EB 303 LIFE SCIENCE

Module I

Anatomy & Physiology: Human body as a whole organization of cells, tissues, organs and systems – Muscular system – structure of skeletal muscle, principle groups of muscles, classification of bones & joints. Nervous system – Organization of the nervous system – Structure of neuron and nerve fibre, nerve centres – cerebrum, cerebellum, thalamus, hypothalamus, brainstem and spinal cord, cranial nerves, spinal nerves. Autonomic nervous system. Central nervous system – receptors, ascending tracts and descending tracts, sensory perception with special reference to pain, muscle tone, regulation of posture and equilibrium. Urinary system – Brief ideas of the various structure of various organs of this system including nephron – Renal function – process involved in urine formation, micturition, composition of urine, regulation of acid – base balance & principles of haemo – dialysis. Skin & appendages – an elementary idea, regulation of body temperature.

Module II

Respiratory system – concepts of organs concerned with the respiration and their structure and organization – Mechanics of respiration, physical principles of gaseous exchange, transport of gases and control of respiration, lung volumes & capacities. *Digestive system* – structure of digestive tract, organs and associated glands – saliva, gastric & intestinal digestion &motility of gastrointestinal tract. *Endocrine system* – Elementary knowledge of function of various endocrine glands. *Reproductive system* – General plan of sex organs in male and female – Functions of male reproductive organs, female reproductive organs & contraception. Special senses – organs of vision, hearing, taste & smell. Mechanism of vision, colour vision, mechanism of hearing, sense of taste, sense of smell, tests of hearing, audiometry.

Module III

Blood – The composition of blood, functions, blood groups, lymphatic systems, reticuloendothelial system & defence mechanism of the body. Cardiovascular system – Heart – Structure of heart and major blood vessels, rhythmic excitation of heart – ECG- normal waves, cardiac cycle, heart rate, heart sounds, cardiac outputs. Circulatory system – systemic circulation and pulmonary circulation, blood pressure, arterial pulse, blood flow, measurement of blood flow & blood pressure.

Module IV

Microbiology: Physiology of bacterial cell – Growth and identification of bacteria, observation of cultures. Infection and immunity – serodiagnosis of infections, diseases. Microscopic examination methods.

Module V

Biochemistry: Basic principles of metabolism and nutrition – Enzymes – Classification – mode of action, factors influencing the velocity o enzyme action and assay of enzymes – brief note of all hormones and their assay. Water and electrolytes – Brief description – acid – base balance, electrophoresis, flame photometry, densitometry, colorimetry & pH metry.

References:

1) Charles Herbert Best and Burke Taylor : Living body, Chapman & Hall Ltd.
2) Dr. T. S. Ranganath : Textbook of Human Anatomy, S. Chand & Company.
3) Gordonsears and Winwood : Anatomy and Physiology for Nurses, ELPS.
4) Anantha Narayana and R. Jeyaram Panickar : Textbook of Microbiology, Orient Longman.
5) Paul and Reich : Hemetology, Physio Pathological Basis for Clinical Practice, Little Brown.
6) Charles A. Jacobi : Textbook of Anatomy and Physiology for Radiological Technology, The C. V. Mosby Company Sam Louis.
7) Warrik C. K. : Anatomy and Physiology for Radiographers, Oxford University Press 1977.
8) Syril A. Keele and Eric Neil : Samsons Wright's Applied Physiology, Oxford University Press 1979.

EB 404 BIOPHYSICS

Module I

Cell membrance – Nernst equation, Resting membrance potential, action potential propagation of nerve impulses, monophasic and biophasic recordings - electrical activity of the heart , original and propagation of excitation & contraction refractoriness regular and ectopic pace makers electrocardiogram, waveform and measurment – ECG in diagnosis – arrhythmia's – flutter – fibrillation – vulnerable period – phonocardiography, ballistocardiography.

Module II

Electrical activity of brain – waveforms & measurements, Electrogastrogram, electroneurography – nerve conduction studies – electroretinography – electroocculography – recording electrodes – interfaces – skin contact impedance – biological transducers – receptor potentials – Hodgkin Huxley model of squid gait axon membrances..

Module III

Introduction to electrical simulation – impedance & current distribution – dielectric properties of biological materials – skin impedance – total body impedance – impedances at high frequencies – high voltage & transient properties – patient safety – electrical shocks and hazards – leakage currents – types & measurements.

Module IV

Radioactivity - Units - radio emission - law of radioactive decay , half life period - production of radio isotopes for medical use - electromagnetic radiation - interaction of radiation with matter - exponential attenuation - half value thickness - photo electric, compton and pair production process and their significance in radiology. Radiation units - detection and measurements of radiation

Module V

Useful and harmful effects of magnetic fields , radio waves, micro waves , ultra violet radiation and infrared radiation on human beings - Applications. Effect of hypothermia and hyperthermia. Production of ultra low and low temperature for medical use. Electrical safety - Regulation to keep the hospital environment safe. BIS standards - ISO regulations - Protection against shock, burn & explosion hazards. Medical ethics.

Reference :

1) Plummer," Bio Chemistry - The chemistry of Life", Mc Graw Hill
2) Kuchel," Bio Chemistry", Schaum Series Mc Graw Hill
3) Massey and Meredeth ,"Medical Physics " 4)Patrick Rcully, "Electrical Simulation & Electropathology, Cambridge University press
4) Joseph Bronzino," Biomedical Instrumentation"
5) Khandpur R S ,"Handbook of Analytical Instrumentation ", Tata Mc Graw Hill
6) Khandpur R S ,"Handbook of Medical Instrumentation", Tata Mc Graw Hill
7) David Cooney ,"Principles of Biomedical Engineering"
8) Snell et al ,"Bio Physical Principles of Structure and functions
9) Ruch and Patton ,"Bio Physics and Medical Physiology"

EB 501 BIOMATERIALS

Module I

Definition and classification of biomaterials : Applications of polymers, metals, ceramics and composite as biomaterials for implantation. Surface properties of materials- physical properties of materials- mechanical properties- viscoelasticity.

