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M.E. BIOMEDICAL ENGINEERING

PROGRAMME OBJECTIVES:

The students will learn and gain knowledge
- In the use of different types of sensors and measurement of various physiological parameters
- About various imaging modalities used in the hospitals
- In the application of basic processing techniques for the analysis of these signals
- About the functions of biomedical engineer in the hospital for the proper functioning and management of hospital
- In some of the latest techniques that can be applied to research
OBJECTIVE

- 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  TRANSUCERS  9
Characteristics- Static, Dynamic, Errors in the measurements, Classification of transducers - Resistive, Capacitive, Inductive, Photoelectric, piezoelectric and mechanoelectronics.

UNIT II  ELECTRODES & AMPLIFIERS  9

UNIT III  CHEMICAL AND OPTICAL TRANSDUCERS  9
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  9
Measurements of Respiration Rate, Temperature, Pulse rate, Blood pressure Measurements- Direct, Indirect, Blood flow Measurements – Invitro, Invivo, Gas flow measurements.

UNIT V  RECORDERS AND DISPLAY  9
Types of recorders, Ink jet, heated stylus, Photographic recorder, Multicolor dot scanners, CRO, storage type, long persistence, digital scope, magnetic tape recorders.

TOTAL: 45 PERIODS

REFERENCES:

OUTCOMES:
- Students will get the clear domain knowledge about various measurement systems.
- Students will be able to develop measurement systems by selecting different types of sensors, electrodes, signal conditioning circuits for acquiring and recording various physiological parameters.
OBJECTIVES:
- To know the various biopotential recordings so as to enable students to record various biosignals.
- To know the various functional blocks present in 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.

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

UNIT II CARDIAC CARE UNITS
Pace makers - different types, batteries for pace makers. DC defibrillators, asynchronous and synchronous types, patient monitoring system, principles of bio telemetry.

UNIT III DIATHERMY AND STIMULATOR
Physiological effects of HF radiation, Depth of Penetration, short wave, Ultrasonic and microwave diathermy, Surgical diathermy, Galvani, Faradic stimulators, Interferential therapy, Electrical safety-Leakage current, Micro and macro electric shock, GFI units, Earthing Scheme, Electrical safety Analyser

UNIT IV ASSIST DEVICES

UNIT V RECENT TRENDS
Principles and application of thermography, Detection circuits, Principles of cryogenic Technique and application, principles of Fiber optics cables, Endoscopy, Laparoscopy, principle of Lithotripsy.

TOTAL: 45 PERIODS

REFERENCES:
1. Albert M Cook and Webster J G – Therapeutic medical devices Prentice Hall Nee York 1982
5. Leslie Cromwell, Fred J.Weibell and Erich A.Pfeiffer - Biomedical Instrumentation Prentice Hall New Delhi 2000
OUTCOMES:
By successfully completing this course, students will be able to:

- Develop measurement systems by selecting different types of, electrodes, signal conditioning circuits for acquiring and recording various biopotential.
- Describe and explain specific parts in Cardiac care units.
- Describe important working mechanisms of assist devices.
- Get clear domain knowledge about various types of Medical stimulators, and recently developed equipments.

BO8103 MEDICAL IMAGING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- 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 EQUIPMENT 8
X-Ray tubes, cooling systems, removal of scatters, Fluoroscopy- construction of image Intensifier tubes, angiographic setup, mammography, digital radiology, DSA.

UNIT II COMPUTED TOMOGRAPHY 10
Need for sectional images, Principles of sectional scanning, CT detectors, Methods of reconstruction, Iterative, Back projection, convolution and Back-Projection. Artifacts, Principle of 3D imaging

UNIT III RADIO ISOTOPIC IMAGING 9
Alpha, Beta and Gamma radiation, Radiation detectors, Radio isotopic imaging equipments, Radio nuclides for imaging, Gamma ray camera, scanners, Positron Emission tomography, SPECT,PET/CT.

UNIT IV ULTRASONIC SYSTEMS 9
Wave propagation and interaction in Biological tissues, Acoustic radiation fields, continuous and pulsed excitation, Transducers and imaging systems, Scanning methods, Imaging Modes, Principles and theory of image generation.

