PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO I: To ensure that Graduates are professionally capable in Medical Electronics to solve problems in environmental, food, biochemical and biomedical engineering and technology.

PEO II: To enable graduates to communicate at technical levels and to serve as team members or leaders with good interpersonal skills.

PEO III: To enable graduates to acquire proficiency in the theory and practice of bio-techniques through life-long learning.

PEO IV: To enable graduates to recognize societal and industrial needs and work to develop and produce any product of the desired quality at a competitive cost.

PROGRAMME OUTCOMES (POs):

PO1: To Solve the real-life engineering problems by employing the knowledge and skills of Medical Electronics.

PO2: Ability to design and conduct experiments, as well as to acquire, analyze interpret and report experimental data

PO3: Ability to design biomedical engineering systems, components or processes to meet desired needs to provide for sustainable development.

PO4: Ability to use the current engineering techniques, skills and modern tools necessary for biomedical engineering practice.

PO5: Ability communicates effectively, not only with engineers but also with the society.

PO6: Ability to function effectively as a leader with management and entrepreneurship skills as well as an active member in a multi-disciplinary learns.

PO7: Understanding of and commitments to biomedical engineering professional and ethical responsibilities.

PO8: Understanding of the social, cultural and environmental responsibilities in global and local of a professional biomedical engineer.

PO9: Understanding and developing the competence for continuous learning in the area of design, Medical Image Processing and Radio Therapy.

PO10: Knowledgeable in current biomedical engineering issues.

PROGRAM SPECIFIC OBJECTIVES (PSOs):

PSO1: To acquire and understand the basic skill sets required for Medical Electronics Engineering.

PSO2: To implement the techniques and tools of Medical Electronics Engineering to address the needs of technology in healthcare domain.

PSO3: To address the problems associated with the interaction between living and non-living materials and systems.
MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table.

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Note: The table represents a course structure with PO1 to PO10 columns, indicating the presence or absence of courses and electives for different semesters.
| II | 3 | Human Assist Devices | x | x | x | x | x | x |
| II | 3 | Professional Elective IV |   |   |   |   |   |   |
| II | 3 | Professional Elective V |   |   |   |   |   |   |
| II | 3 | Hospital / Biomedical Industry Training | x | x | x | x | x | x |
| II | 3 | Project Work Phase I | x | x | x | x | x | x |
| II | 4 | Project Work Phase II | x | x | x | x | x | x |
ANNA UNIVERSITY, CHENNAI  
AFFILIATED INSTITUTIONS  
M.E. MEDICAL ELECTRONICS  
REGULATIONS – 2017  
CHOICE BASED CREDIT SYSTEM  
CURRICULA AND SYLLABI

SEMESTER I

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<td>Wavelets Transforms and its Applications</td>
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### SEMESTER III
**ELECTIVE V**

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<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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<td>1.</td>
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<td>4.</td>
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OBJECTIVES:
The main objective of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and logical thinking applicable for the students in various engineering discipline. This course also will help the students to identify, formulate, abstract, and solve problems using mathematical tools from a variety of mathematical areas, including linear algebra, numerical solution of linear equations and differential equations, approximation of functions in terms of polynomials using interpolation, numerical differentiation and integration, linear programming and queueing models.

UNIT I VECTOR SPACE AND LINEAR TRANSFORMATION
Vector spaces – Subspaces – Linear spans – Linear independence and linear dependence – Basis and dimension – Linear transformation - Null space and range – Dimension theorem (no proof) – Matrix representation of linear transformation.

UNIT II NUMERICAL LINEAR ALGEBRA, INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION

UNIT III NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

UNIT IV LINEAR PROGRAMMING

UNIT V QUEUEING MODELS

TOTAL : 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following topics:

- Compute basic objects associated with vector spaces and linear transformation.
- Solve an algebraic or transcendental equation, linear system of equations using an appropriate numerical method.
- Construction of an approximate polynomial using interpolation methods, finding of the derivatives and evaluation of integrals numerically.
- Numerical solution of ordinary differential equations using single and multistep methods.
- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- Exposing the basic characteristic features of a queuing system and acquire skills in analyzing queueing models.

The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical knowledge, methodologies and modern computational tools.
REFERENCES:

BM5151 HUMAN ANATOMY AND PHYSIOLOGY L T P C
3 0 0 3

OBJECTIVES:
- To understand basics of Human Anatomy and Physiology.
- To study the organs and systems involved in body functions.

UNIT I INTRODUCTION OF HUMAN BODY 8

UNIT II BUILDING BLOCKS OF HUMAN BODY 8

UNIT III RESPIRATION, NUTRITION AND EXCRETORY SYSTEM 10

UNIT IV CARDIOVASCULAR AND ENDOCRINE SYSTEM 9
UNIT V  NERVOUS SYSTEM AND SPECIAL SENSES


TOTAL: 45 PERIODS

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

- Qualitatively and quantitatively describe each system of the human body covered in this course: integumentary, skeletal, muscular, nervous, sensory, and endocrine and the components of these systems on the organ and cellular level.
- Apply this knowledge into biomedical engineering field.
- Integrate a basic knowledge of chemistry and biochemistry with human physiology

REFERENCES:

BM5191  BIO SIGNAL PROCESSING  L T P C
3 0 0 3

OBJECTIVES
- It provides a solid foundation in advanced biomedical signaling and imaging systems including up-to-date coverage of commercially relevant topics.
- It focuses on biomedical signals, processing the signals, and validate the methods and results for optimization of clinical applications
- To introduce techniques for automated classification and decision making to aid diagnosis

UNIT I  SIGNAL, SYSTEM AND SPECTRUM

UNIT II  TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION
Time series analysis – linear prediction models, process order estimation, non stationary process, fixed segmentation, adaptive segmentation, application in EEG, PCG and HRV signals, 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  9
Filtering – LMS adaptive filter, adaptive noise cancelling in ECG, improved adaptive filtering in FECG, EEG and other applications in Bio signals, Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.

