MAT BME 201 ENGINEERING MATHEMATICS III [4-0-0-4]

Complex variables: Functions of a Complex Variable, Limits, Continuity, Analytic functions, C-R equations, Conformal mapping, Bilinear transformations, Complex integration: Cauchy's integral theorem, Cauchy's integral formula, Taylor's and Laurent's series, Cauchy's residue theorem. Evaluation of standard real integrals.
Fourier Series: Periodic Functions, Euler's formula, Fourier Series of even and odd functions, Fourier series of functions of arbitrary period, Half-range expansions, Fourier sine and cosine series, Exponential Fourier Series, Fourier Transforms: Definition, Convolution and Applications.

Partial differential equations: Basic concepts formulation of PDE, solution of PDE using indicated transformations. Solution by the method of separation of variables, Fourier series solution of one dimensional wave and heat equations by the method of separation of variables, D'Alembert's solution of wave equation.

Numerical Analysis: Finite Differences: Forward differences, Backward differences, Newton's forward interpolation formula, Newton's backward interpolation formula, Newton's general interpolation formula, Numerical Differentiation, Numerical integration, The general quadrature formula :Trapezoidal and Simpson's 1/3 rule

References:

1. Kreyszig Erwin, "*Advanced Engineering Mathematics*", John Willey, Edition 7, 1994.
2. S G Stanton, "*Numerical Analysis For Science And Engineering*".
3. S SSastry, "*Introductory Methods In Numerical Analysis*", Prentice Hall, Edition 3, 1999.
4. B S Grewal, "*Higher Engineering Mathematics*", Khanna, Edition 36, 2002.
5. J B Scarborough, "*Numerical And Mathematical Analysis*", Oxford Press, Edition 6, 1974.
6. A Ralston, "*A first Course in Numerical Analysis*", McGraw Hill, Edition 2, 1986.

BME 201 ELECTRONIC DEVICES & CIRCUITS [3-1-0-4]

Working principle and characteristics of PN diode, Zener diode, Photo diode, tunnel diode, Varactor diode, Light emitting diode, BJT, Photo transistor, JFET, MOSFET, UJT, SCR, DIAC and TRIAC. Biasing and stabilization of Q-point of BJT, Biasing circuits, and stability factors. Low frequency analysis of BJT, Composite transistors circuits. Biasing and stabilization of Q-point of FET, FET Small signal analysis. Hybrid-π Model of transistor and analysis. Integrated circuits principles and fabrication methods.

References:

1. J Millman, C Halkias, "*Integrated Electronics*", McGraw Hill, 2002.
2. Boylestead, Nashelsky, "*Electronic Devices and Circuits Theory*", Pearson Education, Edition 8, 2002.
3. P M Chirlian, "*Analysis and Design of Integrated Electronics*", John Willey, Edition 2, 1987.

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BME 203 NETWORK ANALYSIS [3-1-0-4]

Network topology, principles of duality & network transformation, KVL and KCL equationsfor DC and AC networks, network reduction using Y-Δ transformations, coupled circuits, network theorems, series and parallel resonant circuits, transient behavior and Initial conditions in networks, switching condition and their representation, evaluation of initial and final conditions**,** Laplace transforms, Inverse Laplace transform and applications,one and two port networks,driving point admittance and transfer function, Open circuit impedance parameters, Short circuit admittance parameters, transmission parameters, h-parameters.

References:

1. M E Van Valkenburg, "*Network Analysis*", Prentice Hall, Edition 3, 2002.
2. Joseph .A Edminister, "*Theory and Problems of Electric circuits*", McGraw Hill, Edition 3, 2001.
3. A Chakrabarti, "*Circuit Theory*", DhanapatPai& co
4. .B S Yoganarasimhan, "*Network Analysis*".

BME 205 BIOMEDICAL INSTRUMENTATION [4-0-0-4]

Biomedical transducers: Classification and Selection; Resistive, capacitive & Inductive transducers, Photoelectric, Piezo-electric, Temperature and Digital transducers; Electrodes & Amplifiers: Principles of working and their characteristics, Electrode-Electrolyte model, Half- cell potential, Microelectrodes. Amplifiers for biomedical instrumentation, Patient lead devices, Isolated leads & Filters. Physiological Signals & Measurements: Basics of ECG, EMG, EEG, PCG and Instrumentation for measuring these signals, Measurement of blood pressure & blood flow. Cardiac Pacemakers: Types of pacemakers &its working principle, Modes of triggering, Pacemaker power supplies. Defibrillators: AC and DC defibrillators, Types of electrodes and their features, cardiovertors. Lasers: Basic principles, types, applications and safety. Recorders: Types, Principle of working and applications. Electrical Hazards & Safety:Electrical hazards during bioelectric monitoring, Safety code standards, Micro and Macro shock and its physiological effects, Leakage currents and protection by use of isolation transformers, equipotential grounding and earth free monitoring system.

References:

1. John G Webster, "*Medical Instrumentation Applications and Design*", John Willey, Edition 3, 1998.
2. Leslie Cromwell, "*Biomedical Instrumentation and Measurements*", Prentice Hall, Edition 2, 2000.
3. R S Khandpur, "*Handbook of Biomedical Instrumentation*", McGraw Hill, Edition 2 2003.
4. L A Geddes, L E Baker, "*Principles of Applied Medical Instrumentation*", John Wiley, Edition 3, 1989.