UNIT V MAGNETIC RESONANCE IMAGING 9
NMR, Principles of MRI, Relaxation processes and their measurements, Pulse sequencing and MR image acquisition, MRI Instrumentation, Functional MRI.

TOTAL: 45 PERIODS

REFERENCES:
5. Jerry L.Prince and Jnathan M.Links,“ Medical Imaging Signals and Systems“- Pearson Education Inc. 2006

OUTCOMES:
- Students will get the clear domain knowledge about the various Medical Imaging techniques.
- Students will be able to understand the various diagnostic applications of the medical imaging techniques.
OBJECTIVES:

- To encourage students to develop a working knowledge of the central ideas of linear algebra;
- To study and understand the concepts of probability and random variable of the various functions;
- Understand the notion of a Markov chain, and how simple ideas of conditional probability and matrices can be used to give a thorough and effective account of discrete-time Markov chains;
- To formulate and construct a mathematical model for a linear programming problem in real life situation;
- Introduce the Fourier Transform as an extension of Fourier techniques on periodic functions and to solve partial differential equations;

UNIT I  LINEAR ALGEBRA  9+3

UNIT II  ONE DIMENSIONAL RANDOM VARIABLES  9+3

UNIT III  RANDOM PROCESSES  9+3
Classification – Auto correlation - Cross correlation - Stationary random process – Markov process — Markov chain - Poisson process – Gaussian process.

UNIT IV  LINEAR PROGRAMMING  9+3
Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

UNIT V  FOURIER TRANSFORM FOR PARTIAL DIFFERENTIAL EQUATIONS  9+3

TOTAL: 45+15=60 PERIODS

TEXT BOOKS:

REFERENCES:
OUTCOME:
- On successful completion of this course, all students will have developed knowledge and understanding in the fields of linear algebra, probability, stochastic process, linear programming problem and fourier transform.

MD8152 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.
- To apply this knowledge into biomedical engineering field.

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 10

TOTAL: 45 PERIODS

REFERENCES:
OUTCOMES:
By successfully completing this course, students will be able to:
- Describe and explain specific parts and key terms applied in anatomy and physiology
- Describe important physiological mechanisms involved in cell, tissue, and organ
- Understand organisation and functions of each organs and systems in human body

BO8111 CLINICAL INSTRUMENTATION LABORATORY

OBJECTIVES:
- To study the various aspects of bio signals and amplifiers
- To understand the performance of surgical diathermy.
- To study practically the concepts of audiometer

LIST OF EXPERIMENTS
1. Operational Amplifier-various amplifier configurations
2. Study of Timer circuit
3. Study of FSK modulation and demodulation
4. Design and testing of Bio-Amplifiers
5. Recording of Electromyogram.
7. Study of EEG machine
8. Study of Patient monitoring system and biotelemetry
9. Bio-chemical measurements
10. Performance and testing of surgical diathermy unit using diathermy analyzer
12. Study of Multi parameter simulator.

OUTCOMES:
Students will get the clear practical knowledge about the various basic amplifiers and their characteristics.

BO8252 BIO MECHANICS

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.

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.
UNIT II  MECHANICS OF CIRCULATION  9
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  MECHANICS APPLIED TO ORTHOPAEDICS  9
Orthopedic biomechanics, mechanical properties of bones, stress induced bone growth, kinematics and kinetics of joints, lubrication of joints, and analysis of force in orthopedic implants.

UNIT IV  MECHANISM OF BIOLOGICAL SYSTEMS  9
Skeletal muscles servo mechanism, Cardio vascular control mechanism, respiratory control mechanism

UNIT V  BIO MECHANICAL ASPECT OF ACCIDENT INVESTIGATION  9
Experimental and Analytical method of analysis, Clinical evaluation, Head Injury tolerance, rotational injury, spine injury – Accident reconstruction, Analysis of impact, skid analysis – Damage analysis.

REFERENCES:

OUTCOME:
The study of mechanical properties of biological tissues and the properties of blood give us a wide understanding about its structure and when it undergo wear and when it fails so many precautions can be given by ourselves to elders. The knowledge gained will be helpful in doing research in properties of hard tissues like bones and to generate a mathematical model of bone structure etc.