UNIT IV  BIOSIGNAL CLASSIFICATION AND RECOGNITION  9
Signal classification and recognition – Statistical signal classification, linear discriminant function, direct feature selection and ordering, Back propagation neural network based classification. Application in Normal versus Ectopic ECG beats and other biomedical applications

UNIT V  TIME FREQUENCY AND MULTIVARIATE ANALYSIS  9
Time frequency representation, spectrogram, Time-scale representation, scalogram, wavelet analysis – Data reduction techniques, ECG data compression, ECG characterization, Feature extraction-Wavelet packets, Multivariate component analysis-PCA, ICA

TOTAL: 45 PERIODS

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

- Carry out multivariate component analysis.
- Explain biosignal classification

REFERENCES:

MX5101  MEDICAL INSTRUMENTATION  L T P C
3 0 0 3

OBJECTIVES:

- To understand the components of an medical instrument and different types of electrodes used.
- To gain knowledge of the different biopotential characteristics and recording methods used for various biosignals.
- To develop an understanding of the nonelectrical parameters measurements so as to enable to record various non electrical parameters.
- To learn the methods used for blood flow measurement.
- To study the measurement techniques used for measurement of biochemical parameters.
UNIT I  BIOELECTRODES 9

UNIT II  BIOAMPLIFIERS, BIOPOTENTIAL SIGNALS AND THEIR RECORDING 9
Bioamplifiers- Carrier Amplifier, - Isolation Amplifier - Differential amplifier - Chopper Amplifier - Instrumentation Amplifier - Bioelectric signals (ECG, EMG, EEG, EOG & ERG) and their characteristics - Electrodes for ECG, EEG and EMG - ECG Machine - EMG machine – 10-20 electrodes placement system for EEG - EEG machine - Heart sound and characteristics, PCG

UNIT III  NON ELECTRICAL PARAMETER MEASUREMENTS 9
Measurement of Blood pressure – Direct Methods and Indirect Methods - Temperature - Respiration rate - Heart rate measurement - O2 , CO2 measurements, Respiratory volume measurement, BMR Measurement, Plethysmography technique, Detection of various physiological parameters using impedance technique.

UNIT IV  BLOOD FLOW METER AND BLOOD CELL COUNTER 9

UNIT V  BIOCHEMICAL MEASUREMENT TECHNIQUES 9

TOTAL: 45 PERIODS

OUTCOMES:
By the completion of this course the student will be able to
- Understand the origin of biopotentials and various bioelectrodes
- Analyze different biopotential characteristics and recording methods.
- Develop measurement systems for non electrical parameters measurements.
- Perform biochemical measurements

REFERENCES:
OBJECTIVES:
- To learn about cardiac care unit, pulmonary analyzers and aid equipments and their functions
- To understand the principle involved in physiotherapy and electrotherapy equipments
- To gain knowledge about instruments used to kidney and bones measurements
- To study about the instruments used for sensory measurements and be able to design sensors
- To provide latest knowledge of special medical assistive and therapeutic equipments.

UNIT I  CARDIAC CARE UNIT AND PULMONARY ANALYSERS
- Pacemakers – Need, different types, electrode types and placement, batteries for pacemakers.
- Defibrillators AC and DC defibrillators. Regulation of Breathing - Pulmonary gas flow measurements - Pulmonary volume measurements - Respiratory gas analyzers – Nitrogen Gas Analyzer, Oxygen Analyzer - Humidifier, Nebulizer – Ventilators - Anesthesia machine

UNIT II  PHYSIOTHERAPY AND ELECTROTHERAPY EQUIPMENTS
- Tissue response -Short ware diathermy - Microwave diathermy - Ultrasonic therapy Unit - Electrotherapy - FES, TENS - Bladder stimulator - Lithotripter system - Extra corporeal Shock wave therapy- Electrical safety-IEC-60601 standard

UNIT III  INSTRUMENTS DEALING WITH KIDNEY AND BONES

UNIT IV  SENSORY INSTRUMENTATION

UNIT V  SPECIAL EQUIPMENTS

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course the student will be able to
- Describe the working of the pacemaker, pulmonary analyzers and aid equipments and their functions
- Obtain knowledge on different physiotherapy equipments and instruments dealing with kidney and bones.
- Develop measurement systems for sensory parameter measurements.
- Familiar with the special therapeutic equipments available.
REFERENCES:

MX5111 MEDICAL INSTRUMENTATION LABORATORY L T P C
0 0 4 2

OBJECTIVES:
- To record the different biopotential characteristics and understand their characteristics.
- To study the physiological parameters by performing measurements using suitable techniques.