Module II

Metallic implant materials: Stainless steel , Co-based alloys, Ti and Ti-based alloys .Ceramic implant materials: Aluminium oxides , Glass ceramics , Carbons. Hard tissue replacement implant: Orthopedic implants, Dental implants. Soft tissue replacement implants: Percutaneous and skin implants, Vascular implants, Heart valve implants-Tailor made composite in medium.

Module III

Polymeric implant materials: Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers. Rubbers, Thermoplastics . Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes. . Synthetic polymeric membranes and their biological applications. Biopolymers in controlled release systems. Artificial skin. Dialysis membrane.

Module IV

Structure of solids: Crystal structure of solids -crystal imperfections -noncrystalline solids . Strength of biomaterials : Strength and strengthening mechanisms of metals ,ceramics, glasses and polymers. Structural properties of tissues- Bone , Teeth ,Elastic tissues.

Module V

Biocompatibility :Definition, Wound healing process-bone healing, tendon healing. Material response: Function and Degradation of materials in vivo.Host response: Tissue response to biomaterials , Effects of wear particles. Tesing of implants: Methods of test for biological performance- Invitro implant tests, Invivo implant test methods. Qualification of implant materials.

Reference :

1) J B Park , “Biomaterials - Science and Engineering”, Plenum Press , 1984
2) Jonathan Black, “ Biological Performance of materials”, Marcel Decker, 1981
3) Piskin and A S Hoffmann,“ Polymeric Biomaterials(Eds)”, Martinus Nijhoff Publishers.(Dordrecht. 1986) Eugene D. Goldbera , “Biomedical Ploymers”, Akio Nakajima.
4) A . Rembaum & M. Shen, “ Biomedical Polymers “, Mercer Dekkar Inc. 1971
5) Lawrence Stark & GyanAgarwal , “Biomaterials”
6) L. Hench & E. C. Ethridge, “ Biomaterials - An Interfacial approach”

EB 502 HOSPITAL ENGINEERING

Module I

Definition of Bio-Engineering , Biomedical Engineering, Clinical engineering & Hospital engineering . Organization of Hospital engineering in small, medium and large hospitals. - Functions, responsibilities and training requirements of hospital engineers and clinical engineers. - Modern Hospital Architecture. Planning of structural, electrical air conditioning, gas supply, waste disposal, cleaning, sterilizing, laundry, storage and operation theatre systems. Philosophy. Design of wards, intensive care units, theatre etc. Management of services in clinical, OPD, Casuality, Operation theatre, Radiology, Central labs, Blood banks etc.

Module II

Electrical power systems in hospitals - Safety of electrical systems - Protective systems . Design of sub stations , circuit breakers , wiring details etc. Surge protectors , EMI filters , voltage stabilizers, generator sets and UPS. Preparing specification & estimation for hospital wiring - small case study.

Module III

Basics of air conditioning and refrigeration systems for small and large areas. Air changes, filtering and sterility. Deodourization and disinfection and dehumidification. Principles and techniques of sterilization - Sterilizing systems - Steam , formaldehyde & EO sterilization - specification & working of systems. - Cryogenic systems for hospitals.

Module IV

Hospital gas supply systems - Centralized supply of air, oxygen, nitrous oxide & vacuum - Principle of production of liquid oxygen. Working of dry, oil free air compressor - small and big vacuum engines. Theatre lighting, operating tables , wheel chairs & strechers

Module V

Costing and financial planning of hospital systems. Preparation of estimates, specifications , tender details etc. Planning of BME dept, Importance of BME department - Ordering, testing, acceptance & maintenance protocols - Organization of maintenance protocols for hospital systems and equipments - Basic principles of quality and reliability. Computerized preventive maintenance planning. - Importance of ISO 9000 Certificates - Obtaining ISO certificates in hospitals . Proposed protocols.

References :

1) C A Caceras ,"Clinical Engineering"
2) L C Redstone ,"Hospital and Health Care Facilities"
3) Ward ,"Aneasthetic Equipments"
4) BIS, "ISO Certification details"
5) Bhaumick and Bhattachary," EHV Substation equipments"
6) Alexander Kusko," Emergency and Standby Power Systems"
7) Balagune Swamy ,"Reliability Engineering"
8) Anantha Narayanan ,"Basic Refrigeration and Air Conditioning"

EB 507 MEDICAL ELECTRONICS LABORATORY-1

I. CIRCUIT USING OP-AMPS

1. Instrumentation Amplifier
2. Astable, monostable multivibrators.
3. Triangular, square waveform generators
4. Precision rectifiers
5. Second order active RC filters
6. Universal active filters, Double integration oscillator

II.

1. Pacemaker circuits
2. Temperature sensor and their application circuits
3. Photo transducer and their application circuits
4. Heart rate meters

EB601 BIO SIGNAL PROCESSING

Module I

Introduction to signals & systems- Sampling theorem - Discrete time signals and systems - Properties of discrete systems - linearity - time invariance - causality - stability – LTI system convolution – correlation – auto correlation - difference equation representation of discrete systems - The Z transform - properties of Z transform - the inverse Z transform - Transfer function.

Module II

Frequency Domain Analysis of discrete time signals: Fourier Transform, Frequency response Function, Discrete Fourier series - Discrete Fourier Transform –properties – block convolution – Fast fourier Transform – decimation in - time FFT algorithms - decimation in - frequency FFT algorithms - FFT algorithms for N a composite number- Spectrum analysis of biosignals.

Module III

FIR Digital Filters Realizations - direct - cascade - lattice forms –FIR filter design using Fourier series – use of window functions like rectangular, raised Cosine, Kaiser, Triangular - frequency sampling design – Notch filter Software implementation of filters.