BO8253  REHABILITATION ENGINEERING  L T P C  3 0 0 3

OBJECTIVES:
- To develop an understanding of the various rehabilitation aid principle and its working.
- To give various information about rehabilitation medicine and Advocacy.

UNIT I  PROSTHETIC AND ORTHOTIC DEVICES  9
Hand and arm replacement, different types of models for externally powered limb prosthetics, Lower limb, Upper limb orthotics, and material for prosthetic and orthotic devices, mobility aids.

UNIT II  AUDITORY AND SPEECH ASSIST DEVICES  9
Types of deafness, hearing aids, application of DSP in hearing aids, Cochlear implants, Voice synthesizer, speech trainer.

UNIT III  VISUAL AIDS  9
Ultra sonic and laser canes, Intra ocular lens, Braille Reader, Tactile devices for visually challenged, Text voice converter, screen readers.
UNIT IV  MEDICAL STIMULATOR  
Muscle and nerve stimulator, Location for Stimulation, Functional Electrical Stimulation, Sensory Assist Devices, Design issues.

UNIT V  REHABILITATION MEDICINE AND ADVOCACY  
Physiological aspects of Function recovery, Psychological aspects of Rehabilitation therapy, Legal aspect available in choosing the device and provision available in education, job and in day-to-day life.

TOTAL: 45 PERIODS

REFERENCES:
3. Levine, S. N. Editor, Advances in Bio Medical Engineering and Medical Physics, Inter University Publication, New York 1968.

OUTCOME:
- By the end of this course the student will be able to design rehabilitation aid and apply them with confidence, to help the challenged people.

BO8211  HOSPITAL INFORMATION SYSTEM LABORATORY  L T P C 0 0 4 2

OBJECTIVES:
- To study about the basics of Java programming, web designing and to develop a hospital information system.
- To study about signal and image processing applications using MATLAB

LIST OF EXPERIMENTS
1. HTML, XHTML, XML programming
2. Java Script programming
3. Development of front end and back end applications for hospital information system
4. Development of Web postal for medical applications
5. Study of medical standards-HL7, DICOM, LOINC, Medical data formats
6. Processing of BioSignals using Mat Lab
7. Image processing techniques using Mat Lab
8. Study of Data acquisition systems

TOTAL: 60 PERIODS

OUTCOME:
Students gain the programme based knowledge to design a hospital information system
OBJECTIVES:
- To introduce strengths and limitations of measures of central tendency and measures of variability.
- Classify common statistical tests and tools.
- Distinguish between p-values and confidence intervals as measures of statistical significance.
- Interpret commonly used regression analysis.
- 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 trails, epidemical reading and interpreting of epidemical 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

REFERENCE:

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

OBJECTIVES:
- The objective of this subject is to expose the students to decision making by corporate board in the areas of finance function.
- To provide an understanding of the basic principles and processes involved in the accounting system of a hospital.

UNIT I INTRODUCTION

UNIT II ACCOUNTING TECHNIQUES
UNIT III COSTING IN 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

TOTAL: 45 PERIODS

REFERENCES:

OUTCOME:
• The students is equipped with concepts, technical and analytical tools for optimal management of financial resources.
• Also the course helps to develop skills in analyzing accounting statements for decision-making in a hospital setting and practice the preparation of final accounts.

BO8003 FINITE ELEMENT ANALYSIS FOR BIOMEDICAL ENGINEERING

OBJECTIVES:
• To introduce the basic concepts of finite element analysis
• To study about the application to Field Problems in Bio mechanics
• To gain ideas about the materials used in the field of biomedical engineering

UNIT I GENERAL INTRODUCTION

UNIT II BEAM ELEMENTS AND SCALAR PROBLEM IN 2D

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 \( \xi, \eta \) and \( \zeta \) – 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  8
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  9
Introduction to Non-linear problems - some solution methods- computational procedure- simple material nonlinearity, stress stiffening, contact interfaces- problems of gaps and contact- geometric 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.