LIST OF EXPERIMENTS
1. Recording of ECG in standard lead systems
2. Recording of Electromyogram and measurement of nerve conduction velocity.
3. Recording and analysis of EEG in time and frequency domains.
4. Design of preamplifier for acquiring bio signals
5. Acquisition of Heart sounds using PCG
8. Study of different types of muscle stimulator waveforms.
9. Measurement of respiratory parameters using spirometer
10. Measurement of Galvanic skin resistance
11. Performance and testing of surgical diathermy unit using diathermy analyser
13. Glucose measurement using sensor

TOTAL: 60 PERIODS

OUTCOME:
Students acquire knowledge about recording of bioelectric potentials, various physiological measurements used in medical field.
OBJECTIVES:

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

UNIT I  IMAGE FUNDAMENTALS 9
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 – DFT, DCT, KLT, SVD.

UNIT II  IMAGE ENHANCEMENT AND RESTORATION 9
Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic mean filters, Homomorphic filtering, Color image enhancement. Image Restoration - degradation model, Unconstrained and constrained restoration, Inverse filtering- Wiener filtering

UNIT III  MEDICAL IMAGE REPRESENTATION 9
Pixels and voxels – algebraic image operations - gray scale and color representation- depth-color and look up tables - image file formats- DICOM- other formats- Analyze 7.5, NifTI and Interfile, Image quality and the signal to noise ratio

UNIT IV  MEDICAL IMAGE ANALYSIS AND CLASSIFICATION 9
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 9
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.

TOTAL: 45 PERIODS

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:

OBJECTIVES:
- To study the production of x-rays and its application in medical imaging.
- 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 understand the Radiation therapy techniques and also Radiation safety.

UNIT I  X – RAYS AND COMPUTED TOMOGRAPHY

UNIT II  EMISSION IMAGING
Alpha, Beta, Gamma Emission, different types of Radiation Detectors, G.M. & Proportional Counters, Pulse Height Analysers, Isotopic, Scanners, Principle of PET and SPECT, PET/CT.

UNIT III  MAGNETIC RESONANCE IMAGING
Principle of MRI, Relaxation processes and their measurements, Pulse sequencing and MR image acquisition, MRI instrumentation, Magnets, gradient coils, Imaging Different Sections of the Body, Tissue Characterization, MR Spectroscopy, Functional MRI.

UNIT IV  ULTRASOUND IMAGING AND THERMOGRAPHY
Wave propagation and interaction in Biological tissues, Acoustic radiation fields, continuous and pulsed excitation, Transducers and imaging systems, Scanning methods, Imaging Modes-A, B & M, Principles and theory of image generation. Thermography- Principle, detectors and applications.

UNIT V  THERAPY USING X – RAYS AND ISOTOPES
Direct and Indirect effects of high energy radiation, Units for radiation Exposure, Depth Dose curves, Linear Accelerator Betatron, Cobalt and Cesium Therapy, Computation of Absorbed Dose Level, Automatic Treatment Planning, Hazardous Effects of Radiation, Radiation measuring units, Allowed Levels, ICRP regulation Protection Methods.

TOTAL: 45 PERIODS

OUTCOME:
- Will obtain domain knowledge in understanding various Medical Imaging techniques and Therapeutic applications of Radiation.

REFERENCES:
5. Jerry L.Prince and Jnathan M.Links,ll Medical Imaging Signals and Systemsll- Pearson Education Inc. 2006
OBJECTIVES:
- To get the clear understanding of application of mechanics in medicine.
- To study the properties of blood, bone and soft tissues like articular cartilage tendons and ligaments.
- To gain necessary knowledge about accident and injuries.
- Introduction to basic structural analysis of medical implants

UNIT I  INTRODUCTION
Introduction to bio-mechanics, relation between mechanics and Medicine, Newton's laws, stress, strain, shear rate, viscosity, visco elasticity, non Newtonian viscosity, soft tissue mechanics, mechanical properties of soft biological tissues, biofluid mechanics. Steps in analyzing a biomechanical problem – Graphical methods – contact forces – resolution of forces

UNIT II  MECHANICS OF CIRCULATION
Flow properties of blood, effect of shear rate, hematocrit, temperature and protein Content of blood, rheology of blood and micro vessels, dynamics of circulatory system, turbulence flow around prosthetic heart valves.

UNIT III  MECHANICAL PROPERTIES OF BONES

UNIT IV  MECHANICS OF THE JOINTS
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. Structure of the Tibio femoral joint, patello femoral joint, knee joint motion – flexion, extension, rotation, Arthro-kinematics, stabilization and its contributors, positioning of the knee joints, locking/unlocking mechanism, Q- angle. 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 V  DESIGN OF MEDICAL IMPLANTS USING SOFTWARE

TOTAL : 45 PERIODS

OUTCOMES:
The study of mechanical properties of biological tissues and the properties of blood give us a wide understanding about its structure and when it undergoes wear and when it fails so many precautions can be given by ourselves to elders. Introduction to FEM and its medical applications. Human body boundary conditions for implants design and analysis. The knowledge gained will be helpful in doing research in properties of hard tissues like bones and to generate a mathematical mode of bone structure etc.
REFERENCES:
1. A Z Tohen and C T Thomas, Manual of Mechanical Orthopaedics
4. D N Ghista, Biomechanics of Medical Devices, Macel Dekker, 1982
6. D. Dawson & V. Wright, Introduction to Biomechanics of Joints and Joint Replacement
9. V.C. Mow and W. C. Hayes, Basic Orthopedic Biomechanics, Lippincott, Raven Publishers

MX5203 HEALTH CARE, HOSPITAL AND EQUIPMENT MANAGEMENT

OBJECTIVES:
To develop an understanding of the various setups of hospital, health care codes and equipment management, so as to enable the student to work in the hospital environment.