Module IV

IIR Digital Filters Realizations - Direct - Cascade - Parallel forms - - Analog filter approximations - Butterworth and chebychev approximations – Frequency transformation techniques - The method of mapping of impulse transformation – transformation – Matched trasform technique – software implementation of digital filters.

Module V

Finite word length effects in digital filters - Fixed point arithmetic - Floating point arithmetic - Block floating point arithmetic - Truncation - Rounding - Quantization error in analog to digital conversion - finite register length effects in IIR & FIR filters Limit cycles. Digital signal processing applications – image processing – processing of biomedical signals like ECG, EEG etc.(Only brief description required) Soft ware implementation of digital filters- Architecture of typical DSP processor like TMS330.

Reference:

1) Oppenheim & Ronald W Schafer," Digital Signal Processing", Prentice Hall India
2) Andreas Antonion , "Digital Filters Analysis & Design", Prentice Hall India
3) R Rabiner & B. Gold , "Theory & Application of Digital Signal processing", Prentice Hall India
4) Andreas Antoniou , "Digital Signal Processing", Prentice Hall India

EB602 BIOMECHANICS

Module I

Bone structure & composition mechanical properties of bone viscoelastic properties – Maxwell & Voight models - anisotropy – Electrical properties of bone – fracture mechanism and crack propagation in bones – fracture fixators – repairing of bones - mechanical properties of collagen rich tissues, teeth.

Module II

Structure and functions of cartilages, tendons, ligaments – biomechanics of joints, Human locomotion – gait analysis - Foot Pressure measurements - Pedobarograph - Force platform - mechanics of foot- mechanics of plantar ulcers- arthritis – biomechanical treatment.

Module III

Artificial heart valves- biological mechanical valves development- Heterografts, Homografts – testing of valves. Total Hip Prosthesis- requirements – different types of components- Stress analysis & instrumentation , Knee Prosthesis.

Module IV

Biomechanics of spine - Scoliosis - Measurement – biomechanicl treatment- instrumentation – Muscle mechanics - Exoskeletal system for paraplegics - Powered wheel chairs - crutches& canes.

Module V

Monitoring Devices . Catheter Mathematical Model, response to a sinusoidal input. Tonometry- different types. Respiratory Sound measurement

Reference :

1) Alexander R Mc Neill , “Biomechanics”, Chapman and Hall, 1975
2) D N Ghista , “Biomechanics of Medical Devices” , Macel Dekker , 1982
3) A Z Tohen and C T Thomas , “Manual of Mechanical Orthopaedics”
4) D N Ghista and Roaf , “Orthopaedic Mechanics”, Academic Press
5) VC Mow and W C Hayes “Basic Orthopedic Biomechanics”, Lippincott – Raven publishers.

EB 603 ANALYTIC AND DIAGNOSTIC EQUIPMENTS

Module I

Analytical equipments used in clinical environment - Beer-Lambert's Law in spectrometry. UV, visible and infra-red spectrophotometers.- monochromators , detection systems and amplifiers for various types . Basic applications in Biochemical analysis. Autoanalysers. .Flame photometers - principles and applications - Densitometers –principle and applications of of gas and liquid chromatographs.

Module II

Blood Flow meters- different types – cardiac output measurement- different techniques – pulmonary function analysers – spirometers –Electrophoresis and applications of Electrophoresis.

Module III

Blood gas analysers – pH measurement pCO3 measurement pO3 measurement – oximeters- Blood cell counters- methods- Coulter Counters- automatic recognition and differential counting- audiometers. IV.ECG recorders - Generation of ECG wave form and its physical correlations. Detection, amplification and recording of ECG. Detection of arrhythmias. Ambulatory ECG. Basics of vector cardiograph. Principles of Electro myographs - Detection and applications - Measurement principles of Electro encephalography and applications.

Module V

Medical display systems - cardioscope – multicahnnel displays- nonfade display- patient monitoring insruments – Cardiotachograph- fetal heart rate measurements.

Reference :

1) Willard Van, Nostrand, ".Instrumental Methods of Analysis"-
2) Sharms, ' Instrumental Methods", S Chand & Co
3) Khandpur R S, " Handbook of Bio-Medical Instrumentation ", Tata McGraw Hill
4) Joseph Bronzino, " Biomedical Engineering and Instrumentation ", PWS Engg . , Boston
5) Harry Bronzino E, " Handbook of Biomedical Engineering and Measurements", Reston, Virginia
6) Jacobson & Websler, " Medicine & Clinical Engg"
7) Leslie Cromwell, " Biomedical Instrumentation and Measurements
8) Hcinz Kressc, " Handbook of Electro medicine", John Wilcy
9) Geddes & Baker , "Principles of Applied Biomedical Instrumentation Wiley

EB 604 BIO SENSORS AND TRANSDUCERS

Module I

Study of biological sensors in the human body and their basic mechanism action organization of nervous system- neuronal mechanism and circuit processing - Study of various corpuscles like pacinian - functions and modelling - Chemoreceptors, hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste.

Module II

Chemical Transducers: Transducers for the measurement of ions and dissolved gases. Reference electrodes - Hydrogen electrodes - silver-silver chloride electrodes- Calomel electrodes. Measurement of pH- Glass pH electrodes. Measurement of pO2, Measurement of pCO2 - catheter type electrodes for the measurement of pO2 and pCO2.

Module III

Bio sensors - Ion exchange membrane electrodes- oxygen electrodes- CO2 electrodes enzyme electrode - construction - ISFET for glucose, urea etc. Electrolytic sensors - optical sensor - fiber optic sensors.

Module IV

Different Transduction principles - Temperature transducers - thermoresistive transducers, thermoelectric, p-n junction, chemical thermometry. Displacement transducers - potentiometric - resistive strain gauges - inductive displacement - capacitive displacement transducer. Pressure transducer - indirect method - measurement of blood pressure using sphygmomanometer -instrument based on Korotkof sound , strain gauge and LVDT transducers, capacitive and piezo electric type, catheter tip transducers - measurement of intrancranial pressure -catheter tip - implantable type.

Module V

Flow measurement transducer -Electro magnetic flow meters and ultrasonic blood flow meters - Fibre optic flow transducers & transducers for light . Electrodes for ECG, EEG, EMG Electrode- Electrolyte interface - electrode potential -electrode impedence - surface electrodes - subdermal electrodes - micro electrodes.

Reference :

1) Brown & Gann, " Engineering Principles in Physiology Vol. I " Academic Press
2) Iberall & Guyton ," Regulation & Control in Physiological System ", Instruments Society USA
3) A V S De Renck , "Touch Heat & Pain ", Churchill Ltd. London
4) Harry Thomas , "Handbook of Bio medical Instrumentation " Reston, Virginia
5) R S Khandpur, " Handbook of Bio medical Instrumentation" Tata McGraw Hill
6) D L Wise , "Applied Bio Sensors", Butterworth, London
7) R S C Cobbold, " Transducers for Biomedcial Instruments", Prentice Hall

EB 606 MEDICAL ELECTREONICS LAB - II

1. High input impedence Amplifier Design
2. Timers
3. ADC &DAC circuit design and testing
4. ECG simulator
5. Isolation circuits
6. Chart Drive circuits
7. R F Power measurment
8. Power Amplifier for stylus drive
9. ESU waveform generators
10. Modulator – Demodulator circuits

EB 607 MINI PROJECT

EB//EE/EI 701 Computer Communication and Networks

Module 1

Introduction to computer networks - need for networking - various topologies and configurations Concept of Internet -Internet services - concept of layering - peer processes - ISO - OSI - & layer standard - functions of each layer.

Module 2

Transmission media - description and characteristics - base band and broad band transmission - synchronous and asynchronous transmission - full duplex and half-duplex links - MODEMS serial communication standards - X-21 digital interface - need for data link layer - stop and wait sliding window protocol - HDLC protocols terminal handling - polling, multiplexing and concentration.

Module 3

Virtual circuits and data grams - routing - different types congestion control - LAN - base band and broad band LANs - carrier sense networks - CSMA/CD - ring networks - shared memory systems - IEEE 802 standard - introduction to X -25 standards.

Module 4

Transport layer - design issues - connection management - connection establishment flow control and buffering - multiplexing - crash recovery - a simple transport protocol on top of X-25 standard . Session layer - design issue - data exchange – dialogue management - synchronisation - remote procedure call - client server model

Module 5

Presentation layer - data representation - data compression - network security and privacy - cryptography - presentation layer in ARPANET application layer - virtual terminal and file transfer protocols - electronic mail - introduction to distributed system.

References:

- A S Tannenbaum, " Computer Networks
- Hausly, " Data Communication"
- UYLESS BALACK, " Computer Networks, Protocols Standards & Interfaces"
- Stalling , "Local Area Networks"
- Communication networks, 2nd Edition By Jean Walrand

EB 702 Therapeutic Equipments

Module I

Cardiac Pacemakers & Defibrillators : Effects of electric field on cardiac muscles and laws of stimulation. External and internal pacemakers - programmable pacemakers - power sources - defibrillators - basic principle and comparison of output wave forms of different DC defibrillators - energy requirements - synchronous operation - implantable defibrillators - defibrillator analyzers - RF ablation treatment for arrhythmia.

Module II

Ventilators : Basic principles - Different generators , Inspiratory phase, Different cycling mechanism - Expiratory phase - Different ventillatory adjuncts - study of typical ventilator - Anesthetic machines.

Module III

Electrical stimulators. Nerve and muscle stimulators - stimulators for pain and relief – functional electrical stimulation - Ultrasonic stimulators - surgical diathermy - Burn and shock hazards - electro surgical analyzers - principles of short wave diathermy. Physics and engineering of ultrasonic lithotripter - basic principle of extracorporeal shock wave lithotripter.

Module IV

Basic principles of Bio-medical lasers - various application of CO2, He -Ne, Nd - YAG lasers - Application of laser in surgery, Angioplasty and endoscopy.

Module V

Principle of endoscopy-Types of endoscopes , cystoscopes , laproscopes - Fiber optic endoscopes and endoscopes with integral TV cameras - infusion pumps, peristaltic pumps – Dialysis equipments - Heart lung machines.

References :

- Mushin, “Automatic Ventilation of Lung” , Black Well
- Goldman , “Bio medical Lasers”, Springer Verlag
- R S Khandpur, “ Handbook of Bio medical Instrumentation”, Tata McGraw Hill
- Massey & Meredith , “Fundamental Physics of Radiology”, Wright, Bristol
- J A S Carruth & A L McKenzie , “Medical Lasers “, Adam Hilger, Bristol

EB 703 Medical Imaging Techniques

Module I

Ultra Sound In Medicine - Introduction, production of ultra sound - properties – principles of image formation, capture and display - principles of A-mode , B-mode and M-mode display - Doppler Ultra sound and Colour flow mapping - Applications of diagnostic ultra sound.

Module II

X-Ray computed tomography - Principles of sectional imaging - scanner configuration - data acquisition system - image formation principles - conversion of x-ray data in to scan image - 2D image reconstruction techniques - Iteration and Fourier methods.Types of CT scanners.

Module III

Magnetic Resonance Imaging - Principles of MRI – pulse sequence - image acquisition and reconstruction techniques – MRI instrumentation – magnets – gradient system – RF coils - receiver system – Functional MRI - Application of MRI .

Module IV

Radio isotope imaging - Rectilinear scanners , Linear scanners - SPECT - PET –Gamma Camera – Radio nuclides for imaging, Emission Computed Tomography.

Module V

Infra red Imaging - Physics of thermography - Imaging systems - Pyroelectric vidicon camera – clinical themography - liquid crystal thermography.

References :

- S Webb ,"The Physics of Medical Imaging", Adam Highler, Bristol
- A C Kak, " Principle of Computed Tomography" ,IEEE Press New York
- G A Hay, " Medical Image Formation Preception and Measurement ".

EB 704 Principles of Radio Diagnosis and Radio Therapy

Module I

Production of X-rays – Various components of radiographic systems – Electrical circuit for X-ray unit – filament circuits and mA control- IITV circuits - KV control –exposure switching and control of exposure timers - types of X-ray tubes for various medical applications .. Rating charts of X-ray tubes .

Module II

Scattered radiation & its control in radiography – collimators – bucky grids – absorbed dose- Basics of tables & arms. Fluoroscopy systems – TV chain for fluroscopy – Properties of X-ray films &screens - Characteristics of imaging system - modulation transfer function.

Module III

Automatic exposure controls - Photo timers - types - limitations - performance - serial film chargers – types - radiographic considerations - film exposure time - photo timer applications - automatic brightness control system.

Module IV

Basic of digital angiography - Image processors for digital angiography - processor architecture-Temporal integration techniques for digital angiography- digital subtraction angiography

Module V

Physical principles of radio therapy. Dosage data for clinical applications. Measurement of output and use of ISODOSE charts. Collimators and beam direction devices. Telemetry sources and acceptance calibration. Safety protocols & protection.
Principles of linear accelerators for radiation therapy.Radiation therapy planning.

References :

- Massey & Meredith , "Fundamental Physics of Radiology",
- John Wright & Sons
- Webb S, " The Physics of Medical Imaging", Adam Hilger, Bristol
- Thomas Thompson , "A Practical Approach to Modern Imaging Equipment" ,.Little Brown elo
- Sybil M Stockley, " A Manual of Radiographic Equipments", Churchill Livingstones
- Chistrmis, "Physics of Diagnostic Radiology"

EB/EC 705A OPTO ELECTRONICS

Module I

Nature of light – Basic optical laws-optical fiber-ray analysis- wave propagation in dielectric slab wave guide-mode theory of optical fibers- multi mode fibers – single mode – graded index fiber – N A- Fiber materials – Fabrication- Specifications of a typical optical fiber- reading a data sheets - attenuation Characteristics-dispersion various types and its effects on bandwidth-dispersion shifted fiber –polarization maintaining fiber.

Module II

Optical sources- direct & indirect band gap materials- LED structure-quantum efficiency - modulation. Laser diodes-rate equations-diode structure-single mode laser-modulation and temperature effects- quantum cascade lasers- modal Partition and reflection noise. Photo detectors: PIN, APD, Photodetector noise-response time-structure of detectors receiver units.

Module III

Light coupling to optical fiber- fiber splices effect of misalignment on signal transmission- fiber-tofiber coupling- optical fiber couplers -Coherent detection –comparisons -Transceivers for fiber optic communication

pre amplifier type- optical receiver performance calculation - noise effect on system performance –receiver modules.

Module IV
Components for Fiber optic Networks- Couplers/Splitters- -semiconductor optical amplifier- bandwidth of SOPA- Polarization dependant gain –noise-erbium doped fiber amplifiers- WD multiplexes / demultiplexers- Filters- isolator-circulators-Optical switches-wavelength converters- Fiber gratings-tunable sources –tunable filters.

Module V
Optical networks- Basic networks-sonnet/ SDH-wavelength routed networks -Nonlinear effects on network performance-performance of various systems (WDM –DWDM+ SOA) - Optical CDMA- solitons-Ultra high capacity networks-

References:
1. Optical Fiber Communication: Gred Keiser Mc Graw Hill Third edition
2. Optical communication components & Systems : J H Franz Narosa Publication
3. Fiber Optic Technology D K Mynbaev & LL Scheiner Pearson Education Asia
3. Optical Fiber Communication and applications S C Gupta PHI

EB/EC/EI 705B EMBEDDED SYSTEMS

Module I
Overview of Embedded System:- Embedded System, Categories of Embedded System,Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems,Handheld computers, Communication devices.

Module II
Embedded Hardware & Software Development Environment ÷ Hardware Architecture, Micro- Controller Architecture, Communication Interface Standards, Embedded System Development Process, Embedded Operating systems, Types of Embedded Operating systems.

Module III
8Bit microcontrollers – Architecture on chip peripherals instruction set/programming of Intel MCS51 family (8 bit) microcontroller,Inter facing of 8051 with LCD,ADC,sensors,stepper motor,key board, DAC,memory

Module IV
Real Time & Database Applications ÷ Real-Time Embedded Software Development, Sending a Message over a Serial Link, Simulation of a Process Control System, Controlling an Appliance from the RTLinux System, Embedded Database Applications using examples like Salary Survey, Energy Meter Readings.

Module V
Microchip PIC16 family – PIC16F873 processor – features – architecture – memory organization – register file map – I/O ports – PORTA - PORTB – PORTC – Data EEPROM and flash program memory – Asynchronous serial port – SPI mode – I2C mode.

Text :
1.Programming for Embedded Systems- Dreamtech Software Team, Wiley Dreamtech
2. The 8051 micro controllers , M A Mazidi& Mazidi, Pearson Education

3. Design with PIC micro-controllers: John B Peatman, Pearson Education

References

1) Fundamentals of Embedded Software where C and Assembly Meet – Daniel W Lewis.
2) DS101374: National Semiconductor reference manual.
3) Embedded / RealTime systems: Concepts, Design and programming, Dreamtech Software Team, Wiley Dreamtech
4) 1187D: Atmel semiconductor reference manual.
5) Atmel semiconductor web site – www.atmel.com
6) DS30292B: Microchip reference manual.
7) Microchip semiconductor web site – www.microchip.com
8) National semiconductor web site – www.national.com

CS/EB/EC/EI/IT 705 C ARTIFICIAL NEURAL NETWORKS

Module I

Fundamentals of ANN – Biological prototype – Neural Network Concepts, Definitions - Activation. Functions – single layer and multilayer networks. Training ANNs – perceptrons – Exclusive OR problem – Linear seperability – storage efficiency – perceptron learning - perceptron training algorithms – Hebbian learning rule - Delta rule – Kohonen learning law – problem with the perceptron training algorithm.

Module II

The back propagation Neural network – Architecture of the back propagation Network – Training algorithm – network configurations – Back propagation error surfaces – Back propagation learning laws – Network paralysis _ Local minima – temporal instability

Module III

Counter propagation Networks – Architecture of the counter propagation network – Kohonen layer – Training the Kohonen layer – pre-processing the input vectors – initialising the weight vectors – Statistical properties. Training the Grossberg layer- Feed forward counter propagation Neural Networks – Applications.

Module IV

Statistical methods – simulated annealing – Bloltzman Training – Cauchy training -artificial specific heat methods. Application to general non-linear optimisation problems – back propagation and Cauchy training.

Module V

Hopfield net – stability – Associative memory – statistical Hopfield networks – Applications – ART NETWORKS – GENETIC ALGORITHMS –Bi-directional Associative memories- retrieving stored information . Encoding the association – continuous BAMS

References

1) Linus Fe, *Neural Network in Computer Intelligence* , McGrawHill
2) Philip D.Wasserman, *Neural Computing(Theory and Practice)*
3) Robert Hecht-Nilson, *Neuro Computing*
4) James A.Anderson, *An Introduction to Neural Networks*
5) Jack M. Zureda, *Introduction to Artificial Neural Systems*

EB 705 D Medical informatics and expert systems

Module I

Introduction to data structures : elements , arrays, records, sets, tables etc. Singly and doubly linked datas, stacks, queues, trees etc.. .Introduction to database - data models - Relational , distributed and other types of databases, data indexing and structuring techniques - data independence - data definition language and data manipulation language.E -R diagram with examples .Relational model - structure of Relational databases - Query language - views- Examples.

Module II

Relational database design- Normalisation - 1NF, 2NF and 3NF. Indexing and Hashing. Security of databases . Design example on a popular RDBMS package. Miniaturised data storage and retrieval system like CD-ROM, Magneto Optical Discs, optical juke boxes, write many read many devices and miniature magnetic tape devices. Interfacing and retrieval details.

Module III

Hospital Information system - Role of database in HIS. Need of Networking in HIS. Overview of Networking, topologies and its configuration. Structuring medical records to carry out functions like admissions, discharges, treatment history etc. Computerization in pharmacy & billing. Automated clinical laboratory systems & radiology information system. Detailed study of picture archival & communication systems (PACS).

Module IV

Introduction to AI & Expert system. Knowledge components, knowledge representation schemes - production systems. Expert system tools- Languages ,shells - Lisp Machines and PC based expert system tools.

Module V

Study of MYCIN project and context of MYCIN experiments, knowledge representation and searching. Study of EMYCIN.Study of ONCOSIN.ONCOLGY Protocol management. Basics of DENDRAL project - Artificial Intelligence for Organic Chemistry.

References :

- H Dominic Covvey et al , “Computer in the practice of,medicine”, Addison Wesley
- Edward Shortlife, “ Computer based medical Consultations”, Elsevier Scientific
- Date C J, “ An introduction to Database Systems”, Addison Wesley Publication
- M F Collen, “ Hospital Computer Systems” -
- Lee, “ Computers in Medicine”, Mc Graw Hill
- Szolovits P (ed), “Artificial Intelligence in Medicine”, Westview Press
- G Buchanan & Shortliffe , “Rule based Expert systems - The MYCIN Experiments of the stanfold Heuristic Programming Project”, Addison Wesley
- Clancey & Shortliffe , “Readings in Medical Artificial Intelligence “ , Addison Wesley
- Earl B Hunt, “ Artificial Intelligence “, Academic Press
- shortliffe E, “ Computer Based Medical Consultancy”, Elsevier Scientific Pub.
- The DENDRAL Project, “ Applications of Artificial Intelligence for Organic Chemistry”, Mc Graw Hill
- Elaine Rich , “Artificial Intelligence “
- Earl B Hunt, “ Artificial Intelligence “, Academic Press

EB 706 Bio-Engineering Lab

1. TGC circuits

2. X-ray timer circuits

3.Lead selection circuits

4.Study and characterisation of Bio-electrodes - E.C.G., E.E.G. AND E.M.G.

5.Skin resistance measurement

6.Study and characterisation of Bio medical transducers - Pressure, Temperature, Humidity & Moisture.

7.B. P Measurement and calibration - Mercury type, Aneroid type

8.Study of Ultra Sound devices - Ultra sound transmitter, Ultra sound detector.

9.Introduction to ADC guards.

10. software implementation fibers.

EB 707 Medical Systems Lab

1. pH meter : Study, standardisation & calibration

2.Calorimeter
3.Spectro Photometer
4.Flame photometer
5.Hb meter
6.Conductivity meter
7. Study & familiarization of Laser Equipments
8.Study of physiological pre-amplifiers.
9.Pressure measurements using physiological transducers.
10.Servicing of ECG equipments.
11.Study of multi channel physiological recorders.
12.Study of vacuum tube and solid state cautery.
13.Study of ventilator.
14.Study of ultrasonic equipment
15.Study of X-ray radiography system.

EB 708 SEMINAR

Each student shall individually prepare and submit a seminar report on a topic of current relevance on stipulated time. Few panels consisting of three teachers (internal) each should evaluate the seminar report and the presentation. Marks should be distributed considering report writing, presentation, technical content, depth of knowledge, brevity and references and their participation in seminar. The time allotted for presentation is 30 minute

EB 801 Modelling of Physiological systems

Module I

Feed back control system - homeostasis - Regulatory system - Servo mechanism – biological control
system - similarities and differences - components of living control system.

Module II

Mathematical approach , electrical analogues, etc. Introduction to various process controls like cardiac rate , blood pressure, respiratory rate . Blood - Glucose regulation. Phamaco modelling - drug diffusion system.

Module III

Modelling of human thermal regulatory system : Parameters involved, control system model etc. Biochemistry of digestion, types of heat loss from body, models of heat transfer between subsystems of human body like skin - core etc. and systems like within body, body environment, etc.

Module IV

Respiratory system : Modelling oxygen uptake by RBC and pulmonary capillaries , Mass balancing by lungs, Gas transport mechanisms of lungs, oxygen and carbon dioxide transport in blood and tissues.

Module V

Ultra filtration system : Transport through cells and tubules, passive diffusion, facilitated diffusion and active transports. Methods of waste removal, counter current model of urine formation in nephron, model of Henle's loop.

References :

1)Rushmer, " Medical Engineering", Academic Press
2)Yukihito Nose, " The Artificial Kidney", C V Moshy Co
3)Kennedy & Blackie, " Electromedcial Engineering"

4)Webstar, " Electronic Devices for Rehabilitation"
5)Myers, " Engineering in Heart and Blood Vessels", Wiley International
6)David Cooney, " Advanced in Bio medical Engineering", Marcel Decker Publications
7)David Cooney , "Biomedical Engineering Principles", Marcel Decker Publications
8)Ibrall & Guytion , "Regulations and Control in Physiological Systems ", Instruments Society USA
9)Brown & Gann, " Engineering in Physiology Vol 1 & Vol 2 "

EB 802 Modern Medical Instrumentation

Module I

Microprocessor based ECG Machines . Holter monitoring. Exercise systems. Digital central monitoring systems for patient monitoring. Design concepts. Advanced Computer based arrhythmia detection system- software design protocols.

Module II

Evoked potential - Stimulations - Recording - Amplifiers - Analysis and storage : Measurement of average auditory evoked potential - application - visual evoked potential measurement and application -Brain mappers - magneto encephalogram - principles and measurements.

Module III

Principles of electromyography – detection & application - Myoelectric control – Introduction -Voluntary control of myo electric signals - properties - myo electric signals - use of myo electric signal for control - signal processing and recording

Module IV

Impedance Techniques : Bipolar and tetrapolar circuits , detection of physiological activities using impedance techniques - cardiac output , neural activity , respiratory activity, impedance plethysmography- resistance and capacitance type.

Module V

Advanced analytical aids – Fundamentals of NMR spectroscopy, X-ray spectrometers, mass spectrometers, Raman & Moss Beer spectroscopy. Principles of scanning and transmission electron microscopy. Principles of simple, compound and phase contrast microscopes.

Reference :-

1)A M Halliday, " Evoked Potential in Clinical Testing", (ed)

2)IEEE Medical Electronics Monograph Vol 7 to 12

3)System Manuals

4)Current Journals

CS/EB/EC/IT 803 Industrial organisation and management

Module I

Organisation : Concept of organisation, characteristics of organisation, elements of

organisation, organisational structure, organisation charts, Types of organisation- formal line, military or scalar organisation, functional organisation, line & staff organisation, project organisation, matrix organisation, authority and responsibility, span of control, delegation of authority. Industrial ownership: Types of ownership- single ownership, partnership, joint stock company, co -operative societies, public sector, private sector, scientific management- review of different schoolsof thoughts.

Module II

Personal Management: Recruitment and training, labour turnover, operator training, suggestion systems. Industrial safety: working conditions, environmental factors, psychological attitude to work and working conditions, fatigue, accidents and hazards.Wages and Incentives: feature of wages, time and piece rate, different incentive plans, profit sharing,job evaluation and merit rating, factors of comparison and point rating.Industrial relations: industrial disputes, collective bargaining, trade unions, workers' participation inmanagement, labour welfare.

Module III

Marketing Management: Concept of marketing VS sales approach, consumer behaviour and demand concept, buying motives, influence of income level, product design, new product distribution, pricing decisions, major price policy considerations, pricing methods and tools, break even analysis and marginal costing in pricing, sales promotion, marketing research, test marketing, marketing of services, advertising management- types of advertising, choice of media, economic and psychological factors in advertising.

Module IV

Finance Management: Tasks, evolution of corporate management, long term financing, equity, preference and debenture capitals, term loans, dividends and share valuation, legal aspects of dividends, short term financing, working capital influencing factors, cash budgeting, terms of liquidity, management of receivable and inventories, budgets and budgetary control-objectives of budgeting, classification, ratio analysis.

Module V

Management accounting: Fundamentals of book keeping, journalising, ledger accounts, subdivision of journal, cash book, banking transactions, trial balance, preparation of trading, profit and loss account, and balance sheet, adjustments.

REFERENCES:

1) Industrial Organisation and Management : Bethel et.al, McGraw Hill
2) Principles of Industrial Management : Kootnz & Donnel
3) Financial Management : Prasanna Chandra, Tata McGraw Hill
4) Operation Management : Fabricky et al, Tata McGraw Hill
5) Hand Book of MBO : Reddin & Ryan, Tata McGraw Hill.
6) Industrial finance of India : SK Basu
7) First steps in book keeping : J B Batliboi
8) Management accounting : Hingrani & Bemnath.

EB/**EC/EI 804A DIGITAL IMAGE PROCESSING (Elective)**

Module I

Digital image fundamentals: representation - elements of visual perception - simple image formation model - Image sampling and quantization - basic relationships between pixels - imaging geometry. Review of matrix theory results: Row and column ordering - Toeplitz, Circulant and Block matrices. Review of Image transforms: 2D-DFT, FFT, Walsh , Hadamard , Haar, DCT and Wavelet transforms.

Module II

Image enhancement: Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging; Spatial filtering- smoothing filters, sharpening filters. Frequency domain methods: low pass filtering, high pass filtering, homomorphic filtering. Generation of spatial masks from frequency domain specifications.

Module III

Image restoration: Degradation model - Diagonalization of circulant and Block circulant matrices - Algebraic approaches - Inverse filtering - Wiener filter - Constrained Least squares restoration - Interactive restoration -

Geometric transformations. Fundamentals of Colour image processing: colour models - RGB, CMY, YIQ, HIS - Pseudo color image processing - intensity slicing, gray level to color transformation.

Module IV

Image compression: fundamentals- redundancy: coding, inter pixel, psychovisual, fidelity criteria, Models, Elements of information theory, Error free compression- variable length, bit plane, lossless predictive, Lossy compression- lossy predictive, transform coding. Fundamentals of JPEG, MPEG, Fractals.

Module V

Image segmentation: Detection of discontinuities - point, line and edge and combined detection ; Edge linking and boundary description - local and global processing using Hough transform – Thresholding - Region oriented segmentation - basic formulation, region growing by pixel aggregation, region splitting and merging - Use of motion in segmentation. Fundamentals of Representation and Description.

References:

1) Gonzalez and Woods, "Digital Image Processing", 2 Ed, Pearson Education, 2002.
2) Anil K. Jain "Fundamentals of Digital Image Processing", Pearson Education, 2003.
3) Mark Nelson, Jean-Loup Gailly "The Data compression Book" 2 Ed, bpb Publications.
4) Pratt William K.,"Digital Image Processing", John Wiley & sons
5) Chanda & Majumdar, "Digital Image Processing and Analysis" , PHI.
6) M.Sonka,V. Hlavac, R. Boyle, "Image Processing, Analysis and Machine Vision", Vikas Publishing House

EB 804 B BioInformatics(ElectiveII)

EB/EC/EI 804 C – MECHATRONICS

Module I

Introduction to mechatronics - mechatronics in manufacturing - mechatronics in products - scope of mechatronics - fundamentals of numerical control - advantages of NC systems - classification of NC systems - point to point and contouring systems - NC and CNC - incremental and absolute systems - open loop and closed loop systems - features of NC machine tools - fundamentals of machining - design consideration of NC machine tools - methods of improving machine accuracy and productivity - special tool holders

Module II

System devices - system drives - hydraulic systems - DC motors - stepping motors - AC motors - feedback devices - encoders - pulse digitizers - resolvers - inductosyn - tachometers - counting devices - flip flops - counters - decoders - digital to analog converters - interpolation - linear interpolator - circular int erpolators – Complete interpolator-Control Loops for CNC-CNC software interpolator - flow of data in NC machines

Module III

Computer Integrated Manufacturing (CIM)

Introduction-Automated Storage and Retrieval Systems - Group Technology -Computer Aided Process Planning-Material Requirement Planning-Computer Aided Inspection - Machine Vision

NC part programming - manual programming - concepts - tape formats - tab sequential - fixed block word address and variable block formats - part programming examples - point to point programming and simple contour programming - computer aided programming - concepts - post processor programming languages - APT programming - part programming examples

Module IV

Industrial robotics - basic concepts - robot anatomy - robotics and automation - specification of robots - resolution - repeatability and accuracy of manipulator - classification of robots - industrial application –robot control systems - robot drives - characteristics of end of arm tooling – end effectors - sensors - tactile, proximity and range sensors - contact and non-contact sensors - velocity sensors - touch and - slip sensors - force and torque sensors

Robot programming - lead through programming - textual programming - programming languages –generations robot programming languages- robot language structure- on line and offline programming - intelligent robots

Module V* (This Module is only for internal evaluation)

Computer Aided Design (CAD)

Design Process-Application of Computers for Design - Benefits of CAD A utoCAD –file menu –edit menu –draw menu –modify menu-format menu- tools menu - AutoCAD Dimensioning- 3D representations in CAD - View menu - 3D drawing Entities - Rendering in Auto CAD- solid and surface modelling, comparisons with 2D methods, spline curve and surface representations, parametric methods and data exchange

Reference books

1. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill

2. HMT, Mechatronics, TMH.
3. Michel P. Groover, Industrial Robots-Technology, Programming and Applications, McGraw Hill
4. M.P. Groover, and Emory W, Zimmers, CAD/CAM:Computer Aided Design and Manufacturing, Prentice – Hall Englewood Cliffs
5. C.Ray Asfahl ,Robotics and Manufacturing Automation, John Willey & Sons, Inc.
6. Fu K.S., Gonzales et al, Robotics-Control, Sensing, Vision and Intelligence, McGraw Hill.
7. Yoram Koren & Ben Yuri, Numerical Control of Machine Tools, Khanna Publishers.

***For University Examination, Questions from First four modules only and Fifth module is for internal evaluation.**

EB 804 D Biomedical Laser Instrumentation)

Module I

Physical principles of bio-medical lasers - various types of laser devices - Ruby, Nd, Nd-YAG, He-Ne, CO2, Q-switched operations - continuous wave - Quasi - continuous.

Module II

Single frequency operation - coherence of laser - spatial distribution - intensity of laser emission - polarisation of laser emission - measurement of pulsed laser energy.

Module III

Optical properties of tissue - Pathology of laser reaction in skin - thermal effects , laser irradiation – Non thermal reactions of laser energy in tissue.

Module IV

Laser flow cytometry - single cell separation - micro irradication .Laser fluorescent micro irradication - Laser eye instrumentation.

Module V

Laser transillumination & diaphanography - Speckle intereferometry, holography - Application Safety with biomedical Lasers.

Reference :-

1)Leon Goldman, " The Biomedical laser Technology and Clinical Applications " Springer-Verlar

2)Leon Goldman, " Lasers in Medicine", Springer-Verlar

EB 805 PROJECT

The project work commencing from the VII th semester shall be completed and project report shall be submitted by each student by the end of the VIII th semester. There will be an internal examination of the project that includes demonstration and oral examination of the project work. The evaluation panel shall consisting of at least three faculty members including the project guide as appointed by Head of the department

806 VIVA_VOCE

Each student is required to appear for a viva-voce examination, and he/she has to bring his/her seminar report and project report. The evaluation panel should contain at least one External and Two internal examiners appointed by the university. There can be more than one panel in case the number of students is large