TOTAL :45 PERIODS

TEXT BOOKS:

OUTCOME:
At the end of this course the students would have developed a thorough understanding of the basic principles of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving problems in Bio-mechanical Engineering

BO8004    HEALTH INFORMATICS  L T P C
3 0 0 3

OBJECTIVE:
To enable the students to gain knowledge in various aspects of informatics related to health and the techniques to apply these in proper health care delivery

UNIT I    HEALTH INFORMATICS  9
Historical highlights and Evolution, Hospital Information System – its characteristics and functional online and offline modules, Health Informatics, Bioinformatics, Medical Informatics, Clinical Informatics, Nursing Informatics, Public Health Informatics, e – health services, Evidence Based Medicine, Bioethics, Virtual Hospital

UNIT II    ELECTRONICS PATIENT RECORDS AND STANDARDS  9
Electronic Patient Record, Medical data formats, – Medical Standards – HL7 – DICOM - IRMA - LOINC - PACS - Medical Standards for Vocabulary - ICD 10, DRGs, MeSH, UMLS, SNOMED - Healthcare Standards - JCAHO, HIPAA

UNIT III    BIOINFORMATICS AND TECHNOLOGIES  9
Bio-information technologies, Semantic web and Bioinformatics, Genome projects - Education and Training - Nano technology in Healthcare - Nanomedicine, Nanopharma, CNT based Nano sensor, BioCom chip, Medical Nanorobo - Virtual Reality and Multimedia Applications in Medicine

UNIT IV    JAVA PROGRAMMING  9
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  9
Medical Networks - Java script programming - Web Design and programming - Design of Web portal services in medicine.

TOTAL: 45 PERIODS
REFERENCES:
8. H M Dietel, Internet and World Wide Web, AB Goldberg publishers, New Delhi, 2007

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

BO8005 HEALTH POLICY AND EQUIPMENT MANAGEMENT

OBJECTIVES:
- To expose the students for planning and operation of hospitals in a detailed manner which will include all facts of hospital planning activities covering every department that is involved both in clinical care as well as supportive services.
- To introduce the equipment maintenance management skills and how to protect equipment from electromagnetic interferences.

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

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

TOTAL: 45 PERIODS
REFERENCES:

OUTCOMES:
The student becomes an expert in
- Understanding the various health policies
- Planning activities at health care centres.
- Equipment installation ,service & calibration needs

BO8006 HOSPITAL ARCHITECTURE  L T P C
3 0 0 3

OBJECTIVES:
To expose the students to planning and operation of hospitals in a detailed manner which will include all facets of hospital planning activities covering every department that is involved both in clinical care as well as supportive services.

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

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

TOTAL : 45 PERIODS

REFERENCES:
3. Sa Tabish." Hospital and Nursing Homes planning, Organisation and Management", , Jaypee Brothers-Medical publishers, New Delhi, 2003

OUTCOMES:
The student will be able to follow the newest findings in the area of hospital planning, health consultancy, hospital waste and implement the perspectives in constructing hospital standards.
OBJECTIVES:
- With an objective of imbibing a professional approach amongst students towards hospital management.
- The subject encompasses management principles, staffing and marketing processes, discussing their significance and role in effective and efficient management of health care organizations.

UNIT I Sharp (Sole proprietorship), Partnership, Corporation, 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 IN HOSPITAL
System Development life cycle, Reasons to use computers in hospital, main categories of information systems in hospitals.

REFERENCES:

OUTCOME:
The student acquires knowledge of the principles and practices essential for managing a hospital organization.

OBJECTIVES:
- To understand the significance of infections, biomedical waste and its proper disposal.
- To teach the students about the controls applied to waste management.

UNIT I INTRODUCTION

UNIT II PRINCIPLES OF STERILIZATION
Disease Transmission - Disinfection methods — Sterilization - steam sterilizing (Auto claving), Microwave (Non-burn treatment technology).
UNIT III  DISPOSAL OF WASTE  9
Disposal methods - Incinerator - Hazardous waste, radioactive waste, liquid waste destruction - landfill.

UNIT IV CONTROLS APPLIED TO WASTE MANAGEMENT  9
Air pollution and Emission control, Instrumentation and monitoring, Crematories

UNIT V ENVIRONMENTAL SAFETY, RISKS & PUBLIC ISSUES.  9
Risk management in hospitals - Environment issues in hospitals - Risk analysis

TOTAL : 45 PERIODS

REFERENCES:

OUTCOMES:
- Awareness of environmental hazards
- Challenges against the infectious diseases
- To create litter free zone around hospitals
- New & efficient methods in disposing the hospital waste

BO8009 HUMAN RESOURCES MANAGEMENT IN HOSPITAL  L T P C
3 0 0 3

OBJECTIVES:
- This subject acquaints the students with major functions of HRM aligned with the business strategy.
- The subject encompasses the concept of best fit employee, training & executive development, sustaining employee interest and performance appraisal.

UNIT I PERSPECTIVES OF HUMAN RESOURCE MANAGEMENT  9

UNIT II THE CONCEPT OF BEST FIT EMPLOYEE  9

UNIT III TRAINING & EXECUTIVE DEVELOPMENT  9
Types of Training methods and their benefits - Executive development Programme - common practices - Benefits, self-development - knowledge Management.

UNIT IV SUSTAINING EMPLOYEE INTEREST  9

UNIT V PERFORMANCE APPRAISAL  9

TOTAL : 45 PERIODS
REFERENCES:

OUTCOME:
Upon the completion of this course, the student is well acquainted with the knowledge about the significance and role in effective and efficient management of human resources in health care organizations.

BO8010 PHYSICS IN MEDICINE

OBJECTIVE:
To develop an understanding of physics involved in various imaging modalities and the effect of radiation on human body.

UNIT I PRINCIPLES OF NUCLEAR PHYSICS

UNIT II PHYSICS OF INFRARED, MICROWAVE AND RADIO FREQUENCY
Production and properties - interaction mechanism of RF and mirowaves with biological systems: Thermal and non-thermal effects on whole body, lens and cardiovascular systems - tissue characterization and Hyperthermia and other applications. Biomagnetism - Effects - applications- Infrared detectors—thermographic equipments—quantitative medical thermography— pyroelectric video camera—applications of thermography.

UNIT III 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. Optical characteristics of biomolecules from the point of spectroscopy – principles of UV – Visible absorption – IR and FTIR absorption – Raman and Fluorescence spectroscopy – application with regard to characterization of biomolecules – blood oxygen, glucose measurements, monitoring drug concentration, cancer

UNIT IV DIAGNOSTIC ULTRASOUND
Ultrasonic waves – generation and detection of ultrasound –Beam characteristics—attenuation of ultrasound –specific acoustic impedance—reflection at body interfaces---Coupling medium --- interaction ultrasound with tissues—deleterious effects of Ultrasound- Safety levels of Ultrasound- real time scanners image clarity---Resolution ---axial and lateral resolution ---- Artifacts---Pulse echo imaging ----Obsterics abdominal investigations- Echo cardiograph (UCG) – The Doppler Effect-Doppler Shift---continuous wave Doppler system ---Pulsed wave Doppler systems---duplex scanning-display devices for ultrasonic imaging

UNIT V RADIOBIOLOGICAL EFFECT OF RADIATION
Target theory, single hit and multi target theory, cellular effects of radiation, DNA damage, chromosomal damage, Somatic effect: Radio sensitivity protocol of different tissues in human ,LD 50/30 effect, Genetic effect: Threshold of linear dose effect, relationship factors affecting frequency of radiation induced mutation, biological effect of microwave, Rf wave and UV radiation.

TOTAL: 45 PERIODS
OUTCOME:
The students understands the physics behind radiation used in medical techniques and acquires in-depth knowledge about optics & ultrasound along with their effects of radiation.

BO8011   QUALITY ASSURANCE AND SAFETY IN HOSPITALS                L  T  P  C
          3  0  0  3

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  9
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  9
FDA regulations, Accreditation for hospitals - JCI, NABH and NABL, Other regulatory Codes.

UNIT III  HOSPITAL SAFETY  9
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  9
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  9
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

TOTAL : 45 PERIODS

REFERENCES:
3. B.M.Sakharkar, Principles of Hospital administration and Planning, JAYPEE Brothers, Medical Publishers (P) Ltd.
6. Sharon Myers “Patient Safety & Hospital Accreditation - A Model for Ensuring Success” Springer Publishers 2012

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.