UNIT I HEALTH SYSTEM
Health organisation of the country, the State, the Cities and the Region, Health Financing System, Health services, Functions of Hospitals, Types of Hospitals, Primary Health Care – An Introduction, Ambulatory care.

UNIT II HOSPITAL ORGANISATION AND MANAGEMENT
Management of Hospital Organisation, Nursing Sector, Medical Sector, Central Services, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis Human Relation in Hospital, Importance of Team Work, Legal aspect in Hospital Management.

UNIT III REGULATORY REQUIREMENT AND HEALTH CARE CODES
FDA Regulation, Joint Commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPQ.

UNIT IV TRAINED TECHNICAL PERSONNEL
Function of Clinical Engineer, Role to be performed in Hospital, Manpower requirement for different types of hospitals, Professional Registration, Structure in Hospital.

UNIT V EQUIPMENT MAINTENANCE MANAGEMENT

TOTAL : 45 PERIODS
OUTCOMES:
The students will be able to apprehend the organisation structure in hospitals, the duties of personnel & the health codes, the training required for technical work for equipment management.

REFERENCES:

MX5211 DATA ACQUISITION AND PROCESSING LABORATORY

OBJECTIVE:
To study the various aspects of acquisition and analysis of bio signals and medical images.
To understand the importance of electrical safety of medical equipments.
To study practically the concepts of physiological modeling.

LIST OF EXPERIMENTS
1. Acquisition and analysis of bio signals using workstation.
2. Study of auditory and visual evoked responses.
3. Development of software for basic telemedicine.
5. Acquisition and analysis of medical images.
8. Study of IDL as a tool for medical image analysis.
10. Study of lung and cardiovascular models.
11. Electrical safety testing of medical equipment.
12. Mini project (Should include hardware and software).

TOTAL: 60 PERIODS

OUTCOMES:
- Ability to acquire and analyse any physiological signal and model the physiological systems.
- Apply the techniques of medical image analysis and providing security to medical data.
OBJECTIVE:
The objective of this to know the principle, design and application of various human assist devices which includes extracorporeal devices, artificial heart, cardiac assist devices, respiratory devices and hearing aids. Additionally, a brief introduction to design aspects of prosthetic and orthotic devices for the disability will be given.

UNIT I HEART LUNG MACHINE AND ARTIFICIAL HEART 9
Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for Cardiac Transplant, Driving Mechanism, Blood Handling System, Functioning and different types of Artificial Heart, Mock test setup for assessing its Functions.

UNIT II CARDIAC ASSIST DEVICES 9
Synchronous Counter pulsation, Assisted through Respiration Right Ventricular Bypass Pump, Left Ventricular Bypass Pump, Open Chest and closed Chest type, Intra Aortic Balloon Pumping Veno Arterial Pumping, Prosthetic Cardio Valves, Principle and problem, Biomaterials for implantable purposes, its characteristics and testing.

UNIT III ARTIFICIAL KIDNEY 9
Indication and Principle of Haemodialysis, Membrane, Dialysate, Different types of heamodialysers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type.

UNIT IV PROSTHETIC AND ORTHOTIC DEVICES 9
Hand and Arm Replacement - Different Types of Models Externally Powered Limb Prosthesis, Lower Limb and Upper limb orthotic devices, Functional Electrical Stimulation, Sensory Assist Devices, Materials for Prosthetic and orthotic devices, Haptic Devices

UNIT V RESPIRATORY AND HEARING AIDS 9
Ventilator and its types-Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types of Deafness, Hearing Aids, Construction and Functional Characteristics

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the students will be able to
- Explain the role and importance of Heart lung machine and artificial Heart.
- Explain the importance of different types of assist devices and related issues.
- Ability to specify the type of assistive devices for rehabilitation.

REFERENCES:
OBJECTIVES:
- To understand basics of Tissue Engineering
- To understand fundamentals of cell mechanisms
- To teach the Physical & biological principles that serve as the scientific basis for understanding the interactions of biological molecules and cells with biomaterials employed for the fabrication of permanent implantable prostheses and as matrices for tissue engineering.
- To understand application of Tissue Engineering

UNIT I   BASICS OF TISSUE ENGINEERING  9

UNIT II   FUNDAMENTALS OF CELL MECHANISMS  9

UNIT III   BIOMATERIALS IN TISSUE ENGINEERING  9

UNIT IV   STEM CELLS IN TISSUE ENGINEERING  9
Introduction of Stem cells – Hemopoetic Stem cells - Embryonic Stem cells - Adult stem cells – Cancer Stem cells – Cord Blood cells – Induced Pluripotent Stem cells - Stem cell identification - Surface markers & FACS analysis – Differentiation, Dedifferentiation and Immortalization – Application of stem cells in tissue Engineering.