BME 207 ANATOMY & PHYSIOLOGY[4-0-0-4]

PART-A ANATOMY

Skeletal System:Types of bone, classification, Structure of bone, Blood supply,**Cartilage:** Type, Structure in brief, **Joints**:Classification, Structure of synovial joint, Major joints of the limbs and temporomandibular joint. **Muscle tissue:** Types, Structure of skeletal muscle, Types of muscles, **Brain**: Parts, Brain stem, Ventricles, CSE, Meninges, Cranial nerves (names and functions only). **Spinal cord**: Gross features and structures, Spinal nerve, Nerve endings and receptors, Autonomic nervous system.**Sensory**: Eye, Ear, Skin.**Heart**: Pericardium, Cambers, Blood supply. Organs. **Respiratory system** : Parts, Trachea, Lungs.**G I Tract** : Parts, Stomach, Intestine, Liver, Pancreas.Urinary system**,** Parts, Male and Female reproductive organs, Endocrine glands.

PART-B PHYSIOLOGY

Introductory lecture pertaining basic functional concept of the human body as a whole and contribution of individual system for achieving the goal.Leverage system i.e. bone and muscle physiology in general. Nerve action potential and its ionic basis. Body temperature regulation based on thermostats - principle and its operation in different environmental temperature and its abnormalities.Biophysical aspects of blood pressure (Bop) and its recording technique. Electrocardiograph and its gross normal features and alterations, Optics of the eye.Fundamental tonal analysis, determination of pitch, loudness and quality of sound.Sensorium - general role of receptor as transducers, generator potential. Motor control of skilled voluntary movements: Mechanism of abnormal oscillatory movements Electroencephalogram and electrocortcogram.

References:

1. Charles E Tobin, "*Manual of Human Dissection*", McGraw Hill, Edition 4, 1961.
2. J Gibson, "*Modern Physiology and Anatomy of Nurses*", Black Well, 1981.
3. Best Charles Herbert, Taylor, Norman Burke, "*The living body*".
4. A J Vander, J H Sherman, D S Luciano, "*Human Physiology*", McGraw Hill, Edition 8, 2000.
5. Cyril A Keele, Eric Neil, Neil Norman Joels, "*Samson's Wright's Applied Physiology*",Oxford University Press, 1993.

BME 209 SIGNALS & SYSTEMS [3-1-0-4]

Introduction: Signals, Systems, Overview of specific systems, Classification of signals, Basic operations on signals, Elementary signals, Properties of systems. Time domain representations for LTI systems: Introduction, Convolution, Impulse response representation of LTI systems, Properties of the Impulse response of LTI systems. Fourier representations of signals: Introduction, Discrete time periodic signals, Discrete time fourier series, Continuous time periodic signals, Fourier series, Discrete time non-periodic signals, Fourier Transform, Properties of fourier representation. Application of Fourier representations: Introduction, Frequency response of LTI systems, Fourier transform representations for periodic signals, Fourier transform representation for discrete time signals, Sampling and Reconstruction of continuous time signals, Discrete time processing of Continuous time signals. Z Transform: Introduction, Properties of the ROC, Properties of Z transform, Inverse Z transform, Transform analysis of LTI Systems.

References:

1. Haykin, Van Veen, "*Signals and Systems*", John Willey, 2002.
2. Oppenenheim, "*Signals and Systems*", Prentice Hall, Edition 2, 2002.
3. W J Tompkins, "*Biomedical Signal Processing*", Prentice Hall, 2002.

BME 211 PHYSIOLOGY LAB [0-0-3-1]

Recording of B.P. & effects of physical exertion and posture in the parameter.Recording mechanical response of the muscle on application of induced electrical signal.Study of load, length and force relationship of muscle.Study of rate of conduction of nerve impulse.Spirometry- recording tidal volume inspiratory reserve volume, expiratory reserve volume, vital capacity and vital index and effect of posture on vital capacity.Isolated heart perfusion by lagendrak technique (demonstration).Immolated frogs heart perfusion &affects of ions (Na, Ca& K) using slowMicroinjector(demonstration).Analysis of Na & K in an unknown sample using Flames Photometer(demonstration).Test of hearing using Tuning fork.Test of vision:Acuity of vision, Color vision, Opthalmoscopy, Error of Refraction. Recording of EMG & EEG of polygraph (demonstration). Examination of sensory system.Examination of motor system. Recording action potential and its display on oscilloscope (demonstration)

BME213 ELECTRONIC DEVICES AND CIRCUITS LAB [0-0-3-1]

To conduct the following experiments to find the characteristics and waveforms: Diode Characteristics, Transistor Characteristics, FET Characteristics, UJT Characteristics, SCR Characteristics, Full-wave Bridge rectifier circuit, Zener regulator, Voltage multiplier circuits, Photo diode characteristics, Photo transistor characteristics, Resonance circuits

MAT BME 202 ENGINEERING MATHEMATICS – IV [4-0-0-4]

Special functions: Solution by infinite series-Legendre's and Bessel's equations Orthogonal properties.
Optimization: Basic concepts, Classification of optimization problems. Linear programming, Graphical and Simplex method. Degeneracy and difficulties in starting.