BO8012 SIGNAL PROCESSING AND IMAGE PROCESSING TECHNIQUES               L T P C
APPLIED TO BIOLOGICAL SYSTEMS                   3 0 0 3

OBJECTIVES:
- To introduce the basics of signal processing and its application to biological systems.
- To make the students to understand the fundamentals of image processing and its applications.

UNIT I DISCRETE – TIME SIGNALS AND SYSTEMS 9
Review of discrete – time signals and systems, DTFT, Frequency response, Analysis of LTI systems using Z transform, DFT and its properties, FFT algorithms and its applications to convolution.

UNIT II DESIGN OF INFINITE AND FINITE IMPULSE RESPONSE FILTERS 9

UNIT III ADAPTIVE FILTERING AND WAVELET DETECTION 9
Filtering – LMS adaptive filter, adaptive noise cancelling in ECG, improved adaptive filtering in FECG. Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.

UNIT IV IMAGE FUNDAMENTALS AND PREPROCESSING 9

UNIT V IMAGE ANALYSIS AND OTHER APPLICATIONS 9
Image segmentation, Image representation and analysis, feature extraction, Statistical feature based image classification, Neural Network approaches, Image Registration, Medical image fusion, Image visualization.

TOTAL: 45 PERIODS

REFERENCES:

OUTCOME:
The student acquire thorough knowledge about the various image & signal processing techniques that can be applied to biomedical engineering principles.

BO8071 BIO MATERIALS L T P C 3 0 0 3

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 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 thromobogenicity.

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

TOTAL: 45 PERIODS

REFERENCES:

OUTCOMES:
- 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.
OBJECTIVES:
The course will teach a variety of contemporary approaches to neural networks and introduce the theory underlying these approaches. The approaches to be covered will include such things as biological and statistical foundations of neural networks, Perception, MLPs, RBFN,SVM and competitive learning. Additionally, a brief introduction to optimization techniques using Genetic algorithm and its applications will be given.

UNIT I INTRODUCTION TO ARTIFICIAL NEURAL SYSTEMS
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 NETWORKS

UNIT IV GENETIC ALGORITHMS & IMPLEMENTATION TECHNIQUES
The Appeal of Evolution, Search Spaces and Fitness Landscapes, Elements of Genetic Algorithms, Data Structures, Adaptive Encoding. Selective Methods, Genetic Operators, Fitness Scaling, GA 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

TOTAL: 45 PERIODS

REFERENCES:

OUTCOME:
Upon completion of this course student gains knowledge about various neural networks that can be used for biomedical signal analysis and Medical image analysis. Also about the genetic algorithms as well as techniques used in its implementation.
OBJECTIVES:
- Neural engineering and rehabilitation research applies neuroscience and engineering methods to analyze central and peripheral nervous system function and to design clinical solutions to neurological disorders or injury.
- To study the basics of Nervous system
- To understand the development and arrangement of neural tissue
- To study the neuronal disorders and injuries
- To study the repairing and reconstruction mechanism of nervous system.

UNIT I  BASICS OF NERVE

UNIT II  BRAIN, BRAIN STEM AND SPINAL CORD

UNIT III  NEURON TRACING

UNIT IV  NERVE INJURY AND DISORDERS

UNIT V  NEURAL ENGINEERING

REFERENCES:

OUTCOMES:
Through this course of study application of basic science and engineering techniques, neural engineers can develop methods to record from and exert control over the nervous system and associated organ systems.
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 MATERIALS AND FABRICATION  9
Typical MEMs and Microsystems, materials for MEMS - active substrate materials- Silicon and its compounds, Silicon piezoresistors, Gallium Arsenide, quartz, polymers. Micromachining-photolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA

UNIT II  MECHANICAL AND THERMAL SENSORS AND ACTUATORS  9
Mechanics for MEMs design- static bending of thin plates, mechanical vibration, 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  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. Case study: Design of electrostatic actuator

UNIT IV  MICROFLUIDIC SYSTEMS  9
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 , Case study: Design of electrophoretic microcapillary network system.

UNIT V  APPLICATIONS OF MEMS IN MEDICINE  9
CAD for MEMs, Biological MEMS materials, polymer based gas sensor, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR),DNA sensor, Drug delivery- Types of reservoirs, Case study: Design of BP sensor.

TOTAL: 45 PERIODS

REFERENCES:
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.

MD8074 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

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

UNIT III PERIPHERAL INTERFACING AND CONTROLLERS
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 IV COMPUTERISED DATA ACQUISITION AND PROGRAMMING
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
FPGA Design Logics - Virtual Bio- Instrumentation in LABview - Multisim Simulation with bio-amplifiers - Mixed signal SoC applications in biomedical applications

TOTAL: 45 PERIODS

REFERENCES:
8. H M Dietel, Internet and World Wide Web, AB Goldberg publishers, New Delhi, 2007

OUTCOME:
- 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

MD8075 MEDICAL ETHICS AND STANDARDS

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
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

UNIT III HOSPITAL ACCREDITATION STANDARDS

UNIT IV HOSPITAL SAFETY STANDARDS

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

REFERENCES:
4. Physical Environment Online: A Guide to The Joint Commission’s Safety Standards is published by HCPro, Inc. 2010
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.

MD8076  MEDICAL OPTICS  L  T  P  C
3  0  0  3

OBJECTIVE:
The objectives of this course are to: (i) 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; (ii) 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  9
Refraction, Scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, opto-thermal interaction, fluorescence.

UNIT II  INSTRUMENTATION IN PHOTONICS  9
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  9
Laser in tissue welding, lasers in dermatology, lasers in ophthalmology, otolaryngology, urology.

UNIT IV  DIAGNOSTIC APPLICATIONS  9
Optical coherence tomography, Elastography, Fluorescence Imaging, Raman Imaging, FLIM.

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

TEXT BOOKS:

REFERENCES:

OUTCOME:
Able to know the various optical properties of tissue as well as application of lasers in medical fields
OBJECTIVES:
- 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 NANOPARTICLES 9
Overview of nanotechnology from medical perspective, 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 9
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 9
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 9
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 NANOTHERAPEUTICS 9
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

REFERENCES:

OUTCOME:
- The student will be able to follow the newest findings in the area of Nano medicine and implement the perspectives in own research.

MD8078 PATTERN RECOGNITION TECHNIQUES AND APPLICATIONS
OBJECTIVES:
- The objective of this course is to enable the students to understand the fundamentals of Pattern recognition.
- The students should learn to choose an appropriate feature, pattern classification algorithm for a pattern recognition problem, properly implement the algorithm.
- To enrich the students knowledge with fuzzy systems and its applications
UNIT I OVERVIEW OF PATTERN RECOGNITION

UNIT II UNSUPERVISED CLASSIFICATION
Clustering for unsupervised learning and classification, clustering concepts hierarchical clustering, Partitional clustering, k-means algorithm - Validity of clustering solutions.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION

UNIT IV FUZZY SYSTEMS

UNIT V RECENT ADVANCES AND APPLICATIONS
Principle of neuro fuzzy techniques, Application of PR in image segmentation – CAD system in Breast cancer detection, ECG signal analysis, Fingerprint identification - Cell cytology classification

TOTAL : 45 PERIODS

REFERENCES:

OUTCOMES:
• Develop an idea about the fundamentals of Pattern recognition.
• Acquire the knowledge of fuzzy systems & its applications.
• Recent advancements in life science & technology using Fuzzy techniques.

MD8079 PHYSIOLOGICAL MODELLING

OBJECTIVES:
• To understand the fundamental engineering aspects of modelling Physiological systems
• To utilize concepts derived from biomedical research to aid in the design of engineering systems.
• To apply system techniques and methods to biomedical problems.
UNIT I  INTRODUCTION TO SYSTEM CONCEPTS  

UNIT II  TRANSFER FUNCTION  
System as an Operator, Transfer Function of First and Second Order system, Transfer Function and Concept of Impedance – Circuits into transfer function, Circuit Analog from transfer function.

UNIT III  SYSTEM RESPONSE CHARACTERISTICS  

UNIT IV  FEEDBACK  
Feedback and Homeostasis, Review of system stability concepts, Hypophysis – Adrenal Feedback Control System, Thermoregulation, Pupil Control System.

UNIT V  SIMULATION OF BIOLOGICAL SYSTEMS  
Introduction to Simulation, Simulation of Respiratory mechanics, Cardiovascular Control System, Skeletal muscle servo mechanism, Oculomotor System, Hodgkin Huxley Model.

TOTAL : 45 PERIODS

REFERENCES

OUTCOME:
Provides an insight into and understanding of the utilization of models, system analysis and analog simulation in the field of bioengineering.

MD8080  PRINCIPLES OF GENETIC ANALYSIS  
L  T  P  C  
3  0  0  3

OBJECTIVE:
Completion of this subject is expected to enhance a student’s ability to understand the fundamental principles of genetics and to describe the experiments used to establish them. Students will develop skills to apply 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, Chromosomial inheritance, Eukaryotic genomes – repetitive and non repetitive sequence, Genetic mapping - restriction cleavage ,RFLP and SNPs.
UNIT II  DNA AND PHENOTYPE  9
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  9
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  9
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  9
Population Genetics, Quantitative Genetics, Evolution Genetics.

TOTAL: 45 PERIODS

REFERENCES:

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

MD8081  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

REFERENCES:

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
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

UNIT V  TISSUE ENGINEERING APPLICATIONS  9

TOTAL : 45 PERIODS

REFERENCES:


OUTCOMES:

By successfully completing this course, students will be able to:
1. Understand the importance of tissue engineering in the field of biomedical engineering
2. Understand the mechanisms involved in interaction of different materials with cells and tissues
3. Explain different methods involved in characterization and preparation of biomaterials in tissue engineering.
4. Apply the knowledge in creating new models in drug delivery systems using synthetic and natural scaffolds
5. Understand different types of stem cells and its application in tissue engineering
6. Develop new approaches to build new tissues using tissue engineering techniques
OBJECTIVE:
- To teach the principles of ultrasonic's and its interaction with tissue.
- Students will be able to know about the scanning techniques and real time scanners principles and application of these principles in health care settings & gain knowledge about the various applications of ultrasound in medicine.

UNIT I PRINCIPLES OF ULTRASONICS 9

UNIT II TISSUE-ULTRASOUND INTERACTION 9
Introduction, Absorption in biological tissues, Tissue-Ultrasound interaction cross sections, Theory of mechanisms for the absorption of ultrasonic longitudinal waves. Measurement of attenuation and Absorption Coefficients in tissues, Acoustic properties reflecting different levels of tissue organization, Molecular aspects of soft tissue mechanics, Structural contribution to bulk and shear acoustic properties of tissues. Relevance to tissue characterization, Ultrasound quantitation and tissue characterization

UNIT III SCANNING TECHNIQUES 9

UNIT IV REAL TIME ULTRASONIC SCANNERS 9
Different modes of display-A mode, B mode, M mode, B-scan System, The Principles of Ultrasonic Motion Detection, Techniques for Measuring Target Velocity, Phase Fluctuation (Doppler Methods), Envelope Fluctuation Methods, Phase Tracking Methods, Envelope Tracking Techniques, Ultrasound Imaging Systems, Considerations Specific To Color Flow Imaging, Angle Independent Velocity Motion Imaging, Tissue Elasticity & Echo Strain Imaging, Performance Criteria, Use of Contrast Media, Real Time Echo, 2-D and 3-D Scanners, Color Doppler.

UNIT V ULTRASONIC APPLICATIONS 9
Ultrasound diagnosis in Abdomen, Breast, Thyroid, Heart, Chest, Eye, Kidney, Skull, Pregnant and Non Pregnant uterus, 3-Dimensional Ultrasonic Imaging of The Fetus, Advantages And Limitations of 3-Dimensional Ultrasound.

TOTAL: 45 PERIODS

REFERENCES:

OUTCOMES:
• In-depth knowledge about the Ultrasound imaging systems and its interaction with living systems.
• Ability to specify method of ultrasonic scanning method for imaging different organs
• Proficient knowledge about Real time Scanners and their applications.