circular Queue using arrays.
7. Write a C++ Program to implement priority.
8. Write a C++ Program to construct the singly linked list and to do the following operations
   a) Insertion – at front, at end and at any position in the list
   b) Deleting a note based on given field
   c) Searching a note based on given field
   d) Displaying the list
9. Write a C++ Program Implement stack using dynamic variables
10. Write a C++ Program to implement Queue using dynamic variables.
11. Write a C++ Program to do the following operations on doubly linked list.
    a) Add at the front
    b) Insert at the left
    c) Delete the node with given data
    d) Display
12. Write a C++ Program to create a binary search tree.
    a) Add a node
    b) Insert at the node
    c) Delete the node with given data
    d) Display the tree

BIOMEDICAL DIGITAL SIGNAL PROCESSING LAB

Subject Code	:	**06BML68**	IA Marks	:	25
No of Practical Hrs./week	:	03	Exam Hours	:	03
Total No of Practical Hrs.	:	42	Exam Marks	:	50

1. Display of static and moving ECG.
2. Down sampling & up-sampling of ECG signal.
3. Detection of QRS complex and heart rate measurement.
4. Auto-correlation and cross correlation of ECG signals.
5. DCT & IDCT of ECG signal
6. Computation of Convolution and Correlation Sequences.
7. Signal Averaging to Improve the SNR
8. PSD estimation for ECG, EEG, and EMG.
9. Design of 50 Hz notch filter for ECG signal and display PSD.
10. Design of IIR filters for ECG (LPF, HPF, BP)
11. Design of FIR Filter for ECG. (LPF, HPF, BP)
12. Data Compression Techniques: AZTEC, TP, FAN algorithmes
13. Frequency response and phase response of FIR filter using KAISER window.

VII SEMESTER

COMPUTER COMMUNICATION & HEALTH CARE NETWORKS

Subject Code	:	**06BM71**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

COMPUTER NETWORKS IN HEALTH CARE: Introduction, history, impact of clinical data, information types, platforms, current technologies, identifier standards, communication (message format) standards.

INTRODUCTION TO COMPUTER NETWORKS: Uses of Computer Networks: Business Applications, Home Applications, Mobile Users. Network Hardware: Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks. Network Software: Protocol Hierarchies, Design Issues for the Layers, Connection – Oriented and Connectionless Services, Service primitives. The Relationship of Services to Protocols. Reference Models: The OSI Reference3 Model, The TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models. Example Networks: Internet Usage, Architecture of the Internet, Connection–Oriented Networks: X.25, Frame Relay, and ATM, Ethernet, Wireless LANs: 802.11.

12 Hours

UNIT - 3

THE PHYSICAL LAYER: The Theoretical Basis For Data communication: Bandwidth Limited Signals, The Maximum Data Rate of a Channel. Guided Transmission Media: Magnetic Media, Twisted Pair, Coaxial Cable, Fiber Optics. Wireless Transmission: The Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared and Millimeter Waves, Light wave Transmission. The Public Switched Telephone Network: Structure of the Telephone System, The Local Loop, Modems, FDM, WDM & TDM, Switching, Internet over Cable.

7 Hours

UNIT - 4

THE DATA LINK LAYER: Data Link Layer Design Issues: Services Provided to the Network Layer, Framing, Error Control, Flow Control, Error–Detecting Codes. Elementary Data Link Protocols: An Unrestricted Simplex Protocol, A Simplex Stop–and–Wait Protocol, A Simplex Protocol for a Noisy Channel. Sliding Window Protocols: A One – Bit Sliding Window Protocol, A Protocol Using Go Back N, A Protocol Using Selective Repeat, HDLC – High – Level Data Link Control, The Data Link Layer in the Internet.

7 Hours

PART - B

UNIT - 5

THE MEDIUM ACCESS CONTROL SUBLAYER: Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols, Wireless LAN Protocols. Ethernet: Ethernet Cabling, Manchester Encoding, The Ethernet MAC Sublayer Protocol, The Binary Exponential Backoff Algorithm, Ethernet Performance, Switched Ethernet, Fast Ethernet.

Ethernet: Gigabit Ethernet, IEEE 802.2: Logical Link Control. Wireless Lans: The 802.11 Protocol Stack, The 802.11 Physical Layer, The 802.11 MAC Sublayer Protocol, The 802.11 Frame Structure, Services.

7 Hours

UNIT - 6 & 7

BLUE TOOTH: Blue tooth Architecture, Bluetooth Applications. Data Link Layer

SWITCHING: Local Internet Working, Repeaters, Hubs, Bridges, Switches, Routers, and Gateways, Virtual LANs.

THE NETWORK LAYER: Network Layer Design Issues: Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection – Oriented Service, Comparison of Virtual Circuit and Datagram Subnets. Routing Algorithms: The Optimality Principle, Shortest Path Routing, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, CONGESTION control Algorithms: General Principles of Congestion Control, Congestion Prevention Policies. Quality of Service: Requirements, Techniques for Achieving Good Quality of Service. Internetworking: How Networks Differ, How Networks Can Be Connected. The Network layer In The Internet: The IP Protocol, IP Address Formats, IPV6 Header Format.

12 Hours

UNIT - 8

THE TRANSPORT LAYER: The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives. Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing, Crash Recovery. The Internet Transport Protocols – UDP: Header Format. The Internet Transport Protocols – TCP: Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

THE APPLICATION LAYER: DNS – The Domain Name System: The DNS Name Space, Name Servers. Electronic Mail: Architecture and Services, The User Agent, message Transfer, SMTP. The World Wide Web: Architectural Overview, Client Side, Server Side.

7 Hours

TEXTBOOKS:

1. **The Biomedical Engineering Handbook-Volume II (2nd Edition) -** by Joseph D. Bronzino, CRC/IEEE Press, 2000.
2. **Computer Networks** – Andrew S. Tanenbaum, 4e, Pearson Education / PHI, 2004.

REFERENCE BOOKS:

1. **Data and Computer Communication** – William Stallings, 7th Edition, Pearson Education, 2004.
2. **Data Communications and Networking** – Behrouz A Forouzan, 4th Edition, Tata McGraw Hill, 2006.
3. **Computer Networking** – Kurose and Ross, Pearson Education, 2004.

MEDICAL IMAGING SYSTEMS

Subject Code	:	**06BM72**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

X-RAY IMAGING: Fundamentals of X-ray – Electromagnetic radiation, Interactions between X-rays and matter, Intensity of X-ray beam, Attenuation, Generation and Detection of X-rays – X-ray generation, X-ray generators, Filters, Beam restrictors and grids, Intensifying screens, fluorescent screens, and image intensifiers, X-ray detectors, X-ray image characteristics – Spatial resolution, Image noise, Image contrast, Receiver operating curve (ROC), Biological effects of ionizing radiation, Film processors-wet & dry.

6 Hours

UNIT - 2

X-RAY DIAGNOSTIC METHODS: Conventional X-ray radiography, Fluoroscopy, Angiography, Mammography and Xeroradiography, Image subtraction.

COMPUTED TOMOGRAPHY: Conventional tomography, Computed tomography – Projection function, Algorithms for image reconstruction, CT number, Image artifacts, Spiral CT. Recent developments – Digital radiography, Digital subtraction angiography (DSA), 3D reconstruction, Dynamic spatial reconstructor (DSR),

7 Hours

UNIT - 3

ULTRASOUND IMAGING: Fundamentals of acoustic propagation - Stress strain relationship, Characteristic impedance, Intensity, Reflection and refraction, Attenuation, absorption & scattering, Doppler effect, Generation and detection of Ultrasound-Piezoelectric effect, Ultrasonic transducers, Transducer beam characteristics-Huygens's principle, Beam profiles, Pulsed ultrasonic field, Axial and Lateral resolution, Focusing, Arrays.

7 Hours

UNIT - 4

ULTRASONIC DIAGNOSTIC METHODS: Pulse echo systems- Amplitude mode (A-mode), Brightness mode (B-mode), Motion mode (M-mode), Constant depth mode (C-mode), Doppler methods, Duplex imaging, Tissue characterization, Colour Doppler flow imaging, Power Doppler Imaging, Image characteristics – Ultrasonic texture or speckle, Speckle reduction, Compensation of phase aberration, Biological effects of ultrasound, video printers.

6 Hours

PART - B

UNIT - 5

RADIONUCLIDE IMAGING: Introduction, Fundamentals of Radioactivity – Nuclear particles, Nuclear activity and half-life, Units of measuring nuclear activity, Specific activity, Interaction of nuclear particles and matter, Attenuation of Gamma radiation, Radionuclides, Generation & Detection of Nuclear Emission – Radionuclide generators, nuclear radiation detectors, Collimators, Diagnostic methods using radiation detector probes – Thyroid function test, Renal function test, Blood volume measurement, Radionuclide imaging systems- Rectilinear scanner, Scintillation camera, SPECT, PET.

7 Hours

UNIT - 6

BASICS OF MAGNETIC RESONANCE IMAGING: Fundamentals of nuclear magnetic resonance- Angular momentum, magnetic dipole moment, magnetization, Larmor frequency, Rotating frame of reference and RF magnetic field, Free induction decay (FID), Fourier spectrum of the NMR signal, Spin density, Relaxation times, Pulse sequences.

6 Hours

UNIT - 7

MRI SYSTEM & IMAGING METHODS: Introduction, Magnet, Room temperature and magnetic field gradients, NMR Coil/Probe, Transmitter, Receiver, Data acquisition. Imaging Methods- Introduction, slice selection,

frequency encoding, phase encoding, Spin-Echo imaging- Gradient echo imaging, Blood flow imaging, Characteristics of MRI images- Spatial resolution, image contrast. Biological effects of magnetic fields- Static magnetic fields, Radio-frequency fields, Gradient magnetic fields, Imaging safety, Functional MRI.

7 Hours

UNIT - 8

THERMAL IMAGING & ADVANCES IN MEDICAL IMAGING: Medical thermography, Physics of thermography, Infrared detectors, Thermographic equipment, Quantitative medical thermography, Pyroelectric vidicon camera.

Image guided intervention- Introduction, Stereotactic neurosurgery, Stereotactic neurosurgery based on digital image volumes- image acquisition, planning and transfer, Intraoperative Imaging- Intraoperative diagnostic imaging, transfer by matching preoperative with intraoperative images, augmented reality.

6 Hours

TEXTBOOKS:

1. **Principles of Medical Imaging -** by Kirk Shung, Michael B. Smith and Banjamin Tsui, Academic Press, 1992.
2. **Handbook of Biomedical Instrumentation** – by R.S.Khandpur, 2nd Edition, Tata McGraw Hill, 2003.
3. **Fundamentals of Medical Imaging -** by Paul Suetens, Cambridge University Press, 2002.

EMBEDDED SYSTEMS DESIGN

Subject Code	:	**06BM73**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Embedded system overview, design challenge- optimizing design matrix, common design matrix, time to market design matrix, the NRE and unit cost design matrix, the performance design matrix, processor technology, software and hardware, IC technology, Design technology.

7 Hours

UNIT - 2

CUSTOM SINGLE PURPOSE PROCESSORS: Hardware Introduction, combinational logics, sequential logics, custom single processor design, RT level custom single purpose processor design, optimizing custom single purpose processors.

7 Hours

UNIT - 3 & 4

GENERAL-PURPOSE PROCESSORS SOFTWARE: Introduction, basic architecture, operations, programmers view, development environment, Application-specific instruction-set processors, selecting a microprocessor, General-purpose processor design.

12 Hours

PART - B

UNIT - 5

STANDARD SINGLE PURPOSE PROCESSOR: PERIPHERALS: Introduction, Timers, counter and watch dog Timers, UART, Pulse Width Modulator, LCD controllers, Key pad Controllers, Stepper motor Controllers, Analog to Digital converters, Real time clocks.

7 Hours

UNIT - 6

MEMORY: Introduction, Memory writes ability and storage performance, Common memory types, Composing Memory, Memory Hierarchy and Cache, Advanced RAM.

6 Hours

UNIT - 7

INTERFACING: Introduction, communication basics, Microprocessor Interfacing: I/O addressing, Microprocessor Interfacing: Interrupts, Microprocessor Interfacing: Direct Memory Access, Arbitration, Multilevel Bus Architecture, Advanced Communication Principles, Serial Protocols, Parallel Protocols, Wireless Protocols**.**

7 Hours

UNIT - 8

DIGITAL CAMERA EXAMPLE: Introduction, Introduction, to a simple Digital Camera, Requirement Specification, Design.

6 Hours

TEXT BOOK:

1. **Embedded system Design -** By Frank Vahid & Tony Givargis, John Wiley, 2003

REFERENCE BOOK:

1. **Embedded Systems** - By Raj Kamal, Tata McGraw Hill, 7th Reprint, 2006.

MEDICAL IMAGE PROCESSING

Subject Code	:	**06BM74**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Origin of DIP, examples of fields that use DIP, fundamentals of DIP, components of a DIP system.

DIGITAL IMAGE FUNDAMENTALS: Elements of visual perception, light and EM spectrum, a simple image formation model, image sampling and quantization, some basic relationships between pixels.

7 Hours

UNIT - 2

IMAGE ENHANCEMENT IN SPATIAL DOMAIN: Background, some basic gray level transformations, Histogram processing, enhancement using arithmetic and logic operations.

6 Hours

UNIT - 3 & 4

IMAGE ENHANCEMENT IN SPATIAL DOMAIN (CONT…): Basic of spatial filtering. Smoothing spatial filters, sharpening spatial filters

IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN: Background, introduction to FT and frequency domain, smoothing frequency domain filters, sharpening frequency domain filters, homographic filtering, additional properties of the 2-D FT, convolution and correlation theorems.

13 Hours

PART - B

UNIT - 5

IMAGE COMPRESSION: Fundamentals, image compression models, elements of information theory, error free compression, run length coding,

loss less predictive coding, lossy predictive coding, image compression standards, JPEG, video compression standards

7 Hours

UNIT - 6

IMAGE SEGMENTATION: Detection of discontinuities, point detection, line detection, edge detection, gradient operators, Laplacian, edge linking and boundary detection, thresholding, region based segmentation

7 Hours

UNIT - 7 & 8

COLOR IMAGE PROCESSING: Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing & Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression

IMAGE RECONSTRUCTION: Introduction, Fourier slice theorem, filtered back projection algorithm for parallel projection data, algebraic reconstruction technique.

12 Hours

TEXTBOOKS:

1. **Fundamentals of Digital Image Processing** - by Rafael. C. Gonzalez and Richard. E. Woods, 3 Edn, Pearson Education, 2002.
2. **Digital Image Processing** -by Anil K. Jain, 5th Indian Print, PHI, 2002.

REFERENCE BOOKS:

1. **Digital Image Processing** –by William K. Pratt, 3rd Edition, John Wiley and Sons Inc.
2. **Image Processing Analysis and Machine Vision** – by Milan Sonka, Vadan Hlavac and Roger Boyle. 2nd Edition, Brooks/Cole Publishing Company / Thompson Learning, 1999.

ELECTIVE-II (GROUP B)

BIOMECHANICS AND BIODYNAMICS

Subject Code	:	**06BM751**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

BIOMECHANICS APPLICATIONS TO JOINT STRUCTURE AND FUNCTION: Introduction to Kinematics; Displacement in space; Force vectors and gravity; Linear forces and concurrent forces; Kinetics of rotary and translatory forces; Classes of levers; Close chain force analysis.

7 Hours

UNIT - 2

CONSTITUTIVE EQUATIONS: Equations for Stress and Strain; Non-viscous fluids; Newtonian viscous fluids; Elastic solids; Visco-elasticity and its applications in biology.

7 Hours

UNIT - 3

JOINT STRUCTURE AND FUNCTION: Properties of connective tissues; Human Joint design; Joint Function and changes in disease.

6 Hours

UNIT - 4

INTEGRATED FUNCTIONS: Kinetics and Kinematics of Postures; Static and Dynamic Postures; Analysis of Standing, Sitting and Lying Postures.

6 Hours

PART - B

UNIT - 5

GAIT ANALYSIS: Gait cycle and joint motion; Ground reaction forces; Trunk and upper extremity motion; internal and external forces, moments and conventions; Gait measurements and analysis.

7 Hours

UNIT - 6

FORCE PLATFORM AND KINEMATIC ANALYSIS: Design of force platforms, Integrating force and Kinematic data; linked segment, free-body analysis.

6 Hours

UNIT - 7

BIOVISCOELASTIC FLUID: Viscoelasticity, Viscoelastic Models: Maxwell, Voigt and Kelvin Models Response to harmonic variation. Use of viscoelastic models. Bio-Viscoelastic fluids : Protoplasm. mucus, saliva, semen, synovial fluids.

7 Hours

UNIT - 8

RHEOLOGY OF BLOOD IN MICROVESSELS: Fahreus·Lindqulst effect and inverse effect, hematocrit in very narrow tube.

FINITE ELEMENT ANALYSIS IN BIOMECHANICS: Model creation, Solution, Validation of results and applications of FEA.

6 Hours

TEXTBOOKS:

1. **Biomechanics**: Mechanical Properties of living tissues by Y. C. Fung, 2nd Edition, Springer Verlag, 1993.
2. **Joint Structure and Function, A Comprehensive Analysis** - by Pamela K. Levangie and Cynthia C. Norkin, Jaypee Publications, 4th Edition, 2006.
3. **Biomechanics of Human Motion** - by T. McClurg Anderson, Sports Pub., 2007.
4. **Biomechanics, Structures and Systems** - by A. A. Biewener, Sports Publication.

GENETIC ENGINEERING

Subject Code	:	**06BM752**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

INTRODUCTION & BASIC MOLECULAR BIOLOGY: Definition of genetic engineering, foundations, first steps & overview.

Basic Molecular Biology: The flow of genetic information, the structure of DNA & RNA, gene organization, gene expression.

WORKING WITH NUCLEIC ACIDS & TOOLS OF THE TRADE: Isolation of DNA & RNA, handling and quantification of nucleic acids, radiolabeling of nucleic acids, nucleic acid hybridization, gel electrophoresis, DNA sequencing, Restriction enzymes-cutting DNA, DNA modifying enzymes, DNA ligase-joining DNA molecules.

12 Hours

UNIT - 3

THE BIOLOGY OF GENETIC ENGINEERING: Host cell types, plasmid vectors for use in E.Coli, bacteriophage vectors for use in E.Coli, other vectors, getting DNA into cells

7 Hours

UNIT - 4

CLONING STRATEGIES: The approach, cloning from mRNA, cloning from genomic DNA, advanced cloning strategies.

7 Hours

PART - B

UNIT - 5

SELECTION, SCREENING & ANALYSIS OF RECOMBINANTS: Genetic selection and screening methods, screening using nucleic acid hybridization, immunological screening of expressed genes, analysis of cloned genes

7 Hours

UNIT - 6

GENETIC ENGINEERING IN ACTION: Analysis of gene structure and function, making proteins, transgenic plants, transgenic animals, spin-off technologies.

7 Hours

UNIT - 7 & 8

GENE THERAPY: Gene therapy-in somatic and germ line, gene therapy in immuno-deficiency diseases, and cancer, use of genetically modified and humanized antibodies, against cell surface antigens tom prevent the spread of breast cancer, targeting and destroying artificial clotting (thrombosis) by using Plasminogen, activating factor conjugated to humanized antibody against fibrin. Curing Severe-Combined-Immono-Deficiency (SCID) in human beings by using Adenosine Deaminase (ADA) gene, Prevention of tissue and organ graft rejection.

12 Hours

TEXTBOOKS:

1. **An Introduction to Genetic Engineering** - by Desmond Nicholl, Cambridge Low Price Edition, 1996.
2. **From Genetics to Gene Therapy** - The molecular pathology of human disease by David S. Latchman, BIOS Scientific Publications, 1994.
3. **Principles of Gene Manipulation** - An Introduction to Genetic Engineering by Old R.W. and Primrose S.B, Blackwell Scientific Publications, 1993.

REFERENCE BOOKS:

1. **Genes VIII by Benjamin Lewis** - Oxford University/ Pearson Education, 2004.
2. **Recombinant DNA** - Jan Witkowski, M. Zoller, J.P. Watson and M. Gilman, Freeman Company, 1982.

MEDICAL INFORMATICS

Subject Code	:	**06BM753**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

MEDICAL INFORMATICS: Aim and scope, salient feature, Introduction, history, definition of medical informatics, bio-informatics, online learning, introduction to health informatics, prospectus of medical informatics.

7 Hours

UNIT - 2

HOSPITAL MANAGEMENT AND INFORMATION SCIENCE: Introduction**,** HMIS: need, Benefits, capabilities, development, functional areas. Modules forming HMIS, HMIS and Internet, Pre-requisites for HMIS, PACS, why HMIS fails, health information system, disaster management plans, advantages of HMIS.

7 Hours

UNIT - 3 & 4

HOSPITAL MANAGEMENT AND INFORMATION SYSTEMS: Central Registration Module, OPD / Consultant Clinic / Policlinic Module, Indoor Ward Module, Patient Care Module, Procedure Module, Diet Planning Module, MLC Register Module, Pathology Laboratory Module, Blood Bank Module, Operation Theatre Module, Medical Stores Module, Pharmacy Module, Inventory Module, Radiology Module, Medical Records Index Module, Administration Module, Personal Registration Module, Employee Information Module, Financial modules, Health & Family Welfare, Medical Examination, Account Billing, Medical Research, Communication, General Information.

12 Hours

PART - B

UNIT - 5

KNOWLEDGE BASED AND EXPERT SYSTEMS & PATIENT RECORDS: AI, expert systems, materials and methods, applications of ES,

Introduction to computer based patient record, development tools, intranet, CPR in radiology, legal security and private issues, application service providers.

7 Hours

UNIT - 6

COMPUTER ASSISTED MEDICAL EDUCATION & SURGERY: CAME, Education software, Tele-education, Tele-mentoring, CAPE, patient counseling software. Limitation of conventional surgery, computer assisted surgery (CAS), 3D navigation system, intra-operative imaging for 3D navigation system, merits and demerits of CAS.

7 Hours

UNIT - 7

SURGICAL SIMULATION AND VIRTUAL ENVIRONMENT: Need, technology, volume image data file, human resources, interface and applications. Virtual environment (VE), technology, applications of VE, advantages of simulators and after effects of VE participation.

6 Hours

UNIT - 8

TELECOMMUNICATION BASED SYSTEMS: Telemedicine, need of telemedicine, technology materials and methods, internet, applications of telemedicine, reliability and cost analysis, tele-surgery, robotic surgery, needs for tele-surgery, advantages and disadvantages, technology materials and methods, applications.

6 Hours

TEXTBOOK:

1. **Medical Informatics: A Primer** - by Mohan Bansal, 1st Print, Tata McGraw Hill, Publications, 2003.

REFERENCE BOOKS:

1. **Medical Informatics**: Computer applications in health care and biomedicine by E.H.Shortliffe, G. Wiederhold, L.E.Perreault and L.M.Fagan, 2nd Edition, Springer Verlag, 2000
2. **Handbook of Medical Informatics** by J.H.Van Bemmel, Stanford University Press/ Springer, 2000.

DSP ARCHITECTURE

Subject Code	:	**06BM754**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Introduction, A digital signal processing system, The sampling process, Discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time invariant systems, Digital filters, Decimation and Interpolation, Analysis and Design tool for DSP systems.

7 Hours

UNIT - 2& 3

ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES: Introduction, Basic architectural features, DSP computational building blocks, Bus architecture and memory, Data addressing capabilities, Address generation unit, Programmability and Program execution, Speed issues, Features for external interfacing.

12 Hours

UNIT - 4

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Introduction, Commercial digital signal processing devices, Data addressing modes of TMS320C54xx digital signal processors, Memory space of TMS320C54xx processors, Program control, TMS320C54xx Instructions and programming, On-chip peripherals, Interrupts of TMS320C54xx processors, Pipeline operation of TMS320C54xx processors.

7 Hours

PART - B

UNIT - 5 & 6

IMPLEMENTATION OF BASIC DSP ALGORITHMS: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID controller, Adaptive Filters, 2D Signal processing.

IMPLEMENTATION FFT ALGORITHMS: Introduction, An FFT algorithm for DFT computation, A butterfly computation, Overflow and Scaling, Bit Reversed index generation, FFT implementation on the TMS320C54xx, Computation of the signal spectrum.

12 Hours

UNIT - 7

INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES: Introduction, Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

7 Hours

UNIT - 8

INTERFACING SERIAL CONVERTERS TO A PROGRAMMABLE DSP DEVICE: Introduction, Synchronous Serial Interface (SSI), A multi channel buffered serial port (McBSP), McBSP programming, A CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

APPLICATIONS OF PROGRAMMABLE DSP DEVICES: DSP-based Biotelemetry receiver, A speech processing system.

7 Hours

TEXTBOOK:

1. **Digital Signal Processing -** by Avtar Singh and S. Srinivasan, Thomson Publishing, 1st Indian Reprint 2007.

REFERENCE BOOKS:

1. **Digital Signal Processing**: A Practical Approach, Emmanuel C Ifeachor and B W Jervis, 4th Indian Reprint, Pearson Education, 2004.
2. **Digital Signal Processors: Architecture, Programming and Applications -** B Venkataramani and M Bhaskar, Tata McGraw Hill, 4th Reprint, 2004.

LOW POWER VLSI DESIGN

Subject Code	:	**06BM755**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices.

DEVICE & TECHNOLOGY IMPACT ON LOW POWER: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

12 Hours

UNIT - 3 & 4

POWER ESTIMATION, SIMULATION POWER ANALYSIS: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

PROBABILISTIC POWER ANALYSIS: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

14 Hours

PART - B

UNIT - 5

CIRCUIT LEVEL: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library.

LOGIC LEVEL: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic

7 Hours

UNIT - 6

LOW POWER ARCHITECTURE & SYSTEMS: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

7 Hours

UNIT - 7

LOW POWER CLOCK DISTRIBUTION: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network

6 Hours

UNIT - 8

ALGORITHM & ARCHITECTURAL LEVEL METHODOLOGIES: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis.

6 Hours

TEXT BOOKS:

1. **Practical Low Power Digital VLSI Design** - Gary K. Yeap, Practical **Low Power Digital VLSI Design**, KAP, 2002
2. **Low power design methodologies** - Rabaey, Pedram, Kluwer Academic, 1997
3. **Low-Power CMOS VLSI Circuit Design** - Kaushik Roy, Sharat Prasad, Wiley, 2000

SPEECH SIGNAL PROCESSING

Subject Code	:	**06BM756**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

DIGITAL MODELS FOR SPEECH SIGNALS: Process of Speech Production, Lossless tube models, Digital models for Speech signals.

6 Hours

UNIT - 2

TIME DOMAIN MODELS FOR SPEECH PROCESSING: Time dependent processing of speech, Short time Energy and average magnitude, Short time average zero crossing rate, Speech Vs silence discrimination using energy and zero crossing, Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function.

7 Hours

UNIT - 3

SHORT TIME FOURIER ANALYSIS: Linear filtering interpretation, Filter bank summation method, Design of digital filter banks, Implementation using FFT, Spectrographic displays.

6 Hours

UNIT - 4

DIGITAL REPRESENTATIONS OF THE SPEECH WAVEFORM: Sampling speech signals, Review of the statistical model for speech, Instantaneous quantization, Adaptive Quantization, General theory of differential quantization, Delta modulation.

7 Hours

PART - B

UNIT - 5 & 6

LINEAR PREDICTIVE CODING OF SPEECH: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Applications of LPC parameters.

12 Hours

UNIT - 7

SPEECH SYNTHESIS: Principles of Speech synthesis, Synthesis based on –waveform coding, analysis synthesis method, speech production mechanism, Synthesis by rule, Text to speech conversion.

7 Hours

UNIT - 8

SPEECH RECOGNITION: Principles of Speech recognition, Speech period detection, Spectral distance measures, Structure of word recognition systems, Dynamic time warping (DTW), Word recognition using phoneme units.

7 Hours

TEXT BOOKS:

1. **Digital Processing of Speech Signals** - L R Rabiner and R W Schafer, Pearson Education 2004
2. **Digital Speech Processing** - Synthesis and Recognition, Sadoaki Furui, Second Edition, Mercel Dekker 2002.

REFERENCE BOOKS:

1. **Introduction to Data Compression** - by Khalid Sayood, 3rd Edition, Elsivier Pub.
2. **Digital Speech** - by A M Kondoz, 2nd Edition, Wiley Publications

ELECTIVE-III (GROUP C)

BIOSTATISTICS

Subject Code	:	**06BM761**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO BIOSTATISTICS: Introduction, Some basic concepts, Measurement and Measurement Scales, Simple random sample, Computers and biostatistical analysis.

DESCRIPTIVE STATISTICS: Introduction, ordered array, grouped data-frequency distribution, descriptive statistics – measure of central tendency, measure of dispersion, measure of central tendency computed from grouped data, variance and standard deviation-grouped data.

6 Hours

UNIT - 2

BASIC PROBABILITY CONCEPTS: Introduction, two views of probability – objective and subjective, elementary properties of probability, calculating the probability of an event.

PROBABILITY DISTRIBUTIONS: Introduction, probability distribution of discrete variables, binomial distribution, Poisson distribution, continuous probability distributions, normal distribution and applications.

7 Hours

UNIT - 3

SAMPLING DISTRIBUTION: Introduction, sampling distribution, distribution of the sample mean, distribution of the difference between two samples means, distribution of the sample proportion, distribution of the difference between two sample proportions.

6 Hours

UNIT - 4

ESTIMATION: Introduction, confidence interval for population mean, t-distribution, confidence interval for difference between two population means, population proportion and difference between two population proportions, determination of sample size for estimating means, estimating proportions, confidence interval for the variance of normally distributed population and ratio of the variances of two normally distributed populations.

7 Hours

PART - B

UNIT - 5

HYPOTHESIS TESTING: Introduction, hypothesis testing – single population mean, difference between two population means, paired comparisons, hypothesis testing-single population proportion, difference between two population proportions, single population variance, ratio of two population variances.

7 Hours

UNIT - 6

ANALYSIS OF VARIANCE (ANOVA): Introduction, completely randomized design, randomized complete block design, factorial experiment.

6 Hours

UNIT - 7

LINEAR REGRESSION AND CORRELATION: Introduction, regression model, sample regression equation, evaluating the regression equation, using the regression equation, correlation model, correlation coefficient.

6 Hours

UNIT - 8

MULTIPLE REGRESSION AND CHI-SQUARE DISTRIBUTION: Multiple linear regression model, obtaining multiple regression equation, evaluating multiple regression equation, using the multiple regression equation, multiple correlation model, mathematical properties of Chi-square distribution, tests of goodness of fit, tests of independence, tests of homogeneity.

7 Hours

TEXT BOOK:

1. **Biostatistics-A Foundation for Analysis in the Health Sciences** - by Wayne W. Daniel, John Wiley & Sons Publication, 6th Edition, 1995.

REFERENCE BOOKS:

1. **Principles of Biostatistics** - by Marcello Pagano and Kimberlee Gauvreu, Thomson Learning Publication, Indian Edition, 2007.
2. **Biostatistics** - by Ronald N Forthofer, Eun Sul Lee and M. Hernandez, Academic Press, 2007.
3. **Basic Biostatistics and its Applications** - by Animesh K. Dutta, 2006.

TISSUE ENGINEERING

Subject Code	:	**06BM762**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

TISSUE ENGINEERING: Introduction, basic principles and considerations, reconstruction of connective tissue, reconstruction of epithelial or endothelial tissue, bioreactor design in tissue engineering

BIOMATERIALS: Protein surface interactions: Introduction, fundamentals of protein adsorption, calculation and applications of protein adsorption.

ENGINEERING BIOMATERIALS FOR TISSUE ENGINEERING: Introduction, fundamentals, applications.

6 Hours

UNIT - 2

REGENERATION TEMPLATES: Problem of missing organ, search principles for identification of regeneration templates, structural specificity of

dermis regeneration template (DRT), in-situ synthesis of skin with DRT, advantages and disadvantages of clinical treatment of skin loss with DRT, bilayered skin-equivalent graft, structural specificity of nerve regeneration template (NRT), meniscus regeneration template (MRT).

FLUID SHEAR STRESS EFFECTS ON CELLULAR FUNCTION: Introduction, devices and methodologies for in-vitro experiments, shear stress-mediated cell-endothelium interactions, shear stress effects on gene regulation, mechanism of shear stress-induced gene regulation, gene therapy and tissue engineering in vascular biology.

7 Hours

UNIT - 3

BIOLOGY OF STEM CELLS: Introduction, embryonic stem cells, control of stem cell development, adult stem cells, aging of stem cells, other types of stem cells.

CELL MOTILITY AND TISSUE ARCHITECTURE: Introduction, directed motile responses in-vivo, engineering directed motile response in-vitro. Importance of Stromal Cells: Tissue composition and stromal cells, stromal cells as feeder layers, support of cultured cells using cell lines, stereotypic culture vs. monolayer culture

7 Hours

UNIT - 4

TISSUE ENGINEERING OF BONE MARROW: Biology of hematopoiesis, applications of reconstituted ex-vivo hematopoiesis, history of hematopoietic cell culture development, challenges for scale-up, recapitulations.

TISSUE ENGINEERING OF LIVER: Background, hepatocyte transplantation systems, conclusions.

6 Hours

PART - B

UNIT - 5

TISSUE ENGINEERING IN NERVOUS SYSTEM: Delivery of neuroactive molecules to the nervous system, tissue reconstruction-nerve regeneration, in-vitro neural circuits and biosensors, conclusions.

TISSUE ENGINEERING OF SKELETAL MUSCLE: Introduction, skeletal muscle structure, skeletal muscle function, injury and repair of skeletal muscle, reconstructive surgery of skeletal muscle, myoblast transfer and gene therapy.

7 Hours

UNIT - 6

TISSUE ENGINEERING OF CARTILAGE: Scope, cell-based approaches to cartilage tissue engineering, cell-polymer bioreactor system, summary and future directions.

6 Hours

UNIT - 7

TISSUE ENGINEERING OF KIDNEY: Introduction, fundamentals of kidney functions, tissue engineering formulation based upon fundamentals, clinical and economical implications.

6 Hours

UNIT - 8

BIOMECHANICAL ASPECTS OF GROWTH AND TISSUE ENGINEERING: Introduction, Wolff's law and Roux's functional adaptation concept, bioelectric effect on the growth of whole organ, remodeling of soft tissues in response to stress changes, stress field created by fibroblast cells and collagen synthesis, growth factors, significance of zero-stress state, engineering of blood vessels, tissue engineering of skin.

7 Hours

TEXT BOOKS:

1. **The Biomedical Engineering Handbook-Volume II (2nd Edition)**- by Joseph D. Bronzino, CRC/IEEE Press, 2000.
2. **Biomechanics: Motion, Flow, Stress and Growth** - by Y. C. Fung, Springer, Publications, 1990.

ERGONOMICS

Subject Code	:	**06BM763**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

Muscular Work, Nervous Control of Movements, Improving Work Efficiency, Problems of Body Size.

6 Hours

UNIT - 2

Methods for Static Anthropometric Measurements, Anthropometry of Special Regions of the Body.

7 Hours

UNIT - 3

The Design of Work Stations, Heavy Work, Handling Loads, Skilled Work.

7 Hours

UNIT - 4

Man-Machine Systems, Mental Activity, Fatigue, Occupational Stress.

6 Hours

PART - B

UNIT - 5

Boredom, Job Design in Monotonous Tasks, Working Hours and Eating Habits, Night Work and Shift Work.

7 Hours

UNIT - 6

Vision, Ergonomic Principles of Lighting, Noise and Vibration.

6 Hours

UNIT - 7

Indoor Climate, Daylight Colours and Music for a Pleasant Work Environment

7 Hours

UNIT - 8

Ergonomics for Electronic Equipment Design.

6 Hours

TEXT BOOK:

1. **Fitting the Task to the Human -** A Text Book of Occupational Ergonomics by H. E. Kroemer and Etienne Grandjean, 5th Edition, Taylor & Francis.

REFERENCE BOOKS:

1. **The Human Body in Equipment Design** - by A. Damon et. al., Harverd University Press, 1966.
2. **Human Factors in Engineering and Design** - by Mark S. Sanders and Ernest J. Mc Cormick, 1993.

ARM PROCESSORS

Subject Code	:	**06BM764**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
An introduction processor design & The ARM architecture

7 Hours

UNIT - 2
ARM assembly language programming & ARM organization and implementation.

6 Hours

UNIT - 3
The ARM instruction set & Architectural support for high level language.

7 Hours

UNIT - 4
Architectural support for system development.

6 Hours

PART - B

UNIT - 5
ARM processor cores & Memory Hierarchy.

7 Hours

UNIT - 6 & 7
Architectural support for operating systems & ARM CPU cores.

12 Hours

UNIT - 8
Embedded ARM applications & Introduction to new processors-micro controller family, ARM 11

7 Hours

TEXTBOOK:

1. **ARM-System-On-Chip- Architecture** - by Steve Furber, 2nd Edition, Pearson Education, 2000.

WAVELET TRANSFORMS

Subject Code	:	**06BM765**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

MATHEMATICAL PRELIMINARIES: Linear spaces, Vector and vector spaces, basic functions, matrix algebra & linear transformations, Fourier series, properties And examples of Fourier transforms

6 Hours

UNIT - 2

TIME FREQUENCY ANALYSIS: Window function, STFT, Discrete STFT, discrete Gabor representation, Continuous wavelet transform, discrete wavelet transform, wavelet series, WVD and its properties.

6 Hours

UNIT - 3

CONTINUOUS WAVELET TRANSFORMS: Continuous time wavelets, CWT as correlation, filter and time resolution operation. Inverse CWT T

7 Hours

UNIT - 4

DISCRETE WAVELET TRANSFORM: Introduction, vector approximations in nested linear vector subspaces, multi resolution analysis.

7 Hours

PART - B

UNIT - 5

MRA, ORTHONORMAL WAVELETS: Introduction, Definition of MRA, Construction of orthonormal MRA, wavelet basics for MRA, digital filter interpretation, examples of orthogonal basics generating wavelets, MRA interpretation for discrete time signals.

6 Hours

UNIT - 6

WAVELET APPLICATIONS: Data compression; introduction, transform coding, DTWT for image compression, Audio compression.

7 Hours

UNIT - 7

WAVELET DENOISING - speckle removal, edge detection & object isolation, image fusion

6 Hours

UNIT - 8

WAVELET PACKETS - Wavelet packet algorithms, Thresholding, 2D wavelets, wavelet packet algorithms for 2d signals, 3D medical image visualization.

7 Hours

TEXT BOOKS:

1. **Fundamentals of Wavelets** - theory, algorithms & applications – Goswami and Chan, John Wiley & sons, 1999.
2. **Wavelet transforms** - introduction to theory and applications – Raghuveer M Rao, Ajit S Bopardikar, Pearson LPE, 2006

REFERENCE BOOKS:

1. **Introduction to wavelets and wavelet transforms** - A Primer – C Sidney Burrus, Ramesh A Gopinath, Guo, Prentice Hall Inc, 1998.
2. **Wavelet Theory and its applications** - Randy K Young, Kluwer publications, 1963

SOFTWARE ENGINEERING

Subject Code	:	**06BM766**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

OVERVIEW & INTRODUCTION: FAQ's about software engineering, Professional and ethical responsibility.

SOFTWARE PROCESSES: Software Process Models, Process iteration, Software specification, Software design and implementation, Software validation, Software evolution, Automated Process support.

7 Hours

UNIT - 2 & 3

REQUIREMENTS ENGINEERING:

SOFTWARE REQUIREMENTS: Functional and Non – functional requirements, User requirements, System requirements, software requirements document.

REQUIREMENTS ENGINEERING PROCESSES: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

SYSTEM MODELS: Context models, Behavioral models, Data models, Object models, CASE workbenches.

SOFTWARE PROTOTYPING: Prototyping in software process, Rapid prototyping techniques, User interface prototyping.

12 Hours

UNIT - 4
SOFTWARE DESIGN
ARCHITECTURAL DESIGN: System structuring, Control models, Modular decomposition, Domain specific architectures.

OBJECT – ORIENTED DESIGN: Objects and Object Classes, An Object Oriented design process, Design evolution.

7 Hours

PART - B

UNIT - 5 & 6
USER INTERFACE DESIGN: User interface design principles, User interaction, Information presentation, User support, Interface Evaluation.

VERIFICATION AND VALIDATION: Verification and validation planning, Software inspections, Automated static analysis, Clean room software development.

SOFTWARE TESTING: Defect testing, Integration testing, Object oriented testing, Testing Workbenches.

CRITICAL SYSTEMS: Critical system, Availability and reliability, Safety and Security.

CRITICAL SYSTEM SPECIFICATION: Software reliability specification, safety specification.

14 Hours

UNIT - 7 & 8
SOFTWARE MANAGEMENT:
PROJECT MANAGEMENT: Management activities, Project planning, Project Scheduling, Risk management.

SOFTWARE COST ESTIMATION: Productivity, Estimation techniques, Algorithm cost modeling, Project duration and staffing.

QUALITY MANAGEMENT: Quality assurance and standards, Quality Planning, Quality Control, Software measurements and metrics.

SOFTWARE EVOLUTION

LEGACY SYSTEMS: Legacy system structures, Legacy system design and assessment.

SOFTWARE REENGINEERING: Source code translation, Reverse engineering, Program structure improvement, Program modularization, Data reengineering.

12 Hours

TEXT BOOK:

1. **Software Engineering** - by Ian Sommerville, 6th Edition, Pearson Education Ltd., 2001.

REFERENCE BOOKS:

1. **Software Engineering** – A Practitioners approach by Roger. S. Pressman, Tata – McGraw Hill, 6th Edition, 2005.
2. **An Integrated Approach to Software Engineering** - by Pankaj Jalote, Narosa Publications, 1997.
3. **Object Oriented & Classical Software Engineering -** by Stepen R. Schach, 5th Edition, Tata McGraw Hill, 2002.

CLINICAL INSTRUMENTATION LABORATORY – II

Subject Code	:	**06BML77**	IA Marks	:	25
No of Practical Hours/week	:	03	Exam Hours	:	03
Total No of Practical Hrs.	:	42	Exam Marks	:	50

1. Sample & Hold Circuit
2. ASK & FSK: Generation and Detection.
3. Experiment using 8 bit monolithic ADC & DAC to determine linearity error & resolution.
4. Pulse amplitude modulation and Pulse width modulation.
5. Study Experiments: DC defibrillator, baby incubator, ventilator, heart-lung machine, pacemaker, Snell's chart, ophthalmoscope, Recording of pulse & oxygen saturation using pulse oximeter.
6. Recording & Display of ECG / EMG / EEG / PCG.
7. Measurement of hearing loss & threshold using audiometer and plot the characteristics.
8. Measurement & recording of lung parameters using spirometer / pulmonary function equipment.
9. Calibration & testing of syringe infusion pump.
10. Measurement of refractive index using keratometer.
11. Measurement of unknown concentration of given solution using Spectrophotometer and Colorimeter.
12. (a) Measurement of pH of a given solution using pH meter. (b) Determination of Conductivity of a given unknown solution using conductivity meter

MEDICAL IMAGE PROCESSING LAB

Subject Code	:	**06BML78**	IA Marks	:	25
No of Practical Hours/week	:	03	Exam Hours	:	03
Total No of Practical Hrs.	:	42	Exam Marks	:	50

1. Simulation and display of an image, negative of an image (Binary & Gray Scale).
2. Implementation of relationships between pixels.
3. Contrast stretching of a low contrast image, histogram, and histogram equalization
4. Bit plane slicing of an image.
5. Image enhancement by Gray level slicing.
6. Implementation of FFT for an image.
7. Implementation of High pass, Low pass & Band pass filter in frequency domain.
8. Computation of mean, standard deviation and correlation co-efficient of the given image.
9. Mean and Median filtering of an image.
10. Implementation of image sharpening filters and edge detection using gradient filters.
11. Canny edge detection.
12. Image compression by DCT, DPCM, HUFFMAN coding
13. Implementation of image restoring techniques.

VIII SEMESTER

DATABASE MANAGEMENT SYSTEM IN HEALTHCARE

Subject Code	:	**06BM81**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO DATABASE SYSTEMS:

PATIENT DATABASE: Patient Database strategies for HIS, data acquisition, patient admission, transfer, discharge, evaluation & management. Computer based patient record, clinical decision support systems.

MANAGING DATA: A Historical Perspective: File Systems versus a DBMS; Advantages of a DBMS, Describing and Storing Data in a DBMS, Queries in a DBMS, Transaction Management; Structure of a DBMS, People Who work with Databases

6 Hours

UNIT - 2

ENTITY – RELATIONSHIP MODEL: Using High – Level Conceptual Data Models for Database Design, An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design for the COMPANY Database; ER Diagrams, Naming Conventions and Design Issues.

6 Hours

UNIT - 3

RELATIONAL MODEL AND RELATIONAL ALGEBRA: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and Dealing with Constraints Violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER-to-Relational Mapping.

7 Hours

UNIT - 4

SQL – THE RELATIONAL DATABASE STANDARD: SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Schema Change Statements in SQL; Basic Queries in SQL; More Complex SQL Queries; Insert, Delete and Update Statements in SQL; Additional Features of SQL; Specifying General Constraints as Assertion; Views (Virtual Tables)

in SQL; Database Programming: Issues and Techniques; Embedded SQL, Dynamic SQL.

7 Hours

PART - B

UNIT - 5 & 6

DATABASE DESIGN: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms.

DATABASE SECURITY: Introduction to Database Security; Access Control; Discretionary Access Control; Mandatory Access Control.

13 Hours

UNIT - 7 & 8

TRANSACTION MANAGEMENT: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock-Based Concurrency Control; Performance of Locking; Transaction Support in SQL; Introduction to Crash Recovery; 2PL, Serializability and Recoverability; Introduction to Lock Management; Lock Conversions; Dealing with Deadlocks; Specialized Locking Techniques; Concurrency Control without Locking; Introduction to ARIES: The Log; Other Recovery- Related Data Structures; The Write-Ahead Log Protocol; Check-pointing; Recovering from a System Crash; Media Recovery.

SEARCHING THE MEDICAL LITERATURE: Introduction, How the Computer Assists in Searching Medical Literature. Sources of Medical Literature Searches, Internet Grateful Med (IGM), Pubmed, Indian Meddler Centre, CD -Rom Databases, Other Internet Resources, Practicing Evidence-Based Medicine, Tips for Improving Search Techniques, Conclusion.

13 Hours

TEXT BOOKS:

1. **The Biomedical Engineering Handbook-Volume II (2nd Edition)** - by Joseph D. Bronzino, CRC/IEEE Press, 2000.
2. **Database Management Systems -** by Raghu Ramakrishna and Johannes Gehrke, (3rd Edition), McGraw Hill, 2003
3. **Fundamentals of Database Systems** - by Elmasri and Navathe (4th Edition), Pearson Education, 2003
4. **Medical Informatics: A Primer** - by Mohan Bansal, Tata McGraw Hill Pub, 2003.
   Section VI, Chapter 16: Searching the Medical Literature.

REFERENCE BOOK:

1. **Data base System Concepts** - by Silberschatz, Korth and Sudharshan: (4th Edition), McGraw Hill, 2002.

BIOMATERIALS & ARTIFICIAL ORGANS

Subject Code	:	**06BM82**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

BIOMATERIALS

UNIT - 1

Introduction to biomaterials, uses of biomaterials, biomaterials in organs & body systems, materials for use in the body, performance of biomaterials

METALLIC BIOMATERIALS: Introduction, Stainless steel, Cobalt-Chromium alloy, Titanium alloys, Titanium-Nickel alloys, Dental metals, Corrosion of metallic implants, Manufacturing of implants,

6 Hours

UNIT - 2

CERAMIC BIOMATERIALS: Introduction, nonabsorbable/relatively bioinert bioceramics, biodegradable/resorbable ceramics, bioreactive ceramics, deterioration of ceramics, bioceramic manufacturing techniques

POLYMERIC BIOMATERIALS: Introduction, polymerization and basic structure, polymers used as biomaterials, sterilization, surface modifications to for improving biocompatibility.

6 Hours

UNIT - 3

COMPOSITE BIOMATERIALS: Structure, bounds on properties, anisotropy of composites, particulate composites, fibrous composites, porous materials, biocompatibility.

BIODEGRADABLE POLYMERIC BIOMATERIALS: Introduction, Glycolide based biodegradable homopolymers polyesters, non-glycolide linear aliphatic polyesters, aliphatic and aromatic polycarbonates, biodegradation properties of synthetic biodegradable polymers.

TISSUE DERIVED BIOMATERIALS: Structure and properties of collagen and collagen-rich tissues, biotechnology of collagen, design of resorbable collagen-based medical implants.

7 Hours

UNIT - 4

HARD TISSUE REPLACEMENTS: Bone repair and joint implants-long bone repair and joint replacements, dental implants- effects of material selection, effects of surface properties, surface chemistry.

PRESERVATION TECHNIQUES FOR BIOMATERIALS: Phase behavior, nonfreezing storage-hypothermic, freeze-thaw technology, freeze-drying, vitrification.

7 Hours

PART - B

ARTIFICIAL ORGANS

UNIT - 5

INTRODUCTION: Substitutive medicine, outlook for organ replacement, design consideration, evaluation process.

ARTIFICIAL HEART AND CIRCULATORY ASSIST DEVICES: Engineering design, Engg design of artificial heart and circulatory assist devices, blood interfacing implants – introduction, total artificial hearts & ventricular assist devices, vascular prostheses, Non-blood interfacing implants for soft tissues- sutures and allied augmentation devices, percutaneous and skin implants, maxillofacial implants, eye and ear implants.

7 Hours

UNIT - 6

CARDIAC VALVE PROSTHESES: Mechanical valves, tissue valves, current types of prostheses, tissue versus mechanical, engineering concerns and hemodynamic assessment of prosthetic heart valves, implications for thrombus deposition, durability, current trends in valve design, vascular grafts-history, synthetic grafts, regional patency, thrombosis, neointimal hyperplasia, graft infections.

6 Hours

UNIT - 7

ARTIFICIAL KIDNEY: Functions of the kidneys, kidney disease, renal failure, renal transplantation, artificial kidney, dialyzers, membranes for haemodialysis, haemodialysis machine, peritoneal dialysis equipment-therapy format, fluid and solute removal.

ARTIFICIAL BLOOD: Artificial oxygen carriers, flurocarbons, hemoglobin for oxygen carrying plasma expanders, hemoglobin based artificial blood.

6 Hours

UNIT - 8

ARTIFICIAL LUNGS: Gas exchange systems, Cardiopulmonary bypass (heart-lung machine)-principle, block diagram and working, artificial lung versus natural lung. Liver functions, hepatic failure, liver support systems, general replacement of liver functions.

ARTIFICIAL PANCREAS: Structure and functions of pancreas, endocrine pancreas and insulin secretion, diabetes, insulin, insulin therapy, insulin administration systems.

Tracheal replacement devices, laryngeal replacement devices, Artificial esophagus

Artificial Skin: Vital functions of skin, current treatment of massive skin loss, design principles for permanent skin replacement.

7 Hours

TEXT BOOKS:

1. **Biomedical Engineering Handbook-Volume 1, 2nd Edition** - by J.D.Bronzino, CRC Press / IEEE Press, 2000.
2. **Biomedical Engineering Handbook-Volume 2 (2nd Edition)** - by J.D.Bronzino, CRC Press / IEEE Press, 2000.
3. **Handbook of Biomedical Instrumentation -** by R.S.Khandpur, 2nd Edition, Tata McGraw Hill, 2003.

ELECTIVE-IV (GROUP D)

LASERS AND OPTICAL FIBERS IN MEDICINE

Subject Code	:	**06BM831**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Historical background

MEDICAL LASERS: Introduction, Laser physics-fundamentals, principles, advances, Medical Lasers-fundamentals, principles, advances. Medical Laser Systems-fundamentals, principles. Laser safety-fundamentals,

7 Hours

UNIT - 2 & 3

APPLICATIONS OF LASERS IN THERAPY & DIAGNOSIS: Introduction, laser assisted diagnosis and therapy-fundamentals, interaction of laser beams and materials-principles (except 3.3.4), laser interaction with tissue-principles, laser assisted diagnostics-principles, applications of lasers in diagnosis and imaging-advances, laser surgery and therapy-principles-photothermal & photomechanical mechanisms, thermal interaction between laser and tissue-advances.

12 Hours

UNIT - 4

SINGLE OPTICAL FIBERS: Introduction, historical background, optical fibers-fundamentals, light transmission in optical fibers-principles, optical properties of optical fibers-advances, fabrication of optical fibers-principles, optical fibers for UV, visible, IR light-principles, power transmission through optical fibers-principles, modified fiber ends and tips-principles, fiber lasers-advances.

7 Hours

PART -B

UNIT - 5

OPTICAL FIBER BUNDLES: Introduction, nonordered fiberoptic bundles for light guides-fundamentals & principles, ordered fiberoptic bundles for imaging devices-fundamentals & principles, fiberscopes and endoscopes-fundamentals, fiber optic imaging systems-advances.

7 Hours

UNIT - 6

ENDOSCOPY: Introduction, endoscopic imaging systems-fundamentals, principles, advances, endoscopic diagnostics-advances, endoscopic therapy-fundamentals, endoscopic ultrasound imaging-principles.

7 Hours

UNIT - 7 & 8

CLINICAL APPLICATIONS OF FIBER OPTIC LASER SYSTEMS: Introduction, fiberoptic laser systems in cardiovascular disease (except 9.2.6), gastroenterology, gynecology, neurosurgery, oncology, ophthalmology, orthopaedics, otolaryngology (ENT), urology, flow diagram for laser angioplasty & photodynamic therapy.

12 Hours

TEXT BOOK:

1. **Lasers and Optical Fibers in Medicine -** by Abraham Katzir, Academic Press, 1998.

REFERENCE BOOK:

1. **Lasers in Medicine** - by Ronal W. Waynant, CRC Press, 2002.

BIOSENSORS AND SMART SENSORS

Subject Code	:	**06BM832**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

BIOSENSORS

UNIT - 1

INTRODUCTION: What is a biosensor, the first biosensors, urea biosensors, bananatrode, biosensors under different headings, scope and applications.

BIOLOGICAL ELEMENTS: Introduction, enzymes, examples of enzyme biosensors, antibodies, nucleic acids, receptors.

6 Hours

UNIT - 2

IMMOBILIZATION OF BIOLOGICAL COMPONENTS: Introduction, adsorption, microencapsulation, entrapment, cross-linking, covalent bonding.

TRANSDUCERS I-ELECTROCHEMISTRY: Potentiometry: Cells and electrodes, reference electrodes, practical aspects of ion-selective electrodes, measurement and calibration, examples of ion-selective electrodes. Voltammetry: Linear sweep voltammetry, cyclic voltammetry, amperometry, kinetic and catalytic effects. Conductivity, Field effect transistors, applications of FET sensors.

7 Hours

UNIT - 3

AMPEROMETRIC BIOSENSORS: Enzyme electrode, membrane limiting diffusion, glucose assay, electrochemically deposited immobilization matrix, signal enhancement, enzyme labeled linked assays, amperometric determination of bioaffinity reactions, amplification and miniaturization.

6 Hours

UNIT - 4

PHOTOMETRIC ASSAY TECHNIQUES: Fluorescence and phosphorescence, indicator linked bioassay, irrational spectroscopy, the optical transducer, P^H optical probes.

OPTICAL BIOSENSORS & OTHER TECHNIQUES: Indicator labeled bioassay, chemiluminescence, bioluminescence, surface plasma resonance, piezoelectric based sensors and surface acoustic waves.

7 Hours

PART - B

SMART SENSORS

UNIT - 5

BASICS OF SMART SENSORS & MICROMACHINING: Introduction, Mechanical-Electronic transitions in sensing, nature of sensors, overview of smart sensing and control systems, integration of micromachining and microelectronics, Introduction to micromachining, bulk micromachining, wafer bonding, surface micromachining.

7 Hours

UNIT - 6

SENSOR INFORMATION TO MCU: Introduction, amplification and signal conditioning, separate versus integrated signal conditioning, digital conversion

6 Hours

UNIT - 7

MCUS AND DSPS TO INCREASE SENSOR IQ: Introduction, MCU control, MCUs for sensor interface, DSP control, Software, tools and support, sensor integration,

6 Hours

UNIT - 8

COMMUNICATIONS FOR SMART SENSORS: Introduction, definitions and background, sources and standards, automotive protocols, industrial networks, office & building automation, home automation, other aspects of network communications

CONTROL TECHNIQUES: Introduction, state machines, fuzzy logic, neural networks, combined fuzzy logic and neural networks, adaptive control, other control areas.

7 Hours

TEXT BOOKS:

1. **Biosensors: An Introduction** - by Brain R. Eggins, John Wiley Pub., 1996.
2. **Biosensors -** by Elizabeth A. H Hall - Open University press, Milton Keynes.
3. **Understanding Smart Sensors -** by Randy Frank, 2nd Edition, Artech House Publications, 2000.

REFERENCE BOOKS:

1. **Biosensors** - by A.E.G Gass, IRL Press, 1990.
2. **Smart Sensors -** by Paul W. Chapman, ISA Press.

NANOTECHNOLOGY

Subject Code	:	**06BM833**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Physics of solid state-structure, energy bands, localized particles

Methods of Measuring Properties: Structure, microscopy, spectroscopy.

7 Hours

UNIT - 2

PROPERTIES OF INDIVIDUAL NANOPARTICLES: Metal nanoclusters, semiconducting, nanoparticles, rare gas and molecular clusters, methods of synthesis

6 Hours

UNIT - 3

CARBON NANOSTRUCTURES: Carbon molecules, carbon clusters, carbon nanotubes, applications of carbon nanotubes.

7 Hours

UNIT - 4

BULK NANOSTRUCTURE MATERIALS: Solid disordered nanostructures, nanostructures crystals.

6 Hours

PART - B

UNIT - 5

NANOSTRUCTURED FERROMAGNETISM: Basics of ferromagnetism, effect of bulk nanostructuring of magnetic properties, dynamics of nanomagnets, nanopore containment of magnetic particles, nanocarbon, ferromagnets, giant and colossal magnetoresistance, ferro fluids.

7 Hours

UNIT - 6 & 7

OPTICAL AND VIBRATIONAL SPECTROSCOPY: Infrared frequency range, luminescence, nanostructures of Zolite cages.

Quantum Wells, Wires and Dots: Preparation of quantum nanostructures, size and dimensionality effects, excitons, single-electron tunneling, applications, superconductivity.

12 Hours

UNIT - 8

BIOLOGICAL MATERIALS: Biological building blocks, nucleic acids, biological nanostructures.

Nanomachines and Nanodevices: NEMS, Molecular and supramolecular switches.

7 Hours

TEXT BOOK:

1. **Introduction to Nanotechnology** - by Charles P. Poole Jr and Frank J. Owens, John Wiley, 2003.

REFERENCE BOOKS:

1. **Nanotechnology** - by Mark Ratner and Daniel Ratner, Pearson Pub, 2003.
2. **Nanotechnology** - by Gregory Timp, Springer, 1999.
3. **Bionanotechnology -** by David S. Goodsell, John Wiley & Sons, 2004.

NEURAL NETWORKS & AI IN BIOMEDICAL ENGINEERING

Subject Code	:	**06BM834**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

OVERVIEW: Early biomedical systems, medical and biological data

FOUNDATIONS OF NEURAL NETWORKS: Objectives of neural networks, biological foundations of neural networks, early neural models, precursor to current models-pattern classification, basic concepts.

6 Hours

UNIT - 2

CLASSES OF NEURAL NETWORKS: Basic network properties, classification models, association models, optimization models, self organization models, radial basis functions.

CLASSIFICATION OF NETWORKS AND LEARNING: Network structure, feature selection, types of learning, interpretation of output.

6 Hours

UNIT - 3

SUPERVISED LEARNING: Decision surfaces, two category separation-linearly separable sets, nonlinearly separable sets, multiple category classification problems, relationship to neural network models, comparison of methods, applications.

UNSUPERVISED LEARNING: Background, clustering, Kohonen networks & competitive learning, adaptive resonance theory, applications.

7 Hours

UNIT - 4

DESIGN ISSUES: Introduction, input data types, structure of networks, implications of network structures, choice of learning algorithm.

COMPARATIVE ANALYSIS: Introduction, input data considerations, supervised learning, algorithms, unsupervised learning, network structures, interpretation of results.

VALIDATION & EVALUATION: Introduction, data checking, validation of learning algorithm, evaluation of performance.

7 Hours

PART - B

UNIT - 5 & 6

FOUNDATIONS OF COMPUTER ASSISTED DECISION MAKING: Motivation, databases and medical records, mathematical modeling and simulation, pattern recognition, Bayesian analysis, decision theory, symbolic reasoning techniques,

KNOWLEDGE REPRESENTATION: Production rules, frames, databases, predicate calculus and semantic nets, temporal data representations.

KNOWLEDGE ACQUISITION: Introduction, expert input, learned knowledge, meta-knowledge, knowledge base maintenance.

14 Hours

UNIT - 7 & 8

REASONING METHODOLOGIES: Introduction, problem representation, blind searching, ordered search, AND/OR trees, searching game trees, searching graphs, rule base searching, higher-level reasoning methodologies.

VALIDATION AND EVALUATION: Introduction, algorithm evaluation, knowledge base evaluation, system evaluation.

12 Hours

TEXT BOOK:

1. **Neural Networks and Artificial Intelligence for Biomedical Engineering by** - Donna L. Hudson and Maurice E. Cohen, IEEE Press, 2000.

REFERENCE BOOKS:

1. **Artificial Neural Networks -** Robert J. Schalkoff, Tata McGraw Hill, 1997.
2. **Introduction Artificial Neural System** - By Jacek M. Zurada, Jaico Pub. House, 2004.
3. **Artificial Neural Networks** - B. Yegnanarayan –PHI 1999.
4. **Neural Networks a comprehensive foundation -** Simon Haykin, McMillan College Public Company, New York 1994

EMBEDDED SYSTEMS PROGRAMMING

Subject Code	:	**06BM835**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION AND DATA REPRESENTATION: Introduction to embedded systems, real time, multi tasking, embedded processors, real time kernel, fixed precision binary numbers, binary representations of integers, and Binary representation of real numbers

6 Hours

UNIT - 2

GETTING THE MOST OUT OF C: Integer data types, mixing data types, typedefs and defines, manipulating bits in memory, manipulating bits in I/O ports, accessing memory-mapped I/O devices, structures, variant access.

7 Hours

UNIT - 3

A PROGRAMMER'S VIEW OF COMPUTER ORGANIZATION: Memory, CPU, I/O, introduction to Intel architecture, Intel Real mode architecture, Intel protected mode architecture, operand and address-size override prefixes, Intel data manipulation instructions.

7 Hours

UNIT - 4

MIXING C AND ASSEMBLY: Programming in assembly, register usage conventions, typical use of addressing options, instruction sequencing, procedure call and return, parameter passing, retrieving parameters, temporary variables.

6 Hours

PART - B

UNIT - 5

INPUT/OUTPUT PROGRAMMING: Intel I/O instructions, synchronization, transfer rate, and latency, polled waiting loops, interrupt driven I/O, direct memory access, comparison methods.

6 Hours

UNIT - 6

CONCURRENT SOFTWARE AND SCHEDULING: Foreground / Background systems, multithreaded programming, shared resources and critical sections, thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, WDT.

7 Hours

UNIT - 7

MEMORY MANAGEMENT AND SHARED MEMORY: Objects in C, scope, automatic allocation, static allocation, programs to distinguish static from automatic, dynamic allocation, automatic allocation with variable size, recursive functions and memory allocations, recognizing shared objects, reentrant functions, read-only data, coding practices to avoid, accessing shared memory.

7 Hours

UNIT - 8

SYSTEM INITIALIZATION: Memory layout, CPU, C run time environment, system timer, interrupt system.

6 Hours

TEXT BOOK:

1. **Fundamentals of Embedded Software, where C and assembly meet** - by Damiel. W. Lewis, Pearson Education, 2003

REFERENCE BOOK:

1. **Embedded system Design** by, Frank Vahid & Tony Givargis, John Wiley, 2003.

DISTRIBUTED SENSOR NETWORKS

Subject Code	:	**06BM836**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Challenges, Sensor Network Architectures, Sensor Node Deployment, Energy-Efficient Information Processing, Data Dissemination, Self-Configuration Methods.

6 Hours

UNIT - 2

SENSOR NODE DEPLOYMENT: Sensor Node Detection Models, Virtual Force Algorithm, Virtual Forces, Overlapped Sensor Detection Areas, Energy Constraint on the VFA Algorithm, Procedural Description VFA Simulation Results Case Studies Uncertainty Modeling, Modeling of Non-Deterministic Placement Uncertainty-Aware Placement Algorithms Procedural Description Simulation Results, Case Study.

7 Hours

UNIT - 3

ENERGY-AWARE TARGET LOCALIZATION: Detection Probability Table Score-Based Ranking Selection of Sensors to Query 3Energy Evaluation Model Primitive Energy Evaluation Model Refined Energy Evaluation Model Procedural Description Simulation Results, Case Study.

6 Hours

UNIT - 4

ENERGY-EFFICIENT SELF-ORGANIZATION: Introduction Relevant Prior Outline of SCARE Basic Scheme Network Partitioning Problem Details of SCARE. Time Relationships Ensuring Network Connectivity Message Complexity Optimal Centralized Algorithm overage Comparisons Performance Evaluation Simulation Methodology Simulation Results Effect of Location Estimation Error Conclusion.

7 Hours

PART - B

UNIT - 5

ENERGY-AWARE INFORMATION DISSEMINATION: Introduction Related Prior Work Location-Aided Flooding Modified Flooding Location Information Virtual Grids Packet Header Format LAF Node Types Information Dissemination using LAF Resource Management in LAF Completeness of the Data Dissemination Procedure Analysis Errors in Location Estimates Performance Evaluation Energy Model Simulation Model Conclusion.

7 Hours

UNIT - 6 & 7

OPTIMAL ENERGY EQUIVALENCE ROUTING IN WIRELESS SENSOR NETWORKS: Related Work Networking Characteristics of WSNWSN Protocol Stack Classification of Energy Equivalence Routing Energy Saving Routing Protocols Comparison to Flooding Family Comparison to Sensor-Centric Paradigm Data-Centric Routing and Directed Diffusion Energy Equivalence Approach Basics Neighbor Switching Path Rerouting EER Algorithms Assumptions Procedures and Functions Formats of Packets EER Common Entry Algorithm Common Neighbor Switching EER Algorithm (CNS) Shortest Rerouting EER Algorithm (EERS) Longest Rerouting EER Algorithm (EERL) Simulation Analysis Basic Procedure Lifetime and End Condition Density of Network Conclusion.

12 Hours

UNIT - 8

TIME SYNCHRONIZATION IN WIRELESS SENSOR NETWORKS: Introduction Synchronized Time in a WSN Traditional Network Time Synchronization Energy Awareness Infrastructure Supported Vs. Ad Hoc

Static Topology vs. Dynamics Connected vs. Disconnected Design Principles for WSN Time Synchronization Computer Clocks Clock Synchronization in DSN Synchronization Algorithm The Idea Time Transformation Message Delay Time Stamp Calculation Improvements.

7 Hours

TEXT BOOK:

1. **Scalable Infrastructure for Distributed Sensor Networks** - by Krishnendu Chakrabarty and S. S. Iyengar, Springer-Verlag London Limited, 2005.

REFERENCE BOOK:

1. **Distributed Sensor Networks** - A multi-agent perspective by Victor L, Charles Oitiz and Tambe, Kluwer Academic Pub, 2003.

ELECTIVE-V (GROUP E)

BIO-MEMS

Subject Code	:	**06BM841**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

OVERVIEW OF MEMS AND MICROSYSTEMS: MEMS and Microsystems, Typical MEMS and Microsystems products, Evolution of Micro fabrications, Microsystems and Microelectronics, The Multidisciplinary Nature of Microsystems Design and Manufacture, Microsystems and Miniaturization, Applications of Microsystems in health care industry, BioMEMS, Fabrication, Structure, Driving force behind biomedical applications- Diagnostics, Drug delivery systems, Tissue engineering, Minimally invasive procedures, Biocompatibility.

6 Hours

UNIT - 2

WORKING PRINCIPLES OF MICROSYSTEMS: Introduction, Micro-sensors, Microactuation, MEMS with Microactuators, Microaccelerometers, Microfluidics.

7 Hours

UNIT - 3

ENGG SCIENCE FOR MICROSYSTEM DESIGN & FABRICATION: Introduction, Atomic Structure of Matter *(Review only)* , Ions and Ionization, Molecular Theory of Matter and Intermolecular forces, Doping of

Semiconductors *(Review only)*, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

DETECTION & MEASUREMENT SCHEMES: Electrochemical (EC) detection, Chemiluminescence & Bioluminescence, Fluorescence, Confocal laser microscopy, Interferometry, Raman Microscopy & Surface-enhanced resonance Raman scattering, TEM & SEM.

7 Hours

UNIT - 4

ENGINEERING MECHANICS FOR MICRO-SYSTEMS DESIGN: Introduction, Static Bending of thin plates- Bending of circular plates & square plates with all edges fixed, Mechanical vibration- General formulation, Resonant vibration, Microaccelerometers, Design theory of microaccelerometers, Thermo mechanics- Thermal effects on mechanical strength of materials, Creep deformation, Thermal stresses *(excluding thermal stresses in thin plates and beams)*, Thin-Film Mechanics, Overview of Finite Element Stress Analysis.

6 Hours

PART - B

UNIT - 5

SCALING LAWS IN MINIATURIZATION: Introduction to Scaling, Scaling in Geometry, Scaling in Rigid Body Dynamics, Scaling In Electrostatic Forces, Scaling in Electromagnetic Forces, Scaling in Electricity, Scaling in Fluid Mechanics, Scaling in Heat Transfer.

6 Hours

UNIT - 6

MATERIALS FOR MEMS AND MICROSYSTEMS: Introduction, Substrates and Wafers, Active Substrate Materials, Silicon as a Substrate Material- The ideal substrate for MEMS, single-crystal silicon & wafers, crystal structure, mechanical properties, Silicon Compounds- Silicon dioxide, silicon carbide, silicon nitride, polycrystalline silicon, Silicon Piezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals, Polymers, Packaging Materials.

7 Hours

UNIT - 7

MICROSYSTEMS FABRICATION & DESIGN: Introduction, Photolithography, Ion implantation, Diffusion, Oxidation- Thermal oxidation, Silicon dioxide, Chemical vapor deposition- Working principle, Chemical reactions in CVD, Enhanced CVD, Etching- Chemical & Plasma etching.

The LIGA Process- General description of the LIGA process, Microsystem Design- Design considerations

7 Hours

UNIT - 8

EMERGING BIOMEMS TECHNOLOGY: Introduction, Minimally invasive surgery, Point-of-care Clinical Diagnosis, Syncope assessment, Continuous glucose monitoring, Micordroplet analysis, Endoscopy- Introduction, Micro-optical scanner, Neurosciences- Introduction, Micro-probes, Ophthalmology- Introduction, Retinal implants, Tissue Engineering- Introduction, Cell patterning & bioreactors, Cell based biosensors, Homeland security.

6 Hours

TEXT BOOKS:

1. **MEMS & Microsystems: Design and Manufacture -** by Tai-Ran Hsu, Tata McGraw Hill, 2002.
2. **Fundamentals of BioMEMS and Medical Micro devices -** by Steven S. Saliterman, Wiley-Interscience, 2006.

BIOLOGICAL CONTROL SYSTEMS AND MODELLING

Subject Code	:	**06BM842**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

AN INTRODUCTION TO PHYSIOLOGICAL CONTROL SYSTEM: Differences between the technological and Physiological control system, Regulation of electrolyte concentrations, Regulation of Electrolyte concentrations, Regulation of Acid-Base Balance, Regulation of Red blood cell Production, Regulation of Arterial Pressure, Regulation of blood volume, regulation of Respiration, reflex functions of the nervous system, regulation of body temperature, regulation of blood glucose.

7 Hours

UNIT - 2

STATIC CHARACTERISTICS OF TECHNOLOGICAL AND PHYSIOLOGICAL CONTROL SYSTEMS: Introduction, Determination of open-loop gain. Method 1, Application of Method 1 to a physiological system, Determination of open loop gain Method 2, Application of Method 2 to a physiological system, determination of open loop gain Method 3, Application of method 3 to a Physiological system.

7 Hours

UNIT - 3 & 4

THE APPLICATION OF FREQUENCY RESPONSE ANALYSIS TO PHYSIOLOGICAL SYSTEM: Frequency analysis of the cerebral Ischemic pressure response, The papillary Light reflex.

DYNAMIC SYSTEMS AND THEIR CONTROL: A Qualitative Introduction: Introduction, some systems definition , man machine example, the pupil control systems the generic structure of control systems, open and closed loop systems –closed loop instability, automatic aperture control in cameras – an engineering analog of the pupil control system.

12 Hours

PART - B

UNIT - 5

MODELS OF NEURONS: Basic biophysics tools, equilibrium in one ion system, Donan equilibrium, space charge neutrality, voltage across membrane with non-zero permeability for all ions, Goldman equation, ion pumps, membrane potentials for biological membranes, Hodgin-Huxley model, iron-wire model.

7 Hours

UNIT - 6

MODEL FOR NEUROMUSCULAR SYSTEM: Stretch reflex, antagonist muscle, two control mechanics, golgi tendon organs, experimental validation of the model, Parkinson's syndrome

7 Hours

UNIT - 7

MODEL OF THERMOREGULATION SYSTEM: Model of the plant, controlled model, model validation & variation.

6 Hours

UNIT - 8

CARDIOPULMONARY SYSTEM MODEL: Myocardial model, distributed parameter model, model performance, respiratory system model.

6 Hours

TEXT BOOKS:

1. **The Application of control theory to Physiological systems** - by Howard T. Milhorn, Jr.
2. **Biological control systems analysis** - by Jhon H. Milsum, Mc Graw Hill Book company.
3. **Bioengineering** - by A. Terry Bahill, Prentice Hall
4. **Handbook of Biomedical Engineering -** by Jacob Kline, Academic Press, 1988.

PICTURE ARCHIVING & COMMUNICATION SYSTEMS

Subject Code	:	**06BM843**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO PACS: Interpretation Workstations, Strategic Plan, PACS Impact Analysis, Financial Analysis, Technical Requirements, Project Planning and Evaluation, Contract Negotiations, DICOM Standard, Queuing Perspective, Quality Assurance, HL7, IHE.

7 Hours

UNIT - 2

COMPUTER FUNDAMENTALS: Digital Imaging Fundamentals, Image Acquisition, Image Processing Algorithms, Quality Assurance, Future trends, Image Compression, Compression Applications to medical imaging.

7 Hours

UNIT - 3

PACS ARCHITECTURE: Centralized model, Medical-legal Archive, Networking Fundamentals, Factors to consider in building a network**.**

6 Hours

UNIT - 4

SERVERS AND OPERATING SYSTEMS: Disaster recovery, Storage and enterprise archiving, RAID, Direct attached storage, Storage area network, Hierarchical storage.

6 Hours

PART - B

UNIT - 5

IMAGE DISPLAYS: Digital Mammography, Web distribution.

7 Hours

UNIT - 6

PACS WORKSTATION SOFTWARE: Role of Workstation, User Interface, Future of Workstations, Breast Imaging, Cad, CASS.

6 Hours

UNIT - 7

3 DIMENSIONAL IMAGING IN RADIOLOGY: Voice recognition, Order entry in Radiology.

6 Hours

UNIT - 8

TELE RADIOLOGY: Image Acquisition and Image Digitization, Image Transmission, Applications of Tele Radiology, Legal and Socioeconomic issues ACR Standards.

7 Hours

TEXT BOOK:

1. **PACS – A guide to the Digital Revolution**- Keith Dreyer – Springer, 2006

REFERENCE BOOK:

1. **PACS in Medicine** by H.K.Huang, Wiley-IEEE, 2004

PATTERN RECOGNITION IN MEDICINE

Subject Code	:	**06BM844**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

INTRODUCTION: Machine perception, an example, pattern recognition system, the design cycle, Introduction, Bayes decision theory-continues features, Minimum error rate classification, Classifiers, Discriminants and decision surfaces, Normal density, Discriminant functions for the normal density, Base decision theory discrete features, compound Bayes Decision Theory and context.

12 Hours

UNIT - 3

PARAMETER ESTIMATION AND SUPERVISED LEARNING: Introduction, Maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation, sufficient statistics and exponential family, problem of dimensionality.

7 Hours

UNIT - 4

NON-PARAMETRIC TECHNIQUES: Introduction, density estimation, Parzen windows, nearest neighbor estimation, the nearest neighbor rule, Matrix and nearest neighbor classification,

7 Hours

PART - B

UNIT - 5 & 6

NON-PARAMETRIC TECHNIQUES: Fuzzy classifications, relaxation methods, approximation by series expansion.

LINEAR DISCRIMINANT FUNCTIONS: Introduction, linear Discriminant functions and decision surfaces, Generalized linear discriminant functions, the two category linearly separable case, minimizing the perceptron criterion function, relaxation procedures, non-separable behavior, minimum squared error procedures.

14 Hours

UNIT - 7 & 8

UNSUPERVISED LEARNING AND CLUSTERING: Introduction, Mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, unsupervised Bayesian learning, data description and clustering, criterion functions for clustering, iterative optimization, hierarchical clustering, The problem of validity, On line clustering, graph theoretic methods, Component analysis low dimensional representations and multidimensional scaling.

12 Hours

TEXT BOOK:

1. **Pattern Classification** - by Richard. O. Duda, Peter E. Hart and David G. Stork, 2nd Edition, John Wiley Interscience.

DIGITAL SYSTEMS USING VERILOG

Subject Code	:	**06BM845**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO LOGIC CIRCUITS: Variables and functions, Inversions, truth tables, logic gates and networks, Boolean algebra, synthesis using AND, OR, and NOT gates, NAND and NOR logic Networks, Design Examples.

7 Hours

UNIT - 2 & 3

INTRODUCTION TO CAD TOOLS, INTRODUCTION TO VERILOG

IMPLEMENTATION TECHNOLOGY: Transistor switches, NMOS logic gates, CMOS logic gates, Negative logic system, standard chips, and programmable logic devices: PAL, PLA, voltage levels in logic gates, noise margin, fan-in and fan-out in logic gates, transmission gates, implementation details for SPLDs, CPLDs and FPGAs.

12 Hours

UNIT - 4

IMPLEMENTATION OF LOGIC FUNCTIONS AND ARITHMETIC CIRCUITS: K-map, minimization of POS forms, multiple-output circuits, multilevel synthesis, analysis of multilevel circuits, CAD tools, positional number representation, addition of unsigned numbers, signed numbers, fast adders.

7 Hours

PART - B

UNIT - 5

COMBINATIONAL CIRCUIT BUILDING BLOCKS: Multiplexers, decoders, encoders, code converters, arithmetic comparison circuits, Verilog for combinational circuits.

6 Hours

UNIT - 6 & 7

FLIP-FLOPS, REGISTERS, COUNTERS AND A SIMPLE PROCESSOR: Basic latch, Gated SR latch, Gated D latch, master-slave and edge triggered d flip-flops, T flip-flops, JK flip-flops, registers, counters; reset synchronization, different counters, using storage elements with CAD tools, using registers and counters with CAD tools, design examples.

SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS: Basic design steps, mealy state model, design of finite machines using CAD tools, serial adder, state minimization,

13 Hours

UNIT - 8

SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS: Design of a counter using the sequential circuit approach, FSM as an Arbiter Circuit, analysis of synchronous sequential circuits, asynchronous behavior, analysis and synthesis of asynchronous circuits, state reduction, state assignment, vending machine controller.

7 Hours

TEXT BOOK:

1. **Fundamentals of Digital Logic with Verilog Design -** by, Stephen Brown & Zvonko Vranesic, 4th Reprint, Tata McGraw Hill, 2004.

REAL TIME SYSTEMS

Subject Code	:	**06BM846**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

BASIC REAL TIME CONCEPTS: Basic computer architecture, Real Time definitions, Synchronous and Asynchronous Events, Real time Design Issues, CPU, Memories, Input and Output, Other Devices

6 Hours

UNIT - 2

LANGUAGE ISSUES – SOFTWARE LIFE CYCLES: Language features, Basic, Fortran, C,C++ , Pascal, Modula2,Ada, Assembly languages, Code Generation, Scheduling Analysis , Phases of software cycle, Spiral Model, Standards DOD-STD-2167A,ISO 9000,IEEE 830.

7 Hours

UNIT - 3

REAL TIME SPECIFICATIONS AND DESIGN TECHNIQUES: Natural Languages, Flow charts ,Structure Charts, Data Flow diagrams, Petri Nets, State Charts, Polled Loop Systems, Phase. State Driven Codes, Interrupt Driven Systems, Fore ground Background systems, Full features Real Time System

7 Hours

UNIT - 4

INTER STACK COMMUNICATION – REAL TIME MEMORY MANAGEMENT: Buffering data, Mail boxes, Critical Regions, Semaphores, Event Flags and Signals, Deadlock, Process Stack Management, Dynamic Allocation, Static Schemes.

6 Hours

PART - B

UNIT - 5

SYSTEM PERFORMANCE ANALYSIS AND OPTIMIZATION: Response Time Calculations, Interrupt Latency, Time Loading and its Measurement, Reducing Response Time and Time Loading, Analysis of Memory Requirements, Reducing Memory Loading , I/O Performance

6 Hours

UNIT - 6

QUEUING MODELS: Probability Functions, Continuous, Discrete, Basic Buffer Size Calculation, Classical Queuing theory, Little's Law, Erlang's formula.

6 Hours

UNIT - 7

RELIABILITY TESTING- MULTIPROCESSING SYSTEMS: Faults, Failures, Bugs, Reliability, Testing, Fault Tolerance, Classification of Architecture, Distributed Systems, Non- Von Neuman Architecture

7 Hours

UNIT - 8

HARDWARE / SOFTWARE INTEGRATION- REAL TIME APPLICATIONS: Goals of Real Time System Integration, Tools, Methodology, Uncertainty principle, Real Time systems as Complex Systems, Real Time Databases, Real Time Image Processing, Real Time Unix

7 Hours

TEXT BOOK:

1. **Real-Time Systems Design & Analysis** - by Philip A. Laplante, PHI.

REFERENCE BOOK:

1. **Real-Time Systems** – Krishna and Lin, TMH.

♣ ♣ ♣ ♣ ♣ ♣ ♣