UNIT V   TISSUE ENGINEERING APPLICATIONS  9

TOTAL : 45 PERIODS

OUTCOMES:
By successfully completing this course, students will be able to:
- Discuss the importance of tissue engineering in the field of biomedical engineering Explain the mechanisms involved in interaction of different materials with cells and tissues
- Explain different methods involved in characterization and preparation of biomaterials in tissue engineering.
- Apply the knowledge in creating new models in drug delivery systems using synthetic and natural scaffolds
- Explain different types of stem cells and its application in tissue engineering
- Develop new approaches to build new tissues using tissue engineering techniques
REFERENCES:

BM5071 PRINCIPLES OF GENETIC ANALYSIS

OBJECTIVES:
- To understand the fundamental principles of genetics and to describe the experiments used to establish them.
- To develop skills in applying these principles to solve genetic problems and demonstrate how genetic analysis can be used to investigate aspects of biology.

UNIT I GENETIC INHERITANCE
Organisation of DNA, Chromosomal inheritance, Eukaryotic genomes – repetitive and non-repetitive sequence, Genetic mapping - restriction cleavage, RFLP and SNPs.

UNIT II DNA AND PHENOTYPE
DNA structure and replication, DNA sequencing, amplification and hybridisation. DNA Polymorphism, RNA transcription and processing, translation and its post translation modification. Regulation of gene expression.

UNIT III ENGINEERING OF GENES
Gene isolation and manipulation, mutations, repair and recombination, site directed mutagenesis, in vivo techniques of genetic manipulation, tools for analysing gene expression and genetically modified organisms.

UNIT IV HUMAN GENOME PROJECT
Human Genome Project (HGP) – an overview of the project, goals of the project, major scientific strategies & approaches used in HGP, physical mapping, gene ontology, gene annotation, techniques in HGP – microsatellite markers, STS, EST, DNA sequencing and DNA microarray, scientific & medical benefits of this project.

UNIT V IMPACT OF GENETIC VARIATION
Population Genetics, Quantitative Genetics, Evolution Genetics.

TOTAL : 45 PERIODS

OUTCOMES:
- Interpret different forms of inheritance patterns and identify them in genetic data
- Acquire in depth knowledge in evolutionary analysis of genetic sequence
- Interpret and critically evaluate the outcomes of statistical analysis associated with the research project
- Exploit relevant molecular genetic information with skill and confidence to conduct a research project involving the analysis of real molecular genetic data with minimal supervision
REFERENCES:

BM5072 BIO MATERIALS

OBJECTIVES:
• To introduce concepts of materials, surface and tissue placement in biomaterial functions
• To understand diverse elements controlling biological responses to materials
• To provide contemporary biomaterial principles

UNIT I INTRODUCTION
Definition of biomaterials, mechanical properties, surface chemistry of materials, surface modification, Tissue Reaction, Wound Kinetics, Bio Compatibility.

UNIT II MATERIALS IN MEDICAL DEVICES
Metals, Ceramics, Polymers and Biomimetic Materials, Composites. Material preparation, chemical composition, Properties, uses in medicine and biosciences and failure mechanisms.

UNIT III STERILIZATION OF BIOMATERIALS

UNIT IV TESTING OF MATERIALS
Testing with Tissue Culture – in vitro and in vivo assessment of biocompatibility, testing with Soft Tissues and testing at non Thrombogenic surface – blood compatibility and thrombogenicity, ISO 10993- standard for assessment of biocompatibility.

UNIT V HARD AND SOFT REPLACEMENT
Cardiac Implants, Orthopedic Implants, Neuromuscular Implants, Transcutaneous Implants, Intraocular lenses.

TOTAL : 45 PERIODS

OUTCOMES:
The student will be able to
• Widen rational design approaches to biomaterials engineering
• Identify significant gap required to overcome challenges and further development
• Develop critical analyses of biomaterials through proposal writing and review.
REFERENCES:

MX5091  MEDICAL ETHICS AND STANDARDS  L T P C
3 0 0 3

OBJECTIVES:
- Achieve familiarity with some basic ethical framework & understand how these ethical frameworks can help us to think through contemporary questions in medical ethics.
- 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  8
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  9

UNIT III  HOSPITAL ACCREDITATION STANDARDS  9

UNIT IV  HOSPITAL SAFETY STANDARDS  10
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

TOTAL : 45 PERIODS

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

- Legal and professional guidelines for the health professions
- Public duties and consent
- Guidelines to obtain medical standards in hospitals

REFERENCES:

BM5094  BIOMEDICAL OPTICS  L T P C

OBJECTIVES:
THE OBJECTIVES OF THIS COURSE ARE:

- 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
- 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, Lasers in Neurosurgery, Laser Treatment of Breast Tumors, Therapeutic Applications of Lasers in Gastroenterology.
UNIT IV  DIAGNOSTIC APPLICATIONS 9
Optical coherence tomography, Elastography, Fluorescence Imaging, Raman Imaging, FLIM, X-Ray Diagnostic Techniques, Speckle Correlometry, Near-Field Imaging in Biological and Biomedical Applications

UNIT V  THERAPEUTIC APPLICATIONS 9
Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and non-oncological applications of PDT - Biostimulation effect – applications.  

