St. PETER'S UNIVERSITY

St. Peter's Institute of Higher Education and Research
(Declared under section 3 of UGC Act 1956)
Avadi, Chennai – 600 054.

M.E. (BIO – MEDICAL ENGINEERING) PROGRAMME

(I TO IV SEMESTERS)

REGULATIONS AND SYLLABI

(REGULATIONS – 2013)

(Effective from the Academic Year 2013-'14)

M.E. (BIO – MEDICAL ENGINEERING) PROGRAMME

Regulations and Syllabi

(Effective from the Academic Year 2013-'14)

1. **Eligibility:**
(1) Candidates who passed the following Examination or any other equivalent Examination there to and who appeared for the entrance test conducted by the University or approved institutions wherever prescribed are eligible for admission **to Four Year B.E. (Bio - Medical Engineering) Programme.**

Higher Secondary Examination with Mathematics, Physics and Chemistry conducted by the Government of Tamil Nadu or its equivalent in the relevant subjects.

(2) Candidates who passed Three Year Diploma in Technical Education in the concerned subject conducted by the Government of Tamil Nadu are eligible for admission to Second Year of Four Year B.E. (Bio - Medical Engineering) Programme.

2. **Duration:** Two Years comprising 4 Semesters. Each semester has a minimum 90 working days with a minimum of 5 hours a day.

3. **Medium:** English is the medium of instruction and examination.

4. **Weightage for Continuous and End Assessment:** The weightage for Continuous Assessment (CA) and End Assessment (EA) be 25:75 unless the ratio is specifically mentioned in the scheme of Examinations.

5. **Credit System:** Credit system be followed with 18 credits for each semester and each credit is equivalent to 25 hours of effective study provided in the Time Table.

6. **Scheme of Examinations**

I Semester

Code No.	**Course Title**	**Marks**			
Theory		**Credit**	**CA**	**EA**	**Total**
113BMPT01	Applied Mathematics	2	25	75	100
113BMPT02	Human Anatomy and Physiology	2	25	75	100
113BMPT03	Bio Signal Processing	3	25	75	100
113BMPT04	Biomedical Sensors and Instrumentation	3	25	75	100
113BMPT05	Medical Imaging Systems	3	25	75	100
113BMPT08	**Elective I:** Bio Materials	3	25	75	100
Practical					
113BMPP01	Clinical Instrumentation Laboratory	2	25	75	100
	TOTAL	18	175	525	700

SEMESTER II

Code No.	**Course Title**	**Marks**			
Theory		**Credit**	**CA**	**EA**	**Total**
213BMPT01	Applied Medical Image Processing	2	25	75	100
213BMPT02	Diagnostic and Therapeutic Equipments	2	25	75	100
213BMPT03	Bio Mechanics	3	25	75	100
213BMPT07	**Elective II: Nanotechnology and Applications**	3	25	75	100
213BMPT08	**Elective III: Hospital Planning, Organization and Management**	3	25	75	100
213BMPT15	**Elective IV: Biomedical Optics**	3	25	75	100
Practical					
213BMPP01	Bio Signal and Image Processing Laboratory	2	25	75	100
	TOTAL	18	175	525	700

SEMESTER III

Code No.	Course Title	Marks			
Theory		**Credit**	**CA**	**EA**	**Total**
313BMPT01	Rehabilitation Engineering	3	25	75	100
313BMPT03	**Elective V :** Hospital Waste Management	3	25	75	100
313BMPT06	**Elective VI:** Advanced Neural Computing	3	25	75	100
Practical					
313BMPP01	Project Work (phase I)*	9	25	65	100
	Viva Voce			10	
	TOTAL	18	100	300	400

***** Candidates who have completed Project work (Phase I) successfully are eligible for Project Work (Phase - II) Examination.

SEMESTER IV

Code No.	Course Title	Marks			
Project		**Credit**	**CA**	**EA**	**Total**
413BMPP01	Project Work (Phase II)*	18	25	65	100
	Viva Voce			10	
	TOTAL	18	25	75	100

LIST OF ELECTIVES

Course Code	COURSE TITLE	CREDIT
I Semester (Elective		
113BMPT06	Principles of Genetic Analysis	3
113BMPT07	Physics in Medicine	3
113BMPT08	**Bio Materials**	3
113BMPT09	Bio Statistics	3
II Semester (Elective II)		
213BMPT04	Medical Informatics	3
213BMPT05	Tissue Engineering	3
213BMPT06	Tele Health Technology	3
213BMPT07	**Nanotechnology and Applications**	3
ELECTIVE-III		
213BMPT08	**Hospital Planning, Organization and Management**	3
213BMPT09	Finance Management in Hospital	3
213BMPT10	Human Resource Management in Hospitals	3
213BMPT11	Hospital Architecture	3
ELECTIVE-IV		
213BMPT12	Computer Based Medical Instrumentation	3
213BMPT13	Bio MEMS	3
213BMPT14	Finite Element Methods for Bio Mechanical Analysis	3
213BMPT15	**Biomedical Optics**	3
SEMESTER III (ELECTIVE-V)		
313BMPT02	Health Policy and Equipment Management	3
313BMPT03	**Hospital Waste Management**	**3**
313BMPT04	Quality Assurance and Safety in Hospitals	3
313BMPT05	Medical Ethics and Standards	3
ELECTIVE-VI		
313BMPT06	**Advanced Neural Computing**	**3**
313BMPT07	Pattern Recognition	3
313BMPT08	Wavelet Transforms and Applications	3
313BMPT09	Physiological Modeling	3

7. Passing Requirements: The minimum pass mark (raw score) be 50% in End Assessment (EA) and 50% in Continuous Assessment (CA) and End Assessment (EA) put together. No minimum mark (raw score) in Continuous Assessment (CA) be prescribed unless it is specifically mentioned in the scheme of Examination.

8. Grading System: Grading System on a 10 Point Scale be followed with 1 mark = 0.1 Grade point to successful candidates as given below.

CONVERSION TABLE

(1 mark = 0.1 Grade Point on a 10 Point Scale)

Range of Marks	Grade Point	Letter Grade	Classification
90 to 100	9.0 to 10.0	O	First Class
80 to 89	8.0 to 8.9	A	First Class
70 to 79	7.0 to 7.9	B	First Class
60 to 69	6.0 to 6.9	C	First Class
50 to 59	5.0 to 5.9	D	Second Class
0 to 49	0 to 4.9	**F**	**Reappearance**

Procedure for Calculation

Cumulative Grade Point Average (CGPA) = $\frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}}$

= $\frac{\sum (CA+EA)\ C}{\sum C}$

Where Weighted Grade Points in each Course = Grade Points (CA+EA) multiplied by Credits

= (CA+EA)C

Weighted Cumulative Percentage of Marks(WCPM) = CGPAx10

C- Credit, CA-Continuous Assessment, EA- End Assessment

9. Pattern of the Question Paper: The question paper for End Assessment will be set for three hours and for the maximum of 100 marks with following divisions and details.

Part A: 10 questions (with equal distribution to all units in the syllabus). Each question carries 2 marks.

Part B: 5 questions with either or type (with equal distribution to all Units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be reduced to the maximum prescribed in the Regulations.

10. Effective Period of Operation for the Arrear Candidates: Two Year grace period is provided for the candidates to complete the arrear examination, if any.

Registrar

Common To M.E. (APPLIED ELECTRONICS & BIO-MEDICAL ENGINEERING)

I Semester

113AEPT01 & 113BMPT01 – APPLIED MATHEMATICS

OBJECTIVES:

- To develop the ability to apply the concepts of Matrix theory and Liner programming in Electrical Engineering problems.
- To familiarize the students in calculus of variations and queuing model

1. CALCULUS OF VARIATION

Introduction – Euler's equation – several dependent variables Lagrange's equation of Dynamics – Integrals involving derivatives higher that the first – Problem with constrains – Direct methods and eigen value problems.

2. MATRIX THEORY

Eigen values using QR transformations – generalized eigenvectors – canonical forms – singular value decomposition and applications – pseudo inverse – least square.

3. LINEAR PROGRAMMING PROBLEM

Graphical method – simplex method – Big M Technique – Integer programming.

4.TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and Conditional distributions – functions of two dimensional random variables – Regression curve – correlation.

5. QUEUEING MODELS

Poisson Process – Markovian queues – Single and Multi-server Models – Little's formula - Machine Interference Model – Steady State analysis – Self Service queue.

REFERENCES:

1. Gupta, A.S., Calculus of Variations with Applications, Prentice – Hall of India New Delhi, 1997.
2. Bronson.R, "Matrix Operation", Schaums Outline Series, Mc Graw Hill, Newyork, 1989.
3. Richard Bronson, Gabriel B.Costa, "Linear Algebra", Academic Press, Second Edition, 2007
4. Donald Gross and Carl M. Harris, "Fundamentals of Queueing Theory", 2nd edition, John Wiley and Sons, New York (1985).
5. S.C. Gupta and Kapoor V.K."Fundamental of Mathematics Statistics" , Suhan and Sons 2001.\
6. Richard Johnson Miler and Freund Probability and Statistics for Engineering-7th Edition-Printice Hall and India private Ltd, New Delhi.

113BMPT02 - HUMAN ANATOMY AND PHYSIOLOGY

OBJECTIVES:

- To understand basics of Human Anatomy and Physiology.
- To study the organs and systems involved in body functions.
- To apply this knowledge into biomedical engineering field.