Probability and Statistics: Definition, sample space, properties of probability, Chain Rule, Independent events, total probability and Baye's Theorem. Random Variables-Definition, Distribution Function, Classification of Random Variables, Density of Mass function, function of one Random Variable, Mean, Variance and Moment generating Function, Gamma and chisquare distribution. Hypothesis, Basic definitions certain best tests

References :

1. Ervin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern.
2. Peebles Jr, Probability, Random variables and Random signal principles, McGraw Hill.
3. P.L.Meyer, Introduction to Probability and statistical applications.
4. B S Grewal, "*Higher Engineering Mathematics*", Khanna, Edition 36, 2002.
5. Shanmugan K Sam, "*Random signals - Detection, Estimation and Data analysis*", John Wiley, Edition 2, 1988.
6. Papoulis, "*Probability, Random Processes and Stochastic Process*", McGraw Hill, Edition 3, 1991.

BME 202 ANALOG ELECTRONIC CIRCUITS[3-1-0-4]

Power supplies: Rectifiers, unregulated power supply, Zener regulator, linear voltage regulator, Switched mode power supply, voltage doublers, and quadruplers, **Feedback amplifier**: classification (voltage series, voltage shunt, current series, current shunt), effect of feedback on Ri, Ro and Bandwidth of amplifier, **Oscillators**: Barkhausen criterion, R-C phase shift oscillator, Weinbridge oscillators, RF oscillators (Colpitt's oscillator, tuned drain oscillators), and Crystal oscillator, **Multistage amplifiers**: Frequency response characteristic (Log-magnitude and Polar plots), Gain bandwidth product, and Distortion in amplifiers, **Large Signal Amplifiers**: Classification(Class A, B, AB, & C), Transformer coupled Amplifiers, Push-pull arrangements, Theoretical efficiency, Distortion analysis, Complementary and Quasi-complementary push-pull amplifiers, **Tuned amplifiers**: Parallel resonant circuit, Quality factor and Bandwidth, Single tuned capacitor coupled amplifier, Single tuned transformer coupled amplifier, Double tuned amplifier.

References:

1. J Millman, C Halkias, "*Integrated Electronics*", McGraw Hill, 2002.
2. Boylestead, Nashelsky, "*Electronic Devices and Circuits Theory*", Pearson Education, Ed. 8, 2002.
3. P M Chirlian, "*Analysis and Design of Integrated Electronics*", John Willey, Edition 2, 1987.
4. Jacob Millman, Christos C Halkias, Satabrata JIT, "*Millman's electronic Devices and Circuits"*, TATA McGraw-Hill, 2nd edition, 2007.
5. Dharma Raj cheruku and BattulaTirumala Krishna, "*Electronic Devices and circuits*", Pearson education, 2005.

BME 204 DIGITAL ELECTRONICS [3-1-0-4]

Linear wave shaping,analysis of RC high pass and low pass circuits with different input waveforms, clipping circuits using diodes, clamping circuits,bistable, monostable and astablemultivibrators using discrete components, logic gates,basic and universal logic gates withdiscrete and IC version, logic families and their characteristics, number systems and codes, Boolean algebra, canonical and standard forms, K-map and MEV techniques, combinational logic circuits,**s**equential logic circuits such asflip-flops, asynchronous and synchronous counters, shift registers, ring counters.

References:

1. Millman, Taub, "*Pulse, Digital and Switching Waveforms*", McGraw Hill, 1992.
2. Morris Mano, "*Digital Logic and Computer Design*", Prentice Hall, 2001.
3. J Millman, C Halkies, "*Integrated Electronics*", McGraw Hill, 2002.
4. B S Sonde, "*Introduction To System Design Using Integrated Circuits*", Willey Eastern, Edition 2, 1994.
5. Malvino A, Leach D P, "*Digital Principles and Applications*", McGraw Hill, Edition 5, 2001.

BME 206 BASIC CLINICAL SCIENCES – I[4-0-0-4]

PART-ACARDIOLOGY

Heart structure and function - overview, Detail cardiovascular physiology - blood flow (circulation), Detail anatomy of human heart, principles of cardiovascular measurements-blood pressure, cardiac output, etc.Heart valves, Prosthetic heart valves – evolution, detail structure, functions and applications, Open heart surgery and Heart lung machines, Basics of 12-lead Electrocardiography – Einthoven's triangle, ECG potentials – generation and conduction, conduction system, Applications of ECG in cardiac clinics, Normal and abnormal ECGs, Diagnostic applications, Interpretation of ECG, Cardiac pacing.Assisted cardiac devices-concepts and applications from biomedical engineering perspective, Holter monitor.