TOTAL: 45 PERIODS

OUTCOME:
Able to know the various optical properties of tissue as well as application of lasers in medical fields

REFERENCES:

MX5092  BIO MEMS  L T P C
3 0 0 3

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

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

UNIT III  ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATORS 9
Parallel plate capacitor, pull in effect, Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive. Properties of piezoelectric materials, Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.
OUTCOMES:
Students will be able to
- Understand the operation of different types of sensors and actuators at microscale level
- Understand the design issues at microscale level
- Choose the material for any application
- Apply the concepts to the design of different types of micro systems
- Apply the knowledge of CAD tools for MEMS design

REFERENCES:

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 APPLICATION OF BIO MEMS
CAD for 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.

TOTAL: 45 PERIODS

OBJECTIVE:
- To know basic nanotechnological principles and characterization methods
- To understand the essential features of biology and nanotechnology that are converging to create the new areas of bionanotechnology and nanomedicine.

UNIT I INTRODUCTION OF NANO PARTICLES
Overview of nanotechnology from medical perceptive, different types of nanobiomaterials and nanostructure interactions. Synthesis, characterization, and properties smart nanomaterials, Surface modification, biofunctionalization of nanomaterials. Nanocarriers (e.g. liposomes, polymer capsules, polymer nanoparticles, porous materials, nanogels, dendrimers, microemulsions, inorganic nanoparticles, carbon nanotubes, lipoproteins, solid lipid nanoparticles)
UNIT II PROTEIN AS NANOSTRUCTURES
Protein based nanostructures building blocks and templates – Proteins as transducers and amplifiers – nanobioelectronic devices and polymer nanocontainers – microbial production of inorganic nanoparticles – magnetosomes.

UNIT III DNA AS NANOSTRUCTURES
DNA based nanostructures – Topographic and Electrostatic properties of DNA – Hybrid conjugates of gold nanoparticles – DNA oligomers – use of DNA molecules in nanomechanics

UNIT IV NANOPARTICLES IN DIAGNOSIS
Introduction to nanoparticles in diagnostics— nuclear imaging, optical imaging, PET, Micro PET, cardio vascular disease studies, imaging and therapy of thrombosis, emerging Ethical issues and toxicology of nanomaterials.

UNIT V NANTHERAPEUTICS
Nanoparticles as carriers in drug delivery- design, manufacture and physiochemical properties, transport across biological barriers, nanotechnology in Cancer therapy, lung infectious disease, bone treatment, nano particles for oral vaccination and skin disease.

TOTAL: 45 PERIODS

OUTCOMES:
The student will be able to:
- Follow the newest findings in the area of nanomedicine and implement the perspectives in own research.
- Explain nanoparticles in diagnosis
- Discuss nanotherapeutics

REFERENCES:

MX5071 PATTERN RECOGNITION TECHNIQUES AND ITS APPLICATIONS

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

UNIT I PATTERN CLASSIFIER
UNIT II CLUSTERING
Clustering for unsupervised learning and classification – Clustering concept – Hierarchical clustering, Partitional clustering - k-means algorithm – Validity of Clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE

UNIT V RECENT ADVANCES AND APPLICATIONS
Fuzzy logic – Fuzzy Pattern Classifiers – Case Study Using Fuzzy Pattern Classifiers CAD system in breast cancer detection, ECG signal classification, Fingerprint recognition, cell cytology classification

OUTCOMES:
Upon Completion of the course, the students will be able to classify the data and identify the patterns
- Extract discriminatory features and select the features from given data set.

REFERENCES:

MX5093 COMPUTER BASED MEDICAL INSTRUMENTATION

OBJECTIVES:
- To teach PC hardware and its related interfacing
- To give a complete overview of 80186, 80286, 80386 and 80486 microprocessors.
- To understand the basics of computerized data acquisition and programming.
- To enrich the students knowledge with biometrics and network security.

UNIT I PC HARDWARE AND OVERVIEW
System Unit - Overview of Mother Boards - Processors, Memory, Adapter cards, Ports, Power supply - BIOS – DOS interaction, POST, Functional and Architecture Block diagram of a PC, Mother Board logics - Memory and I/O map

TOTAL: 45 PERIODS
UNIT II  PERIPHERAL INTERFACING AND CONTROLLERS  9
Keyboard and Mouse Interfaces - Memory types - RAM - SDRAM and RDRAM, Cache memory, ROM and its types, Flash memory, CMOS semiconductor memory - Adapter Cards - Sound Card, Modem card, Video card, Network Card - I/O slots - ISA, PCI and AGP bus slots - Ports - Serial and Parallel ports, USB, FireWire port, MIDI, SCSI, IrDA, Bluetooth – Connectors - System Bus, ISA, EISA, PCI, AGP and PCI bus - Disk controllers

UNIT III  PROCESSORS AND MEMORY  9
80X86 Processors - Architectures and Memory management - Overview of 80X86 based Mother boards

UNIT IV  COMPUTERISED DATA ACQUISITION AND PROGRAMMING  9
Plug-in-data acquisition and Control Boards, - Data acquisition using GPIB and Serial Interfaces and Programming in C - DSP in Medical applications

UNIT V  CAD IN MEDICAL INSTRUMENTATION  9

TOTAL :45 PERIODS

OUTCOMES:
• Exposed to PC hardware as well as various microprocessor family
• Hardware behind data acquisition
• Scope of virtual reality in health care
• Develop an insight knowledge about the biometrics and network security

REFERENCES:
2. B.Govindarajulu, IBM PC and Clones: Hardware, Trouble shooting and Maintenance, Tata
8. Ramachandra Lele, Computers in Medicine Progress in Medical Informatics, Tata Mcgraw Hill Publishing Company, New Delhi, 2005

MX5001  MEDICAL INFORMATICS  L T P C
3 0 0 3

OBJECTIVE
• To study the modern healthcare data standards
• To understand the use of latest technology to share medical records
UNIT I MEDICAL INFORMATICS
Historical highlights and Evolution, Hospital Information System – its characteristics and functional online and offline modules, Health Informatics, Medical Informatics and its six levels of interfaces - Hardware and software requirements, Virtual Hospital, e – health services - Body Area Networks - Health Grid

UNIT II MEDICAL DATA AND STANDARDS
Electronic Patient Record (EPR) - Integrated clinical data - Biosignal and Medical image formats - Medical data storage and retrieval techniques – Steganography, - Medical Standards – HL7 – DICOM - IEEE 1073 - IRMA - LOINC - ICD10 - Medical standard organizations

UNIT III DECISION MAKING
Fuzzy logic – its applications in Medicine, Physiological System Modeling and Simulation, Virtual Reality and Multimedia Applications in Medicine, Biometrics - Biometric Devices - Physiological Characteristic Devices - Behavioral Characteristic Devices - Feature extraction and Decision making- Social issues

UNIT IV JAVA PROGRAMMING
Design and Development of Hospital Information Systems – Developing front-end, back-end and Client – Server interface programs in Java Environment – SQL

UNIT V INTERNET AND WEB
Medical Networks - Java script programming - Web Design and programming - Design of Web portal services in medicine

TOTAL: 45 PERIODS

OUTCOMES:
The student understands the various aspects of informatics applied in health industry so that quality of health care is improved

REFERENCES:
5. Keng ong, Medical Informatics - An executive Primier, HIMSS, 2011
OBJECTIVES:

- To study the basic concepts of ARM processors
- To understand the computing platform and design analysis of ARM processors
- To study the concepts of Operating systems in ARM
- To study the concept of embedded networks
- To understand case studies related to embedded systems

UNIT I  INTRODUCTION TO ARM PROCESSORS  9

UNIT II  COMPUTING PLATFORM AND DESIGN ANALYSIS  9
CPU buses – Memory devices – I/O devices – Memory Protection Units – Memory Management Units – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

UNIT III  PROCESS AND OPERATING SYSTEMS  9

UNIT IV  HARDWARE ACCELERATES & NETWORKS  9
Accelerators – Accelerated system design – Distributed Embedded Architecture – Networks for Embedded Systems – Network based design – Internet enabled systems.

UNIT V  CASE STUDY  9
Hardware and software co-design - Data Compressor - Software Modem – Personal Digital Assistants – Set–Top–Box. – System-on-Silicon – FOSS Tools for embedded system development.

TOTAL: 45 PERIODS

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

- Revise computing platform and design analysis
- Demonstrate multiple tasks and multi processes
- Discuss hardware and software co-design.

REFERENCES:
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  9

UNIT II  ORTHOTICS & PROSTHETICS IN REHABILITATION:  9
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:  9
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:  9
Types of deafness, hearing aids, application of DSP in hearing aids, Cochlear implants, Voice synthesizer, speech trainer

UNIT V  SENSORY AUGMENTATION AND SUBSTITUTIONS:  9
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

OUTCOMES:
The student will have the knowledge about various rehabilitation aids available and the issues associated with the use of these aids

REFERENCES:
OBJECTIVES:

- To learn the theory and implementation of neural networks
- 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  

UNIT III  OTHER NEURAL NETWORKS  

UNIT IV  GENETIC ALGORITHMS & IMPLEMENTATION TECHNIQUES  

UNIT V  ADVANCES AND APPLICATIONS  

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.

REFERENCES:

CU5093 WAVELET TRANSFORMS AND ITS APPLICATIONS

OBJECTIVES:
- To introduce the fundamentals concepts of wavelet transforms.
- To study system design using Wavelets
- To learn the different wavelet families & their applications.

UNIT I INTRODUCTION TO WAVELETS
Introduction to Multirate signal processing- Decimation and Interpolation, Quadrature Mirror Filters, Subband coding, Limitations of Fourier transform, Short time Fourier transform and its drawbacks, Continuous Wavelet transform, Time frequency representation, Wavelet System and its characteristics, Orthogonal and Orthonormal functions and function space.

UNIT II MULTIRESOLUTION CONCEPT AND DISCRETE WAVELET TRANSFORM
Multiresolution formulation of wavelet systems- signal spaces, scaling function, wavelet function and its properties, Multiresolution analysis, Haar scaling and wavelet function, Filter banks-Analysis and Synthesis, 1D and 2D Discrete wavelet transform, Wavelet Packets, Tree structured filter bank, Multichannel filter bank, Undecimated wavelet transform.

UNIT III WAVELET SYSTEM DESIGN
Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Design of Daubechies orthogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets.

UNIT IV WAVELET FAMILIES

UNIT V WAVELET APPLICATIONS
Denoising of Signals and Images, Image enhancement, Edge detection, Image Fusion, Image compression, Wavelet based feature extraction, Analysis of phonocardiogram signals, Analysis of EEG signals, Speech enhancement for hearing aids.

TOTAL: 45 PERIODS

OUTCOME:
The students will be able to apprehend the detailed knowledge about the Wavelet transforms & its applications.

REFERENCES:
OBJECTIVES:
To understand and appreciate the value and application of
- 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

UNIT II  TRANSFER FUNCTION

UNIT III  PERIODIC SIGNALS
Sinusoidal Functions, Sinusoidal Analysis of Instrumentation System, Evaluation of Transfer Functions 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

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:
OBJECTIVES:
- To introduce strengths and limitations of measures of central tendency and measures of variability.
- To classify common statistical tests and tools.
- To distinguish between p-values and confidence intervals as measures of statistical significance.
- To interpret commonly used regression analysis.
- To evaluate commonly used statistical and epidemiologic measures.

UNIT I INTRODUCTION
Introduction to probability, likelihood & odds, distribution variability.

UNIT II STATISTICAL PARAMETERS
Statistical parameters p-values, computation and level chi square test and distribution.

UNIT III REGRESSION ANALYSIS
Regression, correction use of regression, multiple regression.

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

UNIT V META ANALYSIS
META analysis for research activities, purpose and reading of META analysis, kind of data used for META analysis

TOTAL: 45 PERIODS

OUTCOMES:
- The student is able to explain the techniques used in statistical & regression analysis. Also the student is able to compare the various parameters used in statistical significance.

REFERENCES:

OBJECTIVES:
- To introduce the basic concepts of brain computer interface
- To study the various signal acquisition methods
- To study the signal processing methods used in BCI

UNIT I INTRODUCTION TO BCI
UNIT II ELECTROPHYSIOLOGICAL SOURCES

UNIT III FEATURE EXTRACTION METHODS
Time/Space Methods – Fourier Transform, Wavelets, AR, MA, ARMA models, Bandpass filtering, Template matching, Kalman filter, PCA, Laplacian filter – Linear and Non-Linear Features

UNIT IV FEATURE TRANSLATION METHODS

UNIT V APPLICATIONS OF BRAIN-COMPUTER INTERFACES

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student will be able to:
- Acquire the brain signal in the format required for the specific application
- Preprocess the signal for signal enhancement
- Extract the dominant and required features
- Classify the signal for applications

REFERENCES:

MX5094  TELEHEALTH TECHNOLOGY  L T P C
         3 0 0 3

OBJECTIVES:
- To teach the key principles for telemedicine and health.
- To enable the students with the knowledge of telemedical standards, mobile telemedicine and its applications.

UNIT I  TELEMEDICINE AND HEALTH  9
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  9

UNIT III  TELEMEDICAL STANDARDS  9

UNIT IV  MOBILE TELEMEDICINE  9
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  9
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

TOTAL : 45 PERIODS
OUTCOMES:
The student is exposed to the
- Technologies applied in multimedia using telemedicine
- Protocols behind encryption techniques for secure transmission of data.
- Applications of telehealth in healthcare

REFERENCES:

BM5075 WEARABLE DEVICES AND TECHNOLOGIES

OBJECTIVES:
- To understand the basic principles of Wearable Physiological Monitoring Systems
- To Study various types of wearable systems
- To Learn to design sensors/electrodes for recording various vital parameters
- To Learn to design a wearable computer & Wireless Body Area Networks

UNIT I INTRODUCTION

UNIT II SMART SENSORS & VITAL PARAMETERS
Vital parameters monitored and their significances, Bio-potential signal recordings (ECG, EEG, EMG), Dry Electrodes design and fabrication methods, Smart Sensors – textile electrodes, polymer electrodes, non-contact electrodes, MEMS and Nano Electrode Arrays, Cuff-less Blood Pressure Measurement, PPG, Galvanic Skin Response (GSR), Body Temperature Measurements, Activity Monitoring for Energy Expenditure, Respiratory parameters.
UNIT III  TECHNOLOGIES USED FOR A WEARABLE DEVICE  9
Students will comprehend the functions and very basic principles of different sensors, micro-motors and communication channels that are used in wearable devices. These include accelerometers, optical sensor, GPS, various input methods, Power Requirements, Wearable Systems Packaging, Batteries and charging, Wireless Communication Technologies and Protocols, Receiver Systems (Redrafting may be needed)

UNIT IV  WIRELESS BODY AREA NETOWRKS  9

UNIT V  DATA PROCESSING AND VALIDATION  9
Classification Algorithms, Data Mining and Data Fusion, Signal Processing Algorithms in wearable Applications, Issues of wearable physiological monitoring systems, Statistical Validation of Parameters, Certifications of Medical Devices and Patenting.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, students should be able to:
- Explain the basics of wearable system
- Use smart sensors to monitor vital parameters
- Design wireless body area networks
- Apply classification algorithms

REFERENCES:
5. Kate Hartman, Make: Wearable Electronics: Design, Prototype and wear your own interactive garments, Maker Media
OBJECTIVES:

- To provide basic knowledge on the concept of Healthcare Quality management towards continuous improvement of patient care.
- 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 Standardization & 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. B.M. Sakharkar, Principles of Hospital administration and Planning, JAYPEE Brothers, Medical Publishers (P) Ltd.
7. Sharon Myers “Patient Safety & Hospital Accreditation - A Model for Ensuring Success” Springer Publishers 2012