UNIT I INTRODUCTION TO HUMAN ANATOMY & PHYSIOLOGY

Organization of human body, tissues and cavities – Anatomical planes, positions and sections - Cell: Structure and organelles structure – Functions of Each components in the cell. Cell membrane Transport, Resting membrane potential and ionic basis of potentials, Recording of Action potentials, - Homeostasis

UNIT II BUILDING BLOCKS OF HUMAN BODY

Muscular System: Types of Muscle – Structure & Functions of Skeletal Muscle - Skin and Appendages. Skeletal System: Structure, Type and Functions of Bone - Axial and Appendicular Skeleton. Joints: Definition, Types and functions. Cartilage: An overview - types and functions.

UNIT III ENERGY PRODUCING SYSTEMS IN HUMAN BODY

GI Tract: Organization of structures and functions of GI tract - Accessory Organs of GI Tract: Salivary glands, Liver, Pancreas, Gall bladder, Teeth and Tongue. Ingestion, Digestion and Absorption – Factors regulating Movements and Digestion in GI tracts. Respiratory System: Organization structures and functions of respiratory system – Mechanism of Breathing – Respiratory Volumes, Measurements and Artificial Respiration.

UNIT IV TRANSPORTER AND EXCRETORY SYSTEM

Cardiovascular System: Blood vessel - internal structure - Cardiac Muscle: Structure and functions – Structure and Components of Heart - Conducting System of Heart – Heart Sounds – Blood Pressure – Regulation of Blood Pressure and Measurements. Urinary System: Structure of Kidney, Nephron, Ureter and Urinary bladder. Urine formation and Micturition reflex.

UNIT V CONTROLLING AND COORDINATING SYSTEMS IN HUMAN BODY

Nervous system: Organization of Nervous system. Structure, Types and Properties of Neurons - Action potential of Neuron - Neuroglial Cells - Brain, Lobes and Cortical Areas – Spinal cord arrangement and Plexus formation. Autonomic Nervous System: Divisions and control on each system - Reflex Mechanism. Endocrine System: Hormone – General Action – Second Messenger – Anterior and Posterior Pituitary Gland Hormones. Special Senses: Structure of Eye and Ear - Functions and clinical conditions of Eye & Ear.

OUTCOME:

The student will be in a position to specify the anatomy of organs and the physiology of various systems of the body.

REFERENCES:

1. Anatomy & Physiology, Gary A.Thibodeau, Kevin T.Patton – 7th Edition, Mosby Publisher 2009.
2. The Human Body, Gillian Pocock & Christopher D.Richards, Oxford University Press, 2009.
3. Guyton 'Text book of Medical Physiology – WB Jaunder company Philadelphia - 10th edition 2002.
4. Tobin C.E., "Basic Human Anatomy", McGraw – Hill Publishing Co., Ltd., Delhi 1997.
5. Gibson.J., "Modern Physiology & Anatomy for Nurses", Blackwell SC Publishing 1981.
6. Essential of Human Anatomy and Physiology, Elaine.N.Marieb Eight Edition, Pearson Education, New Delhi, 2007.

113BMPT03 - BIO SIGNAL PROCESSING

UNIT I SIGNAL, SYSTEM AND SPECTRUM

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

UNIT II TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION

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

UNIT III ADAPTIVE FILTERING AND WAVELET DETECTION

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

UNIT IV BIOSIGNAL CLASSIFICATION AND RECOGNITION

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

UNIT V TIME FREQUENCY AND MULTIVARIATE ANALYSIS

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

REFERNCES:

1. Arnon Cohen, Bio-Medical Signal Processing Vol I and Vol II, CRC Press Inc., Boca Rato, Florida 1999.
2. Rangaraj M. Rangayyan, 'Biomedical Signal Analysis-A case study approach', Wiley-Interscience/IEEE Press, 2002
3. Willis J. Tompkins, Biomedical Digital Signal Processing, Prentice Hall of India, New Delhi, 2003.
4. Emmanuel C. Ifeachor, Barrie W.Jervis, 'Digital Signal processing- A Practical Approach' Pearson education Ltd., 2002
5. Raghuveer M. Rao and Ajith S.Bopardikar, Wavelets transform – Introduction to theory and its applications, Pearson Education, India 2000.

113BMPT04 - BIOMEDICAL SENSORS AND INSTRUMENTATION

OBJECTIVES:

- To study the basic characteristics of measurement system.
- To study the different types of transducers, electrodes and signal conditioning circuits.
- To study the techniques used for measurement of various non electrical physiological parameters.
- To know the different types of display and recording devices.

UNIT I TRANSDUCERS

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

UNIT II ELECTRODES & AMPLIFIERS

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

UNIT III CHEMICAL AND OPTICAL TRANSDUCERS

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

UNIT IV NON ELECTRICAL PARAMETERS MEASUREMENTS

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

UNIT V BIO POTENTIAL RECORDING

ECG, EEG, EMG, PCG, EOG, lead system and recording methods, typical waveform, frequency spectrum, abnormal waveforms. Evoked response.

OUTCOME: Will get the clear domain knowledge about various measurement systems includes different
types of sensors, electrodes, signal conditioning circuits for acquiring and recording various physiological parameters.

REFERENCES:

1. Rangan C.S., Sarma G.R., and Mani V.S.V., Instrumentation devices and system, Tata Mc Graw hill Publishing Company limited, New Delhi, 1983.
2. John G.Webster, Medical Instrumentation, Application and Design, Third Edition,John willey and sons,1999.
3. Jacob Kline., Handbook of Bio Medical Engineering, Academic press Inc., Sandiego, 1988.
4. J.B.Gupta, A course in electronic and electrical measurement and instrumentation, S.K.Kataria & Sons, 1999.
5. Tatsuo Togawa, Toshiyo Tamura, P.Ake Oberg, Biomedical Transducers and Instruments, CRC Press, New York, 1997.
6. Joseph J.Carr and John M Brown, Introduction To Biomedical Equipment Technology, 4/E,pearson education India.2001.

113BMPT05 - MEDICAL IMAGING SYSTEMS

OBJECTIVE

- To study the production of x-rays and its application to different medical Imaging techniques.
- To study the different types of Radio diagnostic techniques.
- To study the special imaging techniques used for visualizing the cross sections of the body.
- To study the imaging of soft tissues using ultrasound technique

UNIT I PRINCIPLES OF RADIOGRAPHIC EQUIPMENTS

X-Ray tubes, cooling systems, removal of scatters, construction of image Intensifier tubes, angiographic setup, digital radiology.

UNIT II COMPUTER AIDED TOMOGRAPHY

Need for sectional images, Principles of sectional scanning, Method of convolution and Back-Propagation, Methods of reconstruction, Artifacts, Principle of 3D imaging

UNIT III RADIO ISOTOPIC IMAGING

Radiation detectors, Radio isotopic imaging equipments, scanners, Principle of semiconductor detectors, Gamma ray camera, Positron Emission tomography. SPECT.

UNIT IV ULTRASONIC SYSTEMS

Wave propagation and interaction in Biological tissues, Acoustic radiation, continuous and pulsed excitation, Transducers and imaging systems, Scanning methods, Principle of image generation.

UNIT V MAGNETIC RESONANCE IMAGING

Principles of MRI, Relaxation processes and their measurements, Pulse sequencing and MR image acquisition.

OUT COME

- Will get the clear domain knowledge in understanding the various Medical Imaging techniques and its diagnostic applications.

REFERENCES:

1. D.N.Chesney and M.O.Chesney Radio graphic imaging, CBS Publications, New Delhi, 1987.
2. Peggy, W., Roger D.Ferimarch, MRI for Technologists, Mc Graw Hill, New York, 1995.
3. Steve Webb, The Physics of Medical Imaging, Taylor & Francis, New York.1988.

113BMPP01 - CLINICAL INSTRUMENTATION LABORATORY

COURSE OBJECTIVES:

- To enable the students to know about the measurements and recording of Bioelectric and Bio Chemical Signals.
- To study the different preamplifiers used for amplifying the Bio Signals

LIST OF EXPERIMENTS

1. Operational Amplifier-various amplifier configurations
2. Study of Timer circuit, Study of FSK modulation and demodulation
3. Design and testing of Bio-Amplifiers
4. Recording of ECG signal
5. Recording of Electromyogram.
6. Study of ECG machine, Study of EEG machine
7. Audiometer
8. Recording of various physiological parameters using patient monitoring system and telemetry units
9. Study and analysis of functioning and safety aspects of surgical diathermy
10. Bio-chemical measurements

213BMPT01 - APPLIED MEDICAL IMAGE PROCESSING

COURSE OBJECTIVES:

- To understand the fundamentals of medical image processing techniques.
- To develop computational methods and algorithms to analyze and quantify biomedical Data

UNIT I IMAGE FUNDAMENTALS AND PRE-PROCESSING

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms. Image enhancement – point operation, Histogram modeling, spatial operations, Transform operations.

UNIT II BASICS OF MEDICAL IMAGE SOURCES

Radiology- The electromagnetic spectrum-Computed Tomography-Magnetic Resonance Tomography –ultrasound-nuclear medicine and molecular imaging-other imaging techniquesradiation protection and dosimetry.

UNIT III MEDICAL IMAGE REPRESENTATION

Pixels and voxels – algebraic image operations - gray scale and color representation- depthcolor and look up tables - image file formats- DICOM- other formats- Analyze 7.5, NifTI and Interfile, Image quality and the signal to noise ratio- MATLAB based simple operations.

UNIT IV MEDICAL IMAGE ANALYSIS AND CLASSIFICATION

Image segmentation- pixel based, edge based, region based segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification – Statistical, Rule based, Neural Network approaches.

UNIT V IMAGE REGISTRATIONS AND VISUALIZATION

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.

COURSE OUTCOMES:

- Students will be able to apply image processing concepts for medical images.
- Will be able to analyze Morphology, Segmentation techniques and implement these in images.
- Enables quantitative analysis and visualization of medical images of numerous
- modalities such as PET, MRI, CT, or microscopy.

REFERENCES:

1. Wolfgang Birkfellner, 'Applied Medical Image Processing – A Basic course', CRC Press, 2011.
2. Atam P.Dhawan, 'Medical Image Analysis', Wiley Interscience Publication, NJ, USA 2003.
3. R.C.Gonzalez and R.E.Woods, 'Digital Image Processing', Second Edition, Pearson Education, 2002.
4. Anil. K. Jain, 'Fundamentals of Digital Image Processing', Pearson education, Indian Reprint 2003.
5. Alfred Horowitz, 'MRI Physics for Radiologists – A Visual Approach', Second edition Springer Verlag Network, 1991.
6. Kavyan Najarian and Robert Splerstor," Biomedical signals and Image processing",CRC – Taylor and Francis,New York,2006
7. John L.Semmlow,"Biosignal and Biomedical Image Processing Matlab Based applications" Marcel Dekker Inc.,New York,2004
8. Jerry L.Prince and Jnathan M.Links," Medical Imaging Signals and Systems"- Pearson Education Inc. 2006.

213BMPT02 - DIAGNOSTIC AND THERAPEUTIC EQUIPMENT

OBJECTIVES:

- To know the various biopotential recordings so as to enable students to record various biosignals.
- To know the various functional blocks present is cardiac care units so that the students can handle these equipments with care and safety.
- To develop an understanding of the physiotherapy and diathermy equipment so that the student can learn to operate.
- To study the concept of various assist devices so as to enable the students to develop new assist devices.
- To introduce the recent trends in field of diagnostic and therapeutic equipments.

UNIT I CARDIAC CARE UNITS

Pacemakers – Need for pacemaker, different types and their comparison, batteries for pacemakers. Defibrillator- Need, AC defibrillators and demerits, DC Defibrillator, asynchronous and synchronous DC defibrillators, Hazards and safety issues, patient monitoring system.

UNIT II ASSIST DEVICES

Heart lung machines - Need for the unit, functioning of bubble, disc type and membrane type oxygenerators, fingerpump, roller pump, electronic monitoring of functional parameter. Spirometer, Respiratory volume measurement, pnemograph, artificial respirator – IPR type, functioning, Pulse Oximetry. Indication and Principle of Hemodialysis, Membrane, Dialyasate, Different types of hemodialysers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type.

UNIT III STIMULATORS

Electrical stimulators: Strength-duration curve, types of stimulators, an electrodiagnostic / therapeutic stimulator. Nerve-muscle stimulator: peripheral nerve stimulator, Ultrasonic stimulators, stimulators for pain and relief.

UNIT V PATIENT MONITORING SYSTEMS

Patient monitoring system – ICU, post operative, ICCU, single channel telemetry, multichannel telemetry. Tranmsmission of Biosignals over telephone lines. Digital central monitoring systems for patient monitoring. Computer based arrhythmia detection system.

UNIT V RECENT DEVICES

Principles and application of thermography, Detection circuits, Principles of cryogenic Technique and application, principles of Fiber optics cables, Endoscopy, Laparoscopy, principles of Lithotripsy.

COURSE OUTCOME: The student will have knowledge in the use of medical equipment in the hospitals

REFERENCES:

1. Albert M Cook and Webster J G – Therapeutic medical devices Prentice Hall Nee York 1982
2. Heinz Kresse – Handbook of Electro medicine. John Wiely & Sons – Chrchester – 1985
3. Webster J.G Medical Instrumentation application and design – John Wiley and sons New York 3rd edition 1999
4. Jacobson B and Webster J G Medical and Clinical Engineering – Prentice Hall of India New Delhi 1999
5. Leslie Cromwell , Fred J.Weibell and Erich A.Pfeiffer - Biomedical Instrumentation Prentice Hall New Delhi 2000
6. Joseph J Carr and John M Brown – Introduction to Biomedical equipment Technology - Pearson Education 4th edition New Delhi 2001.
7. Khandpur R.S Hand Book of Biomedical Instrumentation – Tata McGraw Hill publication , New Delhi 2nd edition 2003
8. John Denis Enderle, Joseph D. Bronzino, Susan M. Blanchard, 'Introduction to Biomedical Engineering:'Academic Press, 2005 , 2nd Edition

213BMPT03 - BIO MECHANICS

OBJECTIVES

To Study the deformability, strength, and visco elasticity of hard and flexible tissues, modes of loading and failure and the mechanics of skeletal joints, concussion and head injuries, mechanics of orthopedic implants and joint replacement , mechanical properties of blood vessels and Alveoli mechanics

UNIT I INTRODUCTION

Use of statics, kinetics – rigid and non rigid bodies – Forces and motion – Newtons laws – Moment of force – Static equillibrum – Centre of gravity – Stability of equilibrium - Steps in analyzing a biomechanical problem – Graphical methods – contact forces – resolution of forces.

UNIT II MECHANICAL PROPERTIES OF BONES

Bone structure & composition mechanical properties of bone, cortical and cancellous bones - Electrical properties of bone, fracture mechanism and crack propagation in bones, fracture fixators, repairing of bones. Pseudo elasticity, nonlinear stress-strain relationship, viscoelasticity, structure, function and mechanical properties of skin, ligaments and tendons. Head Injury tolerance, rotational injury, spine injury – Accident reconstruction, Analysis of impact, skid analysis – Damage analysis

UNIT III MECHANICS OF THE MECHANICS OF THE ELBOW

Skeletal joints, skeletal muscles, basic considerations, basic assumption and limitations, forces and stresses in human joints, mechanics of the elbow, shoulder, spinal column, hip, knee and ankle. Human locomotion, gait analysis and goniometry, Ergonomics, Foot Pressure measurements – Pedobarograph, Force platform, mechanics of foot. Total Hip Prosthesis: requirements, different types of components, Stress analysis & instrumentation, Knee Prosthesis.

UNIT IV ALVEOLI MECHANICS

Alveoli mechanics, interaction of blood and lung, P-V curve of lung, breathing mechanism, airway resistance, physics of lung diseases.

UNIT V MECHANICAL PROPERTIES OF BLOOD VESSELS

Mechanical properties of blood vessels – arteries, arterioles, capillaries, veins, physics of cardio vascular diseases, prosthetic heart valves and replacement. Fluids – density – pressure – blood pressure and gravity – buoyancy – moments of force and stability – movement in water - Rheological properties of blood, laminar flow, Couette flow and Hagen-poiseuille equation, turbulent flow.

COURSE OUTCOME:

The student will have clear understanding of

- of application of mechanics in medicine.
- the properties of blood , bone and soft tissues like articular cartilage tendons and ligaments

TEXT BOOKS:

1. Frank Bell, Principles of Mechanics and Biomechanics, Stanley Thorne (Publishers) Ltd., 1998
2. Donald R. Peterson and Joseph D. Bronzino, Biomechanics Principles and applications, CRC press, Taylor & Francis Group, LLC, 2008
3. Duane Knudson, Fundamentals of Biomechanics, Second Edition, Springer publication, 2007

213BMPP01 - BIO SIGNAL AND IMAGE PROCESSING LABORATORY

Course objectives:

- To advance the art and science of extracting clinically significant information from physiologic signals
- Develop innovative techniques of signal processing for computational processing, analysis, understanding, and classification of biomedical signals and data.
- Develop image processing algorithm as image segmentation, feature extraction and classification for biomedical applications.

List of Experiments:

1. Design of FIR filter using MATLAB and DSP kit
2. Design of IIR filter using MATLAB and DSP kit
3. Simulation of ECG waveform, removal of artifacts like line frequency, baseline wandering etc and study of abnormalities in ECG pattern
4. Analysis of EEG waveform
5. Analysis of EMG Signal
6. Processing of biosignals using adaptive filters
7. Image processing for contrast enhancement and sharpening the edges
8. MR Image Processing
9. Data Compressions of biosignals (ECG, EEG, EMGetc.) using DCT and wavelet transforms.

COURSE OUTCOMES:

After completing the course the students are able to independently:

- Describe, apply and evaluate physical, electrical and mathematical models for the origin of bioelectrical signals in the cell, and their conduction in nerves and in tissue.
- Give an in-depth description of bioelectricity in the heart and in the central and peripheral nervous system.
- Describe and evaluate the most important bioelectrical measurement methods: The ECG, the EEG and the EMG, in relation to normal and pathological condiitions.
- Apply and evaluate different methods for signal processing of the ECG, the EEG and the EMG, with respect to time- and frequency domain analysis.

313BMPT01 - REHABILITATION ENGINEERING

OBJECTIVES:

- To develop an understanding of the various rehabilitation aids so as to enable the student to design and apply them with confidence, to help the challenged people.

UNIT I INTRODUCTION TO REHABILITATION

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

UNIT II ORTHOTICS & PROSTHETICS IN REHABILITATION:

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

UNIT III MOBILITY AIDS:

Electronic Travel Appliances (ETA) : Path Sounder, Laser Cane, Ultrasonic Torch, Sonic Guide, Light Probes, Nottingham Obstacle Sensors, Electro cortical Prosthesis, Polarized Ultrasonic Travel aids, Materials used for wheel chairs, Type of Wheel Chairs, design of wheel Chair, Walking frames, Parallel bars, Rollators, Quadripods, Tripods & walking sticks, Crutches.

UNIT IV AUDITORY AND SPEECH ASSIST DEVICES:

Types of deafness, hearing aids, application of DSP in hearing aids, Cochlear implants, Voice synthesizer, speech trainer

UNIT V SENSORY AUGMENTATION AND SUBSTITUTIONS:

Classification of Visual Impairments, Prevention and cure of visual impairments, Visual Augmentation, Tactile vision substitution, auditory substitution and augmentation, tactile auditory substitution, Assistive devices for the visual impaired

REFERENCES:

1. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor & Francics ,CRC press,2006
2. Joseph D.Bronzino,The Biomedical Engineering Handbook,Third Edition: Three Volume Set,CRC Press,2006
3. MacLachlan M. and Gallagher P. Enabling Technologies – Body Image and Body Function, Churchill Livingstone, 2004.
4. Mann W.C. (ed). Smart Technology for Aging, Disability, and Independence – The State of The Science*,* Wiley, New Jersey, 2005.
5. Muzumdar A. Powered Upper Limb Prostheses – Control, Implementation and Clinical Application*.* Springer, 2004.

113BMPT06 - PRINCIPLES OF GENETIC ANALYSIS

OBJECTIVES :

- To describe methods both used in and resulting from the sciences of genetics and molecular biology, or to applications resulting from this research and may be done to identify genetic/inherited disorders
- To make a differential diagnosis in certain somatic diseases such as cancer. Genetic analyses of cancer include detection of mutations, fusion genes, and DNA copy number changes.

UNIT I INHERITANCE - GENETIC ANALYSIS

Basic principles of Heredity, Pattern of inheritance, Mendelian principles of Inheritance Chromosomal basis of inheritance, Chromosome mapping by recombination, Genetics of Bacteria and viruses.

UNIT II DNA AND PHENOTYPE

F DNA structure and replication- DNA sequencing, DNA Amplification, DNA Hybridisation and DNA Polymorphism, RNA transcription and processing, Protein synthesis and regulation of gene expression. Pedigree analysis & Applications, From Gene to Phenotype, molecular mechanism behind phenotypic expressions

UNIT III GENOME STRUCTURE AND GENETIC ENGINEERING

Gene isolation and manipulation, Genomics, mutations, Types of Mutations, molecular basis of Mutation, repair and recombination, site directed mutagenesis, large-scale chromosomal changes and genetic polymorphism.

UNIT IV GENETIC PROCESSES

Gene function, Genetic organization, Genetic regulation, Genetic morphology of normal and cancer cells, Genetic basis of development

UNIT V IMPACT OF GENETIC VARIATION

Population Genetics, Quantitative Genetics, Evolution Genetics and their impact in variation.

REFERENCES:

1. Watson. J. etal, " Molecular Biology of the Gene ", 5th Edition, Pearson Publication, 2004.
2. Griffiths, Wesslers, Lewontin, Bart Gel, Suzuki, Miller "Introduction to Genetics Analysis", – W.H Freeman & company, New York 8th Edition - 2005.
3. Glick, B.R and J.J Pasternak "Molecular Biotechnology", Principles and application of Recombinant DNA" 3rd Edition ASM Press, 2003
4. Karp, Gerald." Cell and Molecular Biology". Concepts and Experiments, 4th Edition, John Wiley Sons, 2005.
5. Weaver. R.F. " Molecular Biology " 3rd Edition, McGraw – Hill, 2005.
6. Tom Strachan, Andrew P Read "Human molecular Genetics" 3rd Edition, Garland Publishing – 2004.

113BMPT07 - PHYSICS IN MEDICINE

OBJECTIVES:

- To understand the principles of nuclear physics
- To gain knowledge in the field of radiation effects in tissue
- To know about the use of lasers in therapy

UNIT I PRINCIPLES OF NUCLEAR PHYSICS

Traditional definition of atom, periodic system of elements, mechanical properties of atom, emission of light and its frequencies. Electromagnetic spectra, Natural radioactivity, Decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Radio nuclides used in Medicine and technology.

UNIT II INTERACTION WITH LIVING CELLS

Target theory, single hit and multi target theory, cellular effects of radiation, DNA damage, depression of Macro molecular synthesis, Chromosomal damage.

UNIT III SOMATIC EFFECT OF RADIATION

Radio sensitivity protocol of different tissues in human, LD 50/30 effect of radiation on skin, blood forming organs, lenses of eye, embryo and Endocrinal glands.

UNIT IV GENETIC EFFECT OF RADIATION

Threshold of linear dose effect, relationship, factors affecting frequency of radiation induced mutation, Gene controlled hereditary diseases, biological effect of microwave, RF wave and UV radiation. Variation in dielectric constant and specific conductivity of tissues. Penetration and propagation of signals, effects in various vital organs, Protection standards.

UNIT V LASER PHYSICS AND PHOTOMEDICINE

Characteristics of laser radiation, Laser speckle, biological effects, laser safety management Synthesis of vitamin D in early and late cutaneous effects, Phototherapy, photo hemotherapy, exposure level, hazards and maximum permissible exposures.

OUTCOME

The student will have clear understanding of the effects and safe use of radiation and also will have knowledge in the therapeutic application of laser radiation.

REFERENCES:

1. Moselly, `Non ionising Radiation' Adam Hilgar Brustol 1988
2. Branski.s and Cherski.P `Biological effects of microwave' Hutchinson & ROSS Inc. Strondsburg 1980.
3. Glasser.O.Medical Physics Vol.1,2,3 year Book Publisher Inc Chicago, 1980.

113BMPT08 - BIOMATERIALS

OBJECTIVES:
To gain a solid appreciation for the special significance of the word biomaterial as well as the rapid and exciting evolution and expansion of biomaterials science and its applications in medicine.

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

UNIT II METALLIC AND CERAMIC BIOMATERIALS
Introduction, Stainless steel, Cobalt-Chromium alloy, Titanium alloys, Titanium-Nickel alloys, Dental metals, Corrosion of metallic implants, Manufacturing of implants, nonabsorbable/relatively bioinert bioceramics, biodegradable/resorbable ceramics, bioreactive ceramics, deterioration of ceramics, bioceramic manufacturing techniques.

UNIT III POLYMERIC AND COMPOSITE BIOMATERIALS
Introduction, polymerization and basic structure, polymers used as biomaterials, sterilization, surface modifications to for improving biocompatibility. Structure, bounds on properties, anisotropy of composites, particulate composites, fibrous composites, porous materials, biocompatibility and synthetic biodegradable polymers, collagen.

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

UNIT V TESTING AND IMPLANTS OF MATERIALS
Testing with Tissue Culture, Testing with Soft Tissues and Testing at non Thrombogenic surface and implants of Biomaterial in Cardiac, Orthopedics , Muscular and Ocular region.

REFERENCES:
1. J.H.U.Brown (Ed), Advances in Bio Medical Engineering, Academic Press 1975.
2. Andrew F.Von Racum, Hand Book of Bio Medical Evaluation, Mc-Millan Publishers, 1980.
3. Jacob Cline, Hand Book of Bio Medical Engineering, Academic Press in Sandiego, 1988.
4. Jonathan Black, Biological Performance of Materials- Fundamentals of bio compatibility, 4th Edition, CRC Press 2005.
5. Larry L. Hench and Julian R.Jones, Biomaterials, Artificial organs and Tissue Engineering, 2005.
6. Buddy D.Ratner,Allan S .Hoffman, Frederick J. Schoen, Jack E. Lemons, Biomaterial Science; An Introduction to Materials in Medicine,2nd Edition, Elsevier Academic Press,San Diego,2004

113BMPT09 - BIO STATISTICS

OBJECTIVES:
The objective of *Biostatistics* is to advance statistical science and its application to problems of human health and disease, with the ultimate goal of advancing the public's health.

UNIT I INTRODUCTION
Introduction, Some basic concepts, Measurement and Measurement Scales, Simple random sample, Computers and biostatistical analysis, Introduction to probability, likelihood & odds, distribution variability.

UNIT II STATISTICAL PARAMETERS
Statistical parameters p-values, computation, level chi square test and distribution and hypothesis testing -single population proportion, difference between two population proportions, single population variance, ratio of two population variances and tests of goodness of fit, tests of independence, tests of homogeneity.

UNIT III REGRESSION AND CORRELATION ANALYSIS
Introduction, regression model, sample regression equation, evaluating the regression equation, using the regression equation, correlation model, correlation coefficient.

UNIT IV INTERPRETING DATA
Interpreting life tables clinical trails, epidemical reading and interpreting of epidemical studies, application in community health.

UNIT V META ANALYSIS AND ANALYSIS OF VARIANCE
META analysis for research activities, purpose and reading of META analysis, kind of data used for META analysis, completely randomized design, randomized complete block design, repeated measures design, factorial experiment.

REFERENCES:
1. Wayne W. Daniel, "Biostatistics-A Foundation for Analysis in the Health Sciences" John Wiley & Sons Publication, 6th Edition.
2. Marcello Pagano and Kimberlee Gauvreu "Principles of Biostatistics", , Thomson Learning Publication, 2006.
3 Ronald N Forthofer and Eun Sul Lee "Introduction to Biostatistics", Academic Press
4. Animesh K. Dutta "Basic Biostatistics and its Applications" (2006)

213BMPT04 - MEDICAL INFORMATICS

UNIT I HEALTH INFORMATICS

Historical highlights and Evolution, Hospital Information System – its characteristics and functional online and offline modules, e – health services, Medical Standards – HL7 – DICOM – PACS, Medical data formats – Bioethics.

Medical Informatics and its six levels of interfaces, Electronic Patient Record (EPR), Medical data storage and retrieval techniques – Steganography, Evidence based Medicine- Virtual Hospital

UNIT III SOFT COMPUTING

Fuzzy logic – its applications in Medicine, Physiological System Modeling and Simulation, Virtual Reality and Multimedia Applications in Medicine, Surgical Simulation, Clinical Expert Systems, Issues related to Web based Health Care Systems design, development and implementation.

UNIT IV JAVA PROGRAMMING

Genesis of JAVA, Data types, Operators, Control statements, Classes – Inheritance – packages and interfaces – I/O applets, String handling Applet Classes – AWT and Swing classes - Java applets, Java servelets, Java script programming, Creating events, interactive forms, frames, documents, spread sheets and windows- Client – Server programming.

UNIT V INTERNET AND WEB

Web Design and programming, HTTP protocol, Web browsers Netscape, Internet explorer, Web site and web page design, HTML,XHTML, XML, CSS, Dynamic HTML, CGI. Data base design and programming, SQL introduction – Queries – Tables – RDBMS, Macromedia Dream Weaver, Web Servers, Databases – SQL, MYSQL, DBI and ADO.NET, Web based Medical Information Systems.

REFERENCES:

1. Ramachandra Lele, Computers in Medicine Progress in Medical Informatics, Tata McGraw Hill Publishing Company, New Delhi, 2005
2. Herbert Schildt, The Complete Reference – JAVA, Tata McGraw Hill Publishing Company, New Delhi, 2005
3. Mohan Bansal M S, Medical Informatics, Tata McGraw Hill Publishing Company, New Delhi, 2005
4. H M Dietel, Internet and World Wide Web, AB Goldberg publishers, New Delhi, 2007
5. Ranjan Parekh, Principles of Multimedia, Tata McGraw Hill Publishing Company, New Delhi, 2006
6. Tay Vaughan, Multimedia – Making it Work, Tata McGraw Hill Publishing Company, New Delhi, 2006
7. Raif Steinmetz, Multimedia – Computing, Communications and Applications, Pearson Education, New Delhi, 2007
8. Deitel, "Java How to Program", Pearson Education / PHI, 2006.
9. A S Godbole A Kahate, "Web Technologies, TCP/IP to Internet Application Architectures", TMH 2007

213BMPT05 - TISSUE ENGINEERING

OBJECTIVES
Tissue engineering is a new field of biomedical engineering, in which synthetic materials are used together with biological components such as tissue fragments, cells, proteins to encourage tissue regeneration, regrowth, and repair.

UNIT I FUNDAMENTAL OF TISSUE ENGINEERING
Introduction: Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

UNIT II CELLULAR STUDIES
Cell culture: Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization, Bioreactors.

UNIT III MOLECULAR BIOLOGY ASPECTS
Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

UNIT IV SCAFFOLD AND TRANSPLANT
Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology, stems cells: introduction, hepatopoiesis.

UNIT V CASE STUDY AND REGULATORY ISSUE
Case study of multiple approaches: cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering..

REFERENCES:
1. W. Mark Saltzman Tissue Engineering – Engineering principles for design of replacement organs and tissue –- Oxford University Press inc New York, 2004.
2. Robert. P.Lanza, Robert Langer & William L. Chick, Principles of tissue engineering Academic press.
3. Joseph D. Bronzino, The Biomedical Engineering –Handbook, CRC press.
4. Enderle, Blanchard & Bronzino Introduction to Biomedical Engg. , , Academic press.
5 . B. Palsson, J.A. Hubbell, R.Plonsey & J.D. Bronzino Tissue Engineering, , CRC- Taylor & Francis

213BMPT06 - TELEHEALTH TECHNOLOGY

OBJECTIVES:

- To teach the key principles for telemedicine and health.
- To make student understand telemedical technology.
- To enable the students with the knowledge of telemedical standards, mobile telemedicine and its applications.

UNIT I TELEMEDICINE AND HEALTH

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Tele health, Tele care, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine.

UNIT II TELEMEDICAL TECHNOLOGY

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN, POTS, ANT, ISDN, Internet, Air/ wireless communications: GSM satellite, and Micro wave, Modulation techniques, Types of Antenna, Integration and operational issues, Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication. Mobile hand held devices and mobile communication. Internet technology and telemedicine using world wide web (www). Video and audio conferencing. Clinical data –local and centralized.

UNIT III TELEMEDICAL STANDARDS

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7, H. 320 series (Video phone based ISBN) T. 120, H.324 (Video phone based PSTN), Video Conferencing, Real-time Telemedicine integrating doctors / Hospitals, Clinical laboratory data, Radiological data, and other clinically significant biomedical data, Administration of centralized medical data, security and confidentially of medical records and access control, Cyber laws related to telemedicine.

UNIT IV MOBILE TELEMEDICINE

Tele radiology: Definition, Basic parts of teleradiology system: Image Acquisition system Display system, Tele pathology, multimedia databases, color images of sufficient resolution, Dynamic range, spatial resolution, compression methods, Interactive control of color, Medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment. Hospital information system - Doctors, paramedics, facilities available. Pharmaceutical information system.

UNIT V TELEMEDICAL APPLICATIONS

Telemedicine access to health care services – health education and self care. · Introduction to robotics surgery, telesurgery. Telecardiology, Teleoncology,
Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability., Telemedicine access to health care services – health education and self care, Business aspects - Project planning and costing, Usage of telemedicine.

REFERENCES:

1. Norris, A.C. Essentials of Telemedicine and Telecare. Wiley (ISBN 0-471-53151-0), 2002
2. Wootton R. Craig, J., Patterson, V. (Eds.), Introduction to Telemedicine. Royal Society of Medicine Press Ltd (ISBN 1853156779), 2006
3. O'Carroll, P.W, Yasnoff W.A., Ward E.Ripp, L.H., Martin, E.L. (Eds), Public Health Informatics and Information Systems. Springer (ISBN 0-387-95474-0), 2003
4. Ferrer-Roca, O., Sosa-Iudicissa, M. (editors), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54). (ISBN 90-5199-413-3), 2002.
5. Simpson, W. 2006. Video over IP. A practical guide to technology and applications. Focal Press (Elsevier). ISBN-10: 0-240-80557-7
6. Bemmel, J.H. van, Musen, M.A. (Eds.) (1997). Handbook of Medical Informatics. Heidelberg, Germany: Springer. (ISBN 3-540-63351-0)

213BMPT07 - NANOTECHNOLOGY AND APPLICATIONS

UNIT I INTRODUCTION

Definition of nanotechnology,Objective and goal of Nanotechnology, Importance of Nanoscale, revolution of Nanotechnology, Silicon based Technology.

UNIT II NANOMATERIALS

Different forms of Nanomaterials – nanocomposite, carbon nanotubes, nanowires,nanoplatesand nanorods.Preparation of nanomaterials-Plasma arcing, Chemical Vapor Deposition, Sol-gels techniques,Electrodeposition,Ball milling and Laser method, Natural nanomaterials, Applications of nanomaterials-Insulation materials, Machine tools, Phosphors, Batteries, High power magnets Medical implants.

UNITIII EXPERIMENTAL TECHNIQUES

Fabrication – lithography, Characterisation – X- ray diffraction (XRD), Scanning electron,Microscopy, Atomic force microscopy ,Scanning Tunneling microscopy (STM), Scanning probe microscopy (SPM), Optical and Raman spectroscopy.

UNIT IV NANOSCIENCE

Nanomachine, nanorobots, nanodevice, nanomedicine – regenerative and replacement medicine, nano pharmacology,Nanotechnology in defense, environmental application.

UNIT V R & D IN NANOTECHNOLOGY

Nanotechnology current and future perspectives, research areas in nanotechnology , development of nanotechnology in India, Ehical issues and socioeconomic challenges In nanotechnology

REFERENCES:

1. Nanobiotechnology – Concepts, Applications and Perspectives – 2004. Edited by CM, Niemeyer , C.A. Mirkin. Wiley – VCH.
2. Nanoparticle Assemblies and Superstructures. By Nicholas A. Kotov.2006 -CRC.
3. Nano: The Essentials: T. Pradeep. McGraw – Hill education – 2007.
4. Nanofabrication Towards Biomedical Applications, Techniques, Tools, Applications and Impact. 2005 - By Challa, S.S.R. Kumar, Josef Hormes, Carola Leuschaer. Wiley – VCH.

213BMPT08 - HOSPITAL PLANNING, ORGANIZATION AND MANAGEMENT

OBJECTIVE:
To study the aspects of managing the hospital in terms of staff, marketing and the use of computers

UNIT I FORMS OF ORGANISATION
Sole proprietorship, Partnership, Company-public and private sector enterprises, Principles of management, Evolution of management.

UNIT II PRINCIPLE OF HOSPITAL MANAGEMENT:
Importance of management and Hospital, Management control systems. Forecasting techniques decision-making process.

UNIT III STAFFING
Staffing pattern in hospitals, Selection, Recruiting process, Training of staff, Organizational structures, Career development.

UNIT IV MARKETING AND MANAGEMENT
Basic concepts marketing, Principles of social marketing, Social marketing in health sector, Consumer behavior and research health, Advertising in Health Sector, Relevance of e-marketing of Health care services.

UNIT V COMPUTER AND HOSPITAL
System Development life cycle, Reasons to use computers in hospital, main categories of information systems in hospitals.

REFERENCES:
1. Goyal R.C., Human Resource Management in Hospital, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
2. Nauhria R.N. and Rajnish Prakash, Management & systems, New Delhi Wheeler publishing, 1995.
3. Koontz, Essentials of Management, McGraw Hill, 1995.

213BMPT09 - FINANCE MANAGEMENT IN HOSPITALS

OBJECTIVE
To study the aspects of managing the finance for proper functioning of the hospital.

UNIT I INTRODUCTION
Finance Function – Meaning – Definition - scope of finance function- Executive functions & Incidental functions - Scope and goal of Financial Management in Hospitals – Profit maximization & Wealth maximization.

UNIT II ACCOUNTING TECHNIQUES
Types of Accounting, Hospital accounting - Financial book Keeping, Book keeping obligations. Accounting Concepts & Conventions – Final Accounts :Trading – Profit & Loss Accounts - Balance Sheet.

UNIT III COSTING AND HOSPITALS
Nature & Scope of Cost Accounting – Cost analysis & Classification - Cost Calculation, significance of internal billing in Hospital -Necessary for internal & external controlling cost, cost unit calculation.

UNIT IV MANAGEMENT ACCOUNTING
Budgeting & Budgetary control – Cost – Volume – Profit analysis.

UNIT V FINANCING DECISIONS
Cost of capital & Capital Structure – Sources of Short term finance: Management of Working Capital –Sources of Long term finance: share capital, debentures - corporate debit capacity.

REFERENCES:
1. James C. Vanhorne, Fundamentals of Financial Management, Prentice Hall of India Pvt. Ltd., New Delhi, 8th Edition, 1993.
2. James C.Vanhorne, Financial Management and Policy, Prentice Hall of India Pvt. Ltd., New Delhi, 9th Edition, 1995.
3. Prasannachandra, Financial Management, Tata McGraw Hill Publishing Co. Ltd., New Delhi, First Revised edition
4. Financial Management IM Pandey Vikas Publishing Co. 1999.

213BMPT10 - HUMAN RESOURCES MANAGEMENT IN HOSPITAL

OBJECTIVE

To study the aspects of managing the resources for proper functioning of the hospital.

UNIT I PERSPECTIVES OF HUMAN RESOURCE MANAGEMENT

Evolution of Human Resource Management - Importance of Human factor, Objectives of Human resource Management - Human Resource Policies - Need for HRD/HRM in Healthcare Organisation - Computer Applications In Human Resource Management.

UNIT II THE CONCEPT OF BEST FIT EMPLOYEE

Organisational Job Design - job description - job analysis - job rotation-job evaluation- Man-power planning- Importance of Human Resource Planning, Forecasting of Human Resource Requirements -Selection procedures - test, Validation, Interviews, Recruitment, Medical Examination.

UNIT III TRAINING & EXECUTIVE DEVELOPMENT

Types of Training methods and their benefits - Executive development Programme - common practices - Benefits, self-development - knowledge Management.

UNIT IV SUSTAINING EMPLOYEE INTEREST

Wage and Salary Administration – concept of incentives and its operational implications – Participative decision making – Concept of Collective Bargaining – Compensation plans – Rewards – Motivation – Theories of motivation - Grievances and redressal methods.

UNIT V PERFORMANCE APPRAISAL

Importance of Performance Appraisal - Methods of Performance Evaluation, - Traditional methods – Modern methods – Feedback – Promotion – Demotion – transfer. Implications of jobs change. The control process, Methods and Requirements of Effective control system.

REFERENCES:

1. R.C.Goyal, Human Resource Management in Hospitals, Prentice Hall of India,2000.
2. Mamoria C.B. and Mamoria S.Personnel Management, Himalaya Publishing Company,1997.
3. Decenzo and Robbins, Human Resource Management, Wiley & Sons, Singapore, 1999.

213BMPT11 - HOSPITAL ARCHITECTURE

OBJECTIVE
To study the basic issues involved in the design of a hospital.

UNIT I INTRODUCTION TO HEALTH CARE SYSTEM:
International and National level policy framework for healthcare facilities –Types of healthcare facilities based on public and private ownership, bed size and type of health care services based on outpatient ,inpatient and diagnostic care - Organizational, function and structure of the hospital.

UNIT II HOSPITAL PLANNING
Principles of planning, regionalization, hospital planning team, planning process, size of the hospital, site selection, hospital architect, architect report, equipping a hospital, interiors & graphics, construction & commissioning, planning for preventing injuries, electrical safety.

UNIT III PLANNING & DESIGNING OF DIFFERENT SERVICES IN HOSPITALS
Planning and designing of administrative services, medical and ancillary services, nursing services, supportive services, public areas and staff services, hospital services.

UNIT IV STANDARDS AND NORMS FOR HOSPITALS
Design and construction standards for the hospitals namely BIS –India and JCAHO, AIA and NHS – general guidelines and standard for out-patient area, in-patient area and diagnostic area in the hospitals. Voluntary & Mandatory standards, General standards, Mechanical standards, Electrical Standards, Standard for centralized medical gas system, Standards for biomedical waste.

UNIT: V FACILITIES FOR SUPPORTIVE SERVICES
Transport, Information system, Communication, Food services, Mortuary, Heating Ventilation and Air Conditioning, Medical gases, House Keeping, Laundry.

OUTCOMES:
The student will have knowledge in the essential services to be provided by the hospitals and the proper design of hospital

REFERENCES:
1. G.Kunders.”Hospitals- Facilities Planning & Management”,Tata Mcgraw-Hill education-2004.
2. S.K.Gupta, S.kant, R.Chandrashekhar, S.Satpathy. “Modern trends in planning and designing of hospitals: Principles and practice”, Jaypee Brothers-Medical publishers,Newdelhi,2007.
3. Sa Tabish.” Hospital and Nursing Homes planning, Organisation and Management”, ”, Jaypee Brothers-Medical publishers,Newdelhi,2003

213BMPT12 - COMPUTER BASED MEDICAL INSTRUMENTATION

UNIT I PC HARDWARE AND OVERVIEW

Hardware – BIOS – DOS interaction, POST, Functional and Architecture Block diagram of a PC, Mother Board – I / O slots – Mother Board logics- Memory and I/O map, Peripheral interfacing and controllers- Serial and Parallel interface – CRT Display Adapter – FDC – HDC – PC buses.

UNIT II PENTIUM MICROPROCESSORS

Pentium Microprocessor Architecture – Special Pentium Registers – Pentium Memory Management – New Pentium Instructions – Pentium Pro Microprocessor Architecture – Special features – Pentium II Microprocessor Architecture – Pentium III Microprocessor Architecture – Pentium III Architecture – Pentium IV Architecture – Comparison of Pentium Processors.

UNIT II I COMPUTER ASSISTED MEDICAL IMAGING AND DECISION MAKING

Computers in Nuclear Medicine – Ultrasound Imaging: Ultrasonography – Computed X-ray Tomography – General Model of CMD – Various Approaches to Decision–making – Computerassisted
Decision Support Systems – Algorithmic Methods – Multivariate Analysis – Database Comparisons and Case-based Reasoning (CBR) – Production Rule Systems – Cognitive Models – Semantic Networks – Decision Analysis in Clinical Medicine.

UNIT IV COMPUTERISED DATA ACQUISITION AND PROGRAMMING

Plug-in-data acquisition and Control Boards, Data acquisition using GPIB and Serial Interfaces and Programming in C, Virtual reality – Multimedia - Telemedicine – Computers in Critically Care Units and radiological centres.

UNIT V BIOMETRICS FOR NETWORK SECURITY

Introduction to Biometrics and its characteristics, Finger print technology, feature extraction and classification, Face recognition and hand geometry - feature extraction and classification, Biometric authentication system.

REFERENCES:

1. N.Mathivanan, PC Based Instrumentation: Concepts and Practice, Prentice Hall of India, New Delhi 2007.
2. Herbert Schildt, The Complete Reference – JAVA, Tata McGraw Hill Publishing Company, New Delhi, 2005
3. John P Woodward, Biometrics – The Ultimate Reference, Dreamtech Publishers, New Delhi, 2003
4. Ranjan Parekh, Principles of Multimedia, Tata McGraw Hill Publishing Company, New Delhi, 2006
5. Stephen J Bigelow, Trouble shooting, Maintaining and Repairing of PCs, Tata McGraw Hill Publishing Company, New Delhi, 2005
6. H M Dietel, Internet and World Wide Web, AB Goldberg publishers, New Delhi, 2007
7. Atul Khate, Cryptography and network security, Tata McGraw Hill Publishing Company, New Delhi, 2008

213BMPT13 - BIO MEMS

OBJECTIVE:

To understand

- Various MEMS fabrication techniques.
- Different types of sensors and actuators and their principles of operation at the micro scale level.
- Application of MEMS in different field of medicine.

UNIT I MEMS AND MICROSYSTEMS

Typical MEMs and Microsystems, materials for MEMS - active substrate materials- Silicon and its compounds, Silicon piezoresistors, Gallium Arsenide, quartz, polymers. Micromachiningphotolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA.

UNIT II MECHANICAL AND THERMAL SENSORS AND ACTUATORS

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

UNIT III ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATORS

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

UNIT IV MICROFLUIDIC SYSTEMS

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

UNIT V BIO MEMS

Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR), DNA hybridization, Electronic nose, Bio chip.

OUTCOMES:

Students will be able to

1. Understand the operation of different types of sensors and actuators at microscale level
2. Understand the design issues at microscale level
3. Choose the material for any application
3. Apply the concepts to the design of different types of micro systems
4. Apply the knowledge of CAD tools for MEMS design

REFERENCES:

1. Tai Ran Hsu , " MEMS and Microsystems design and manufacture", Tata McGraw Hill Publishing Company, New Delhi, 2002
2. Nitaigour Premchand Mahalik, " MEMS", Tata McGraw Hill Publishing Company, New Delhi, 2007
3. Wanjun Wang, Steven A.Soper " BioMEMS- Technologies and applications", CRC Press,Boca Raton,2007
4. Chang Liu,' Foundations of MEMS', Pearson Education International, New Jersey, USA, 2006

213BMPT14 - FINITE ELEMENT METHODS FOR BIO MECHANICAL ANALYSIS

UNIT I GENERAL INTRODUCTION

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems – Variational Formulation of Boundary Value Problems – Ritz Technique –Natural and Essential Boundary conditions - Basic concepts of the Finite Element Method. One Dimensional Second Order Equations – Discretization – element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors - Assembly of Matrices - solution of problems from solid and bio mechanics- Structural, stress, and strain analysis of the human body and/or artifical implants,

UNIT II BEAM ELEMENTS AND SCALAR PROBLEM IN 2D:

Fourth Order Beam Equation –Transverse deflections - Natural frequencies of beams and Longitudinal vibration. Second Order 2D Equations involving Scalar Variable – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems in Bio mechanics - Quadrilateral elements

UNIT III APPLICATIONS TO FIELD PROBLEMS

Higher Order Elements. Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One, two and three dimensions – Serendipity elements – Numerical integration and application to plane stress problems transformation in

• ,• and • • coordinates- Jacobian of transformation-order of convergence- numerical integration –example problems- shape functions in natural coordinates- rectangular elements- Lagrange family- Serendipity family- rectangular prisms- tetrahedral elements-

UNIT IV ISOPARAMETRIC FORMULATION AND MISCELLANEOUS TOPICS

Introduction to elasticity equations – stress strain relations – plane problems of elasticity – element equations Plane stress, plane strain and axisymmetric problems – stress-strain-time or constitutive equations for soft connective tissue components Modelling and force analysis of musculoskeletal systems– Stress calculations - Plate and shell elements – Introduction to flow problems- solution of problems in fluid mechanics- numerical examples -plates and shells

UNIT V NON-LINEAR ANALYSIS

Introduction to Non-linear problems - some solution methods- computational procedure- simple material nonlinearity, stress stiffening, contact interfaces- problems of gaps and contactgeometric non-linearity- modeling considerations- Impact analysis. Mechanical properties of biological and commonly used biomedical engineering materials -. Critical reviews of finite element analysis in biomechanical research.

TEXT BOOKS:

1. Seshu. P. "Textbook of Finite Element Analysis" Prentice Hall of India, 2003.
2. J.N. Reddy, " Finite Element Method" Tata McGraw Hill, 2003.
3. S.S. Rao, "The Finite Element Method in Engineering "Butter worth heinemann, 2001.
4. Reddy, J.N, "An Introduction to the Finite element Method", McGraw – Hill, 1985.

213BMPT15 - BIOMEDICAL OPTICS

OBJECTIVES:

9. To provide a possibility for the student to acquire knowledge about the physical properties of light and its impact and interaction with biological tissue in terms of optical properties, instrumentation in photonics, through the use and design of appropriate optical components;
10. To understand the engineering and practical applications of optics related to diagnostics, sensing and therapeutics of the human body

UNIT I OPTICAL PROPERTIES OF THE TISSUES

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

UNIT II INSTRUMENTATION IN PHOTONICS

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

UNIT III SURGICAL APPLICATIONS OF LASERS

Laser in tissue welding, lasers in dermatology, lasers in ophthalmology, otolaryngology, urology.

UNIT IV DIAGNOSTIC APPLICATIONS

Optical coherence tomography, Elastography, Fluorescence Imaging, Raman Imaging, FLIM.

UNIT V THERAPEUTIC APLLICATIONS

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

TEXT BOOKS:

1. Markolf H.Niemz, "Laser-Tissue Interaction Fundamentals and Applications", Springer, 2007.
2. Paras N. Prasad, "Introduction to Biophotonics", A. John Wiley and sons, Inc. Publications, 2003.

REFERENCE BOOKS:

1. Tuan Vo Dinh, "Biomedical photonics – Handbook", CRC Press LLC, 2003.
2. Mark E. Brezinski, "Optical Coherence Tomography: Principles and Applications", Academic Press, 2006.
3. R. Splinter and B.A. Hooper, "An Introduction to BioMedical Optics", Taylor and Francis, 2007.

313BMPT02 - HEALTH POLICY AND EQUIPMENT MANAGEMENT

UNIT I HEALTH SYSTEM
Health organization of the country, the state and cities, health financial system, teaching cum research hospitals, General Hospital, PHC reference system.

UNIT II HOSPITAL PLANNING
Technical consideration, size & kind of hospitals, principles of planning, selection, site of orientation, equipment plan, communication and information system, Power supply, Airconditioning, Water supply, elevators.

UNIT III NATIONAL HEALTH POLICY
Need for evaluating a health policy, need for providing primary health care, Health education, health insurance, health legislation, inter sectoral cooperation.

UNIT IV EQUIPMENT MAINTENANCE MANAGEMENT
Organizing the maintenance operation, biomedical equipment procurement procedure, proper selection, compatibility, testing and installation, purchase and contract procedure, trained medical staff, on proper use of equipment and operating instructions. Maintenance job planning, preventive maintenance, maintenance budgeting, contract maintenance.

UNIT V LOGISTIC SUPPORT & RELIABILITY
Maintenance equipment and Tools, failure analysis, spare parts and maintenance materials. Reliability fundamentals.

UNIT VI EMI TO HOSPITAL EQUIPMENTS
Principles of EMI, computation of EMI, Method of suppressing and isolating the unit from interference.

REFERENCES:
1. Antony Kelly, `Maintenance Planning & control' Butterworth, London 1984.
2. Hans Pleiff veradammann (ed) `Hospital Engineering in developing countries, GTZ report Eschborn, 1986.
3. R.C.Goyal `Human Resource Management in Hospitals' Prentice Hall of India, New Delhi, 2000.

313BMPT03 - HOSPITAL WASTE MANAGEMENT

OBJECTIVES:
Hospital wastes are among hazardous wastes, and special treatment methods are needed for their disposal. Having information about present status of medical waste management systems is of great importance in finding weak, and for future planning.

UNIT I INTRODUCTION
Introduction, definition of general and hazardous health care waste and diseases, Infectious waste, genotoxic waste, waste sharps, biomedical waste categories categorization and composition of Biomedical waste.

UNIT II PRINCIPLES OF STERILIZATION
Disease Transmission - Disinfection methods – Sterilization - steam sterilizing (Auto claving) - Microwave (Non-burn treatment technology). Mechanical Treatment &Chemical Disinfections.

UNIT III DISPOSAL OF WASTE
Disposal methods - Incinerator - Hazardous waste, radioactive waste, liquid waste destruction - landfill.

UNIT IV CONTROLS APPLIED TO WASTE MANAGEMENT
Environmental pollution, its causes, consequences, mitigation and remedies. Emission control, Instrumentation and monitoring, Crematories.

UNIT V ENVIRONMENTAL SAFETY, RISKS & PUBLIC ISSUES.
Risk management in hospitasls - Environment issues in hospitals - Risk analysis Legislation, policies and law regarding environment on Health care waste management. Biomedical waste management and handling rules, 1998 and its amendment.

REFERENCES:
1. C.R.BRUNNER, Medical Waste Disposable Handbook, Incentrated, Consultant in Corporated, Virginia, 2000.
2. C.R.BRUNNER, Incentrated Consultant in Corporated Incentration System Hand Book, Virginia

313BMPT04 - QUALITY ASSURANCE AND SAFETY IN HOSPITALS

OBJECTIVE

1. To provide basic knowledge on the concept of Healthcare Quality management towards continuous improvement of patient care .
2. To make the students aware of the role of biomedical engineer in hospitals, especially in the management of electrical supply, maintenance of electrical safety.

UNIT I STANDARDIZATION OF QUALITY MEDICAL CARE IN HOSPITALS

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

UNIT II REGULATORY REQUIREMENT FOR HEALTH CARE

FDA regulations, Accreditation for hospitals - JCI, NABH and NABL, Other regulatory Codes.

UNIT III HOSPITAL SAFETY

Security & Safety of Hospital -Property, Staff & Patients**,** Radiation safety, Safety precautions, hazardous effects of radiation, allowed levels of radiation, ICRP regulations for radiation safety, Disposal of Biological waste.

UNIT IV ELECTRICAL & FIRE SAFETY

Sources of shocks, macro & micro shocks -Hazards, monitoring and interrupting the Operation from leakage current- Elements of fire, causes of fire , Action to be taken in case of fire in a Hospital.

UNIT V ASSESSING QUALITY HEALTH CARE

Patient Safety Organization- Governmental & Independent,Measuring Quality care – Evaluation of hospital services – six sigma way, Quality Assurance in Hospitals Sop's – Patient Orientation for Total Patient Satisfaction. 5S techniques

OUTCOMES:

The purpose of this course is to help students to develop knowledge and insight into the procedures used in quality control and assurance activities as well as safety measures to be followed in hospitals.

REFERENCES:

1. Cesar A. Cacere & Albert Zana, The Practice of Clinical Engg. Academic press, New Yark, 1977.
2. Webster J.G and Albert M.Cook, Clinical Engg, Principles & Practices, Prentic Hall Inc., Engle wood Cliffs, New Jersy, 1979.
3. B.M.Sakharkar, Principles of Hospital administration and Planning, JAYPEE Brothers, Medical Publishers (P) Ltd.
4. K.Shridhara Bhat, Quality Management, Himalaya Publishing House.
5. Karen Parsley, Karen Parsley Philomena Corrigan"Quality improvement in Healthcare, 2 nd edition ,Nelson Thrones Pub,2002
6. Sharon Myers "Patient Safety & Hospital Accreditation - A Model for Ensuring Success" Springer Publishers 2012
7. Joseph F Dyro "Clinical Engineering Handbook " Elsevier Publishers,2004.

313BMPT05 - MEDICAL ETHICS AND STANDARDS

OBJECTIVES:

1. Achieve familiarity with some basic ethical framework& understand how these Ethical frameworks can help us think through contemporary questions in medical ethics.
2. Students will be able to know about the legal and ethical principles and application of these principles in health care settings & gain knowledge about the medical standards that to be followed in hospitals.

UNIT I INTRODUCTION TO MEDICAL ETHICS

Definition of Medical ethics, Scope of ethics in medicine, American medical Association code of ethics, CMA code of ethics- Fundamental Responsibilities ,The Doctor And The Patient, The Doctor And The Profession, Professional Independence, The Doctor And Society.

UNIT II ETHICAL THEORIES & MORAL PRINCIPLES

Theories-Deontology & Utilitarianism ,Casuist theory, Virtue theory, The Right Theory. Principles-Non-Maleficence, Beneficence, Autonomy, Veracity, Justice. Autonomy & Confidentiality issues in medical practice, Ethical Issues in biomedical research ,Bioethical issues in Human Genetics & Reproductive Medicine

UNIT III HOSPITAL ACCREDITATION STANDRADS

Accrediation- JCI Accreditation & its Policies. Patient centered standards, Healthcare Organization management standards.

UNIT IV HOSPITAL SAFETY STANDARDS

Life Safety Standards- Protecting Occupants, Protecting the Hospital From Fire, Smoke, and Heat, Protecting Individuals From Fire and Smoke, Providing and Maintaining Fire Alarm Systems, Systems for Extinguishing Fires Environment of Care Standards-Minimizing EC Risks, Smoking Prohibitions, Managing Hazardous Material and Waste, Maintaining Fire Safety Equipment, Features, Testing, Maintaining, and Inspecting Medical Equipment.

UNIT V MEDICAL EQUIPMENT SAFETY STANDARDS

General requirements for basic safety & essential performance of medical equipments.IEC 60601 standards- Base Standard-general requirement of electrical medical devices, Collateral Standards-EMC radiation protection &programmable medical device system, Particular Standards-type of medical device

OUTCOMES:

Upon completion of this course the student should be able to demonstrate a measurable increase in their knowledge, skills and abilities related to:

11. Legal and professional guidelines for the health professions
12. Public duties and consent
13. Bioethical issues including genetic engineering, abortion, and life and death issues
14. Guidelines to obtain medical standards in hospitals

REFRENCES:

1. Domiel A Vallero "Biomedical Ethics for Engineers", Elsevier Pub.1st edition, 2007
2. Biomedical Ethics: A Canadian Focus. Johnna Fisher (ed.), Oxford University Press Canada (2009)
3. Robert M Veatch" Basics of Bio Ethics", Second Edition. Prentice- Hall,Inc 2003
4. Physical Environment Online: A Guide to The Joint Commission's Safety Standards is published by HCPro, Inc.2010
5. Joint Commission Accreditation Standards for Hospitals ,2 nd edition 2003
6. Bioethics-"An Introduction for the biosciences", 2nd edition 2008, Ben Mepham, Oxford.

313BMPT06 - ADVANCED NEURAL COMPUTING

OBJECTIVES

15. To learn the theory and implementation of neural networks
16. To introduce neural computing as an alternative knowledge acquisition/representation paradigm,

- To explain its basic principles and their relationship to neurobiological models,
- To describe a range of neural computing techniques and their application areas.

UNIT I BASIC CONCEPTS OF NEURAL COMPUTING

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

UNIT II BPN AND BAM

Back Propagation Network, Generalised Delta Rule, BPN Application, Associative Memory definition, BAM, Hopfield Memory, Simulated Annealing – Boltzmann Machine.

UNIT III OTHER NEURAL NETWORKS

Counter Propagation Network, Feature Mapping, Self Organising Feature Maps, Adaptive Resonance Theory(ART) Network Descriptions.

UNIT IV GENETIC ALGORITHMS & IMPLEMENTATION TECHNIQUES

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

UNIT V ADVANCES AND APPLICATIONS

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

COURSE OUTCOMES:

- Able to demonstrate an understanding of the principles of Neural Networks and a knowledge of their main areas of application;
- Ability to design, implement and analyse the behaviour of simple neural networks.
- Ability to use a neural network to solve real-world problems,

TEXT BOOKS:

1. Philip D.Wasermann, Advanced Methods in neural Computing, Van Nostrand Reinhold, Newyork 1993.
2. Jang J.S.R., Sun C.T and Mizutani E, "Neuro Fuzzy and Soft Computing: A Computational Approach to Learning Machine Intelligence", Prentice Hall, 1997.

REFERENCES:

1. David Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison – Wesley USA, 1997.
2. Melanie Mitchell, An Introduction to Genetic Algorithms: Prentice Hall of India, New Delhi 1998.
3. Simon Haykins, Neural Networks, Prentice HallinternationalInc, 1999.
4. James A Freeman and David M.Skapra, Neural Networks, Addison – Wesley, India 1999.

313BMPT07 - PATTERN RECOGNITION

COURSE OBJECTIVES:

- To know about Supervised and unsupervised Learning.
- To study about feature extraction and structural pattern recognition.
- To explore different classification models.
- To understand Fuzzy Pattern Classifiers and Perception.

UNIT I PATTERN CLASSIFIER

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II CLUSTERING

Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UINT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION

KL Transforms – Feature selection through functional approximation – Binary selection - Elements of formal grammars - Syntactic description - Stochastic grammars - Structural representation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine – Feature Selection.

UNIT V RECENT ADVANCES

Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- Classify the data and identify the patterns.
- Extract feature set and select the features from given data set.
-

REFERENCES:

1. M. Narasimha Murthy and V. Susheela Devi, "Pattern Recognition", Springer 2011.
2. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press, 2009.
3. Robert J.Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York, 1992.
4. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
5. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley, 2001
6. Andrew Webb, "Stastical Pattern Recognition", Arnold publishers, London,1999.

313BMPT08 - WAVELET TRANSFORMS AND APPLICATIONS

COURSE OBJECTIVES:

- To study the basics of signal representation and Fourier theory
- To understand Multi Resolution Analysis and Wavelet concepts
- To study the wavelet transform in both continuous and discrete domain
- To understand the design of wavelets using Lifting scheme
- To understand the applications of Wavelet transform

UNIT I FUNDAMENTALS

Vector Spaces – Properties– Dot Product – Basis – Dimension, Orthogonality and Orthonormality – Relationship Between Vectors and Signals – Signal Spaces – Concept of Convergence – Hilbert Spaces for Energy Signals- Fourier Theory: Fourier series expansion, Fourier transform, Short time Fourier transform, Time-frequency analysis.

UNIT II MULTI RESOLUTION ANALYSIS

Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General thonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

UNIT III CONTINUOUS WAVELET TRANSFORMS

Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency – Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Daubechies Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal)– Tiling of Time – Scale Plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORM

Filter Bank and Sub Band Coding Principles – Wavelet Filters – Inverse DWT Computation by Filter Banks – Basic Properties of Filter Coefficients – Choice of Wavelet Function Coefficients – Derivations of Daubechies Wavelets – Mallat's Algorithm for DWT – Multi Band Wavelet Transforms Lifting Scheme- Wavelet Transform Using Polyphase Matrix Factorization – Geometrical Foundations of Lifting Scheme – Lifting Scheme in Z –Domain.

UNIT V APPLICATIONS

Wavelet methods for signal processing- Image Compression Techniques: EZW–SPHIT Coding – Image Denoising Techniques: Noise Estimation – Shrinkage Rules – Shrinkage Functions – Edge Detection and Object Isolation, Image Fusion, and Object Detection.

COURSE OUTCOMES

Upon Completion of the course,☐the students will be able to

- Use Fourier tools to analyse signals
- Gain knowledge about MRA and representation using wavelet bases
- Acquire knowledge about various wavelet transforms and design wavelet transform
- Apply wavelet transform for various signal & image processing applications

TEXT BOOKS:

1. Rao R M and A S Bopardikar, —Wavelet Transforms Introduction to theory and Applications, Pearson Education, Asia, 2000.
2. L.Prasad & S.S.Iyengar, Wavelet Analysis with Applications to Image Processing, CRC Press, 1997.

REFERENCE BOOKS:

1. J. C. Goswami and A. K. Chan, "Fundamentals of wavelets: Theory, Algorithms and Applications" WileyInterscience Publication,John Wiley & Sons Inc., 1999.
2. M. Vetterli, J. Kovacevic, "Wavelets and subband coding" Prentice Hall Inc, 1995.
3. Stephen G. Mallat, "A wavelet tour of signal processing" 2 nd Edition Academic Press, 2000.
4. Soman K P and Ramachandran K I, —Insight into Wavelets From Theory to practice☐, Prentice Hall, 2004..

313BMPT09 - PHYSIOLOGICAL MODELING

OBJECTIVE:
To understand and appreciate the value and application of
1. Physiological models, 2.Vital organs 3. Modeling dynamically varying physiological system 4. Methods and techniques to analyze and synthesis dynamic models 5. Develop differential equations to describe the dynamic models, simulate and visualize dynamic responses of physiological models using software.

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

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

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

UNIT IV FEEDBACK
Characterization of Physiological Feedback. Systems, Uses and Testing of System Stability.

UNIT V SIMULATION OF BIOLOGICAL SYSTEMS
Simulation of Skeletal muscle servomechanism, thermo Regulation, cardiovascular control System, Respiration controls, Occulo Motor System, Endocrine control system and Modeling of receptors.

OUTCOME:
The student will have knowledge in the analysis of any physiological systems through the Models

REFERENCES:
1. William B. Blesser, A System Approach to Biomedicine, McGraw Hill Book Co, New York, 1969.
2. Manfreo Clynes and John H. Milsum, Biomedical Engineering System, McGraw Hill and Co, New York, 1970.
3. Douglas S. Rigg, Control Theory and Physiological Feedback Mechanism, The William and Wilkins Co, Baltimore, 1970 .
4. Richard Skalak and Shu Chien, Hand Book of Biomedical Engineering, McGraw Hill and Co, New York, 1987.
5. Michael C.K. Khoo, "Physiological Control System" - Analysis, Simulation and Estimation"- Prentice Hall of India, New Delhi, 2001

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