PART-B ANAESTHESIOLOGY

This course will provide an overview of basic physical principles and their applications in anaesthesia and intensive care. It will begin with the description of general and regional anaesthetic techniques fundamental to the practice of anaesthesia before going on to describe the anaesthesia machine, medical gas supply systems and intravenous drug delivery systems. The principles of equipment used in pain therapy will be discussed. Finally, students will learn about mechanical ventilation with special emphasis on mechanical ventilators and nebulisers. Humidifiers, Baby Incubators, Central oxygen supply. Principles of operation theatre tables and lights, phototherapy, surgical diathermy.

PART-C ENT

Anatomy and physiology of auditory system – introduction, components, outer ear, inner ear, auditory mechanism, and central auditory system. Functional concepts of hearing – central and peripheral mechanisms, Audiogram and audiometry – concepts and applications, basics of Electrocochleogram, Hearing aids – basics and future aids. Noise pollution and cochlear implants, Anatomy of larynx, Physiology of speech or phonation, Language disorders, Language development, Language and brain, Pathological conditions – Aphasias and Dyslexia.

References:

1. Ganong, "Review of Medical Physiology" [available at MIT and KMC libraries]
2. Cyril and Neil, "Samson Wright's applied physiology" [available at MIT and KMC libraries]
3. C.C. Chatterjee, "Human Physiology" [available at MIT and KMC libraries]
4. M.K.Bykes and M.D.Vickers, " *Measurements in Anaesthesia*", Blackwell 1981.
5. Mushin, "*Automatic ventilation of lung*", Blackwell 1970.
6. R.D. Millor, *"Text Book of Anaesthesia*" some chapters.

BME 208 BIOMEDICAL EQUIPMENTS [4-0-0-4]

Respiratory measurements and aids: Principles and Techniques of Impedance Pneumograph and Pneumotachograph; Ventilator and its types. Acoustic measurement and aids: Common tests and procedures, Schematic functional diagram of an audiometer; Hearing aids: Different types, Comparison of microphones, Receivers and amplifiers. Electrosurgical units: modes of operation of the ESU & the safety features. Ultrasonics: Basic principle, block diagram of an echocardiograph. Study of Endoscopes,Neonatal instrumentation, Anesthesia equipment & Lithotripsy. Prosthetic heart valves: Qualitative requirements, types of Mechanical and tissue valves, Invitro performance testing of prosthetic heart valves using a pulse duplicator. Heart- Lung Machine: Governing principles, Qualitative requirements, types of blood oxygenators. Hemodialysers: Qualitative requirements, General scheme of operations, Types of exchangers, Block diagram of the dialysis machine, Electronic control and monitoring systems. Intensive Coronary care concepts; Principles and applications of Thermograph, Infusion pump & Blood cell counter.

References:

1. John G Webster, "*Medical Instrumentation*", John Willey, Edition 3, 2001.
2. R S Khandpur, "*Hand book of Biomedical Instrumentation*", McGraw Hill, Edition 2, 2003.
3. Richard Aston, *"Principles of Biomedical Instrumentation and Measurements*", Maxwell macmilan International editions.
4. LA Geddes & LE Baker, *" Principles of Applied Medical Instrumentation*", John Wiley Edition 3, 1989.

BME 210 ANALOG ELECTRONIC CIRCUITS LAB[0-0-3-1]

Design of power supplies: rectifier (capacitor filter) voltage doublers/ quadruples, series voltage regulator (discrete components).Design of amplifiers: Transistor amplifiers with and without feedback, FET Amplifiers I.F, amplified transistor, power amplifier.Design of oscillators: RC phase shift oscillator, Wein bridge oscillator, Hartley And Colpitt's /Crystal oscillator (using BJT's FET's), UJT oscillator design.

BME 212 DIGITAL ELECTRONICS LAB[0-0-3-1]

Wave shaping circuits:R-Chigh pass and low pass circuits, Clipping and Clamping circuits.Multivibrators:Astable and monostable circuits using discrete components and digital ICs. Comparators:Schmitt trigger circuit using discrete components and digital ICs. Gates:Study of TTL and CMOS gate ICs, Design of combinational circuits using IC gates. Study of MSI combinational IC chips (TTL and CMOS) such as decoder, encoder, multiplexers and demultiplexers.Sweep generator circuits,Flip-Flops: Study of flip-flop IC chips, Design of asynchronous counters and synchronous counters using flip-flop, Design of shift registers, Study of counter IC chips.

BME 301 BASIC CLINICAL SCIENCES – II[4-0-0-4]

PART-A OPTHALMOLOGY

Physiology of Eye: Structure of eye, function**,** Generation of signals and transmission to brain Electrophysiology**,** Aqueous humor production: Intraocular pressure fluctuations.

Equipment Used: Vision testing equipment (Computerized & Manual.), Snellens's Chart, Keratometer, Refractometer, Colour Vision, Eye Examination equipment:Slit lamp biomicroscope& Camera, Fundus Camera, Opthalmoscope-Direct & Indirect, Retinoscope, Tonometers - contact & Noncontact, Perimeters - Listers, Bjerrums, Octopus, and Goldmann, Ophthalmodynamometers, Ultrasound Scanners, Synoptophore + Hesschart, Electromagnet, Lathes, **Specialized equipment used in treatment:**Argon laser, Nd-YAG Laser, Contact Lenses, Intraocular Lenses, Operating Microscope, Cryosurgical equipment, Vitrectomy instrument.

References :

1. Miller Stephen J H, "*Parson Diseases Of The Eye*", Churchhill Livingstone, Edition 18, 1994.
2. Duke Elder*, "System of OpthalmologyVol.VII*".

PART-B ORTHOPAEDICS

Bioengineering aspects of fracture management: Structure of bone-gross, Microscopic biochemical fractures: Types, Mechanism of injury, Normal Healing of Fractures, Treatment of fractures: General principles, Closed methods, External fixation and Internal fixation, Biomechanics of internal fixation and description of external fixators, Bioengineering principles of internal fixation, Intrame: Dullary nails, Plates, and Screws. The concepts of load bearing, load sharing and stress shielding by implants, Piezo electricity and electrical stimulation for bone healing, Bioengineering aspects of joint diseases, Structure of joints: Fibrous, Cartilaginous, Synovial, Lubrication of joints and

the functions of articular cartilage, Degeneration of cartilage, Degenerative arthritis and Rheumatoid arthritis, Joint replacement, hip, knee, shoulder, small joints.

Biomaterials: Requirements of implant materials and biocompatibility, Material implants: Metals, Ceramics, Plastics (UHMWPE), Neoligaments, Materials in external appliances, Materials in prosthetics, Materials in Orthotics, Bioengineering principles of management of paralytic problems, Gait analysis, Orthotics, Principles of tendon transports, Bioengineering principles of amputation and prosthetics, Upper limb prosthesis, Lower limb prosthesis.

References:

1. Wilton H Bunch and Robert D Keagy, "*Principles of Orthotic treatment"*.
2. Adams John Cranfield and Xchurchill living stone, "*Outline of orthopedics and outline of fractures*".
3. Frankel, Lea, Febiger , Nordin, " *Basic Biomechanics of the skeletal system*".
4. M. Dena Gardiner, "*The principles of exercise therapy*", CBS press, Edition 4, 1985.

PART – C SPEECH & HEARING

Audiometers, Middle ear analyzer, Evoked potentials, OAE, Hearing aids, Cochlear implants, ALD, Hearing aid analyzer, Electro Glottography, AAC, Introduction to speech assessment, DSP, Assessment of voice and fluency, Voice and fluency therapy assessment, Artificial larynx, Spirometry, Speech synthesis, Practical demonstration.

References:

1. Community based Rehabilitation, ISBNO 0-7020-1941-0, Saunders, London, 1997.
2. A Nenfeldt and A Albrigt, "Disability and Self- directed employment" , 1998.

BME 303 BIO-MATERIALS & ARTIFICIAL ORGANS [4-0-0-4]

A Brief discussion of: Metalic biomaterials, Ceramic Biomaterials, Polymeric biomaterials, Composite biomaterials. Biodegradable Polymeric biomaterials: An updated overview. Biologic biomaterials tissue derived biomaterials(collagen). Soft tissue replacement: Blood interfacing implants, Non blood interfacing Implants. Hard tissue replacement: Bone repair and joint implants, Dental implants, the relationship of materials characteristics to biology properties. Artificial Kidney: Structure and function of the kidney, kidney disease, Renal failure, treatment of renal failure, Renal transplantation, Mass transfer in dialysis, clearance, filtration, permeability, overall transport, membranes, Hemofiltration. Liver Support Systems: Morphology of the liver, liver functions, Hepatic failure, liver support systems, Hybrid Replacement procedures, Global Replacement of liver function. Artificial Pancreas: Structure and function of pancreas, Endocrine pancreas & insulin secretion, Diabetes, insulin and insulin therapy, therapeutic options in diabetes, insulin administration systems, insulin production system. Artificial Blood

References:

1. Joseph D Bronzino, " The biomedical Engineering Handbook", CRC press
2. Buddy D Ratner & Allen S Hoffman "Biomaterials Science and introduction to materials in Medicine", Academic Press.
3. Joon Bu Park, "Biomaterials Science and Engineering", Plenum Press.

BME 305 INTEGRATED CIRCUIT SYSTEMS [3-1-0-4]

Operational amplifiers, characteristics, frequency response, differential amplifiers, offset voltages and currents, linear applications of OP-AMP, instrumentation amplifier, active filters, integrators and differentiators,non- linear applications of OP-AMPS,switched Capacitor filter,

555 Timer IC and its applicationsphase locked loopsandapplications, voltage to frequency converters,voltageregulators,fixedandadjustable voltage regulator, switching regulators, different type of ADC and DAC, introduction to VLSI, MOS shift registers and charge coupled devices.

References:

1. Jacob Milliman, Christors C Halkias, "*Intergrated Electronics*", Mcgraw Hill, 2002.
2. Jacob Millman, Irvin Grabel, "*Microelectronics*", McGraw Hill, Edition 2, 1988.
3. Ramakanth A Gayakwad, "*OPAMPS and Linear Integrated Circuits*", Prentice Hall, Edition 4, 2000.
4. J Nagrath, "*Electronics (Analog and Digital)*", Prentice Hall.

BME 307 MICROPROCESSORS [4-0-0-4]

Microprocessor architecture, word length, speed, and its operations. Memory, Input/Output (I/O), Interfacing Devices.Organization of the 8086 CPU, Addressing Memory locations, Generating Memory Address.Instruction set of the 8086/8088, Assembling and debugging Programs. Hardware specifications of the 8086/8088 microprocessor, The 8284 clock generator, Minimum and Maximum mode systems, Memory and I/O interfacing, The 8255 programmable port, Interfacing A/D and D/A converters, DMA Controller. Interrupt structure of the 8086/8088, hardware and software interrupts, System Interrupt Service. Architecture and instruction set of Motorola 68000 Microprocessor, Exception processing of the 68000.

References:

1. Gilmore, “Microprocessors Principles and Applications”, TATA McGraw-Hill, Edition 2, 1997.
2. Douglas. V. Hall, “Microprocessors and Interfacing”, McGraw Hill, Edition 3, 2001.
3. Walter A Triebel, Avtar Singh, “68000 and 68020 Microprocessors”, Prentice Hall, 1991.
4. Barry B Bray, “The Intel Microprocessors 8086/8088/80186/80286/80386 and 80486”, Prentice hall, 1995.

BME 309 BIOMEDICAL DIGITAL SIGNAL PROCESSING[3-1-0-4]

Introduction:Some examples of biomedical signals, systems and applications, Review of Signals & Systems. Fourier representation of discrete signals: discrete Fourier series-periodic convolution, properties. discrete Fourier transform- properties, circular convolution, linear convolution using the DFT.Digital filters: Introduction, design of general FIR filters- window method, Design of IIR filters from analog filters-Butterworth, Chebyshev and Elliptic Filters, digital filter design techniques- impulse invariance and bilinear transformation, Comparison of FIR and IIR Filters, Basic network structures for IIR and FIR systems – Direct, parallel, and cascade forms. Fast Fourier Transform: Introduction, Decimation-in-time algorithms, In-place computations, bit-reversed sorting, Decimation-in-frequency algorithm. Biomedical applications: autocorrelation, cross-correlation, power spectrum density (PSD) and their applications, ECG waveform and its utility in medical diagnosis, detection of the QRS complex, R-R interval series and its significance,Periodogram and Welch's method of estimating the PSD. Data compression techniques: AZTEC and CORTES algorithms, fan algorithm and Huffmann coding.

References:

1. Oppenheim A.V. and R.W. Schafer, *Digital Signal Processing,* Prentice Hall of India, .
2. Proakis J.G. and D.G. Manolakis, *Introduction to Digital Signal Processing*, PHI, 1998.
3. R.M. Rangayyan, *Biomedical Signal Analysis: A Case Study Approach*, IEEE Press Series in Biomedical Engineering, John Wiley & Sons, 2002.

BME-311 OBJECT ORIENTED PROGRAMMING [3-1-0-4]

Fundamental concepts of programming language, Object Oriented Programming paradigm, Characteristics of OOPs, C++ Programming basics: Constants, Variables, Data-types, Expressions & Operators, Control flow: Decision making and looping and functions, Classes and Objects: Class specification, Accessing Class Members, Constructors and Destructors, Overloaded Constructors, Operator Overloading and type conversion, Inheritance: Derived class and base class, class hierarchies, Levels of Inheritance, and Multiple Inheritance, Polymorphism, and Virtual Functions, Pure function, Friend function, Friend classes, Files and streams, Exception Handling, Text mode graphic functions, Graphics mode Graphics functions, Object oriented system development.

Reference Books:

1. E Balaguruswammy, "Object Oriented Programming with C++" , Tata McGraw Hill,2008
2. K R Venugopal, Rajkumar, T Ravishankar, "Mastering C++", Tata McGraw hill, 2007.
3. Herbert Schildt, "The Complete Reference C++", Fourth Edition, TMH.
4. Robert Lafore, "Object Oriented Programming in Turbo C++", *Galgotia Publications pvt, ltd, New Delhi*.
5. SouravSahay, " Object oriented Programming", Oxford University press, New Delhi, 2006.

BME 313 INTEGRATED CIRCUIT SYSTEMS LAB[0-0-3-1]

Op-amp linear applications, (adders, subtractors, integrator, differentiator,voltage to current, current to voltage converters.). Op-amp non-linear applications.(Comparators, square wave generator, monostablemultivibrator, precision rectifier).Function generation using op-amps (square & triangular waveform).Op-amp R-C phase shift and wein bridge Oscillator. Op-amp based D-A converters.(ladder type DAC). I.C. Voltage regulators (3 terminal fixed, variable and 723 or equivalent), 555 timer applications, PLL applications, VCO IC 566., A/D & D/A converter ICs.

BME 315 MICROPROCESSOR LAB [0-0-3-1]

Familiarization with IBM PC and Assembler, execution and debugging the programs. Arithmetic and logical operations. Display programs. Memory array and String handling. Applications of Assembler Directives. Writing MACROS using 8086 assembly language instructions. DOS and BIOS Function Calls and waveform generation.

BME 302 BASIC CLINICAL SCIENCES-III[4-0-0-4]

PART-ANEUROLOGY

Introduction to neurology; Review of the structure, development, and function of the nervous system: Central, peripheral and autonomic nervous system, Part of the brain structure, The motor system, Sensation, Cranial nerves. Functional topography of brain. Spinal cord, Consciousness, Higher functions, somatosensations, Neurons and glia, membrane potential, postsynaptic potential, action potential, signal transductions, neurotransmitters, synaptic transmissions, neural plasticity- LTP and LTD, Motor spinal control, cortical and subcortical motor control, Sleep and its disorders, Diagnostic investigations, Electroencephalography, Computerised Axial Tomography, Radioactive brain scanning, Angiography, Pnuemoencephalography, The motor unit recording, The methods of Electrodiagnosis, Neuromuscular stimulation, Electromyography, Clinical Applications, Diseases of muscle, Motor neuron disorders, The electrical study of reflexes, The silent period, The F Response, The H Reflex, The Axon reflexes, Disorders of neuromuscular transmission.

Reference:

1. Victor Maurice, Adams Raymond D , "*Principles of Neurology*", McGraw Hill, Edition 5, 1993.
2. Erodal, "*Neuroanatomy*". Lance and Moleod, "*Physiological approach to Clinical Neurology*

PART-B -RADIOLOGY

Transformers, Motors,X-ray tube, Target material, focal spot, size, shape of filament rotating anode, cooling of target tube, Interaction of X-ray with matter, Use of filters, scattered rays, quality of X-rays, HVL, CONES, Grids, Photographic effects on X-ray film, density, contrast, distortion, Speed of X-ray film, Fluorescent & Intensifying screen, Tomography & High K.V. Technique, Image Intensifier, D.S.A, Ultrasonography, C.T. Scan, Principles of M.R.I, Radiation hazards & protective measures, Brachy Therapy.

PART-C RADIOTHERAPEUTICS

Principles of radiation oncology and cancer radio therapy, LET and RBE, Radio sensitivity and Radio resistance tumors and tissues, Clinical definition of tumor radiosensitivity, Classification of tumors according to cell Radiosensitivity, Cell survival theory, Cell cyclekinetics and age response function, Cell survival curves, Oxygen effect, OER, Cell repair- sublethal and potentially damage repair.Radio curability of tumors, Therapeutic ratio, Normal tissue tolerance dose, Modification of radiation response, Physical, Chemical and Biomedical modifiers, Radiation biology stages of radiation actions, Physical stage LEI-RBE, Physiochemical reactions, Chemical stage.Radioactive effect of important Biological macromolecules, Radiation on cell site in cells, DNA repair process, Effects of radiation on cell cycle process, Cell death survival curves, Oxygen effect, Fractionation, Biological effects of Radiation, Radioactive protection, Acute Radiation syndromes, Somatic effects LD-50, Cause of radiation death - skin - blood and blood forming organs, Reproductive organs, Embryo-Late effects of Radiation, Radiation carcinogenesis, Leukemogenesis, Cataract, Genetic effects, Hazards and permissible exposures, maximum permissible occupational doses, Hazards in various branches of radiation, Protective lines of defense, Protective measures, Physical measurements and medical investigations.

References:

1. Meredith W J , Massey J B, "*Fundamental Physics of Radiology*", John Wright, Edition 3, 1977.
2. Johns H E, Cunningham John Robert, "*The Physics of Radiology*", Charle C Thomas, Edition 4, 1983.
3. Romesh Chandra, "*Introduction to Nuclear Medicine*".

BME 304 MICROCONTROLLERS [4-0-0-4]

Introduction to 8-bit Microcontroller structure and Microcontroller families. The 8051 Microcontroller Hardware, I/O pins, Ports, and Circuits, external memory, Counters and timers, serial data Input/ Output, Interrupts. Programming the 8051 microcontroller**.** Interfacing External memory, Keyboard, Displays, Pulse measurement, D/A and A/D converters to the 8051 microcontroller. Features, Architecture, Instruction set and Serial Sub-system of Motorola 68HC11 microcontroller family.PIC Microcontrollers overview, architectural features, Special features and Applications.

References:

1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, programming, & Applications" Second Edition, Penram International.
2. Muhammad aliMazidi, Janice GillispieMazidi, "The 8051 Microcontrollers and Embedded systems" Second Edition, Pearson Education.
3. Michael Kheir, "The M68HC11 Microcontroller applications in control, Instrumentation, and Communication" Prentice Hall, International Edition.
4. John B. Peatman, "Design with PIC Microcontrollers", first Edition, Pearson Education.

BME 306 Medical Image Processing [4-0-0-4]

Review of signals, systems & transforms; 2D signals & systems, 2D DFT and its computation. Image perception – the human vision system, psycho-visual experiments, monochrome vision model, temporal properties. Image compression – the discrete cosine transform (DCT), properties, computation, practical compression algorithm. Image Enhancement: Point operations, Spatial filtering: linear filters & the median filter; Connected-component labeling. Medical Imaging: Imaging modalities; Computed tomography (CT): mathematical basis, the Radon transform & the central slice theorem; Image reconstruction from projections: the Direct Fourier Method, convolution backprojection (CBP) algorithm, reconstruction from fan-beam projections; X-rays: utility, generation and detection; X-ray CT systems. Emission CT: principles, Positron emission tomography (PET); Magnetic resonance imaging: Principles of data-generation, resolving the tissues, resolving the spatial locations.

References:

1) R.C Gonzalez and R.E. Woods, *Digital Image Processing*, 2nd Ed., Pearson Education Inc., Eighth Indian Reprint, 2002.
2) Jae S. Lim, *Two-dimensional Signal and Image Processing*, Prentice-Hall, Englewood Cliffs, New Jersey, 1990.
3) A.K. Jain, *Fundamentals of Digital Image Processing*, Prentice-Hall, 1989, Fourth Indian Reprint.
4) A.C. Kak and M. Slaney, *Principles of Computerized Tomographic Imaging*, SIAM's Classics in Applied Mathematics, Philadelphia, SIAM, 2001.
5) Kline Jacob, *Handbook of Biomedical Engineering,* Academic Press, 1988.
6) H.H. Schild, *MRI Made Easy,* Berlex Laboratories, Wayne, NJ 1994.

BME 308 TELEMETRY SYSTEMS [4-0-0-4]

Amplitude Modulation (AM) System: Frequency translation, Double Side Band (DSB) modulation, Single Side Band modulation; Generation and detection methods, Vestigial Side Band (VSB) modulation. Frequency Modulation (FM) System: Phase and Frequency modulation, FM spectral analysis, FM generation and detection methods. Noise in AM System: Output signal to noise ratio for AM receivers, Threshold effects. Noise in FM Systems: FM Demodulator, Output signal and noise powers, pre-emphasis and de-emphasis networks, Comparison of continuous wave modulation systems. Analog to Digital Conversions and Digital Modulation Techniques: Sampling theorem, Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Pulse Code Modulation (PCM), Digital modulation and Demodulation systems, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) & Phase Shift Keying (PSK). Biomedical Telemetry: Introduction, Sensing and Transmission of Physiological variables, Applications of Biotelemetry.

References:

1. H Taub, D L Schilling, "*Principles Of Communication Systems*", McGraw Hill, Edition 2, 1994.
2. S Haykin, "*Communication Systems*", Wiley Eastern, Edition 2,1990.
3. R Stuart Mackay, "*Biomedical Telemetry*", IEEE press, Edition 2,1993.

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BME 310 INSTRUMENTATION & EQUIPMENT LAB[0-0-3-1]

Demo and circuit checking of the following equipments: Electro-Surgical Unit, Defibrillator, Ventillator, Baby Incubator, Infusion Pump, Pacemaker. Design & testing of the circuits related to medical equipments (Minimum 5 circuits), PCB Design and making of any of the above circuits. Study of Ergonomics issues. Study of Transducers, ECG, EMG, EEG, Spirometer, Applications of active filters, Study of Spectrophotometer, Colorimeter, PH meter, Instrumentation Amplifier, Audiometer, Measurement of BP, Amplitude Modulation and Detection, Frequency Modulation and Detection, Pulse Modulation Techniques, Pulse Code Modulation.

BME 312MICROCONTROLLER LAB [0-0-3-1]

Familiarization of 8051 simulation software and 8051 instruction set, Arithmetic and logic related programs, Array handling and code conversion programs, Bit manipulation and programming using I/O ports, Timer/Counter programming, Programming using 8051 trainer kit in keyboard mode, Programming 8051 using trainer kit in serial mode and interrupt programs, Interfacing DAC ,ADC ,Seven segment display, keyboard, LCD and Stepper motor .

ESSENTIALS OF MANAGEMENT AND ENGINEERING ECONOMICS [4 0 0 4]

HUM-302/401

Management - Definition of Management, Nature and scope of management, Functions of managers, Corporate social responsibility, Theories of Planning, Organizing, Staffing, Leading and Controlling.
Engineering Economics - Introduction to Micro and Macro Engineering Economics, Value, Utility, Consumer & Producer goods, Factors of Production, Law of demand and supply, Elasticity of demand & supply, Equilibrium of demand and supply. Time value of Money, Economic Evaluation of Alternatives, Replacement analysis and Depreciation.

References:

1. Koontz D. (Latest Edition), "Essentials of Management*" McGraw Hill*, New York.
2. Peter Drucker (Latest Edition) " Management, Task and Responsibility" *Allied Publishers*.
3. Peter Drucker (2003) "The practice of management", *Butterworth Hein Mann*.
4. Tuesen G J &Tuesen H G (Latest Edition) "Engineering Economy" *Prentice Hall of India*, New Delhi.
5. De Garmo L Paul (Latest Edition) "Engineering Economy" *Macmillan*, New York.
6. Blank L T &Tarquin A J (Latest Edition) "Engineering Economy" *McGraw Hill*, New York.
7. James L Riggs, David D Bedworth, Sabah U Randhawa (Latest Edition) "Engineering Economics" *TataMcGraw – Hill Publishing Company Ltd*, New Delhi.

BME 401 ADVANCED BIOMEDICAL SIGNAL PROCESSING [4-0-0-4]

Spectral estimation techniques: The periodogram, averaged periodogram, Blackman-Tukey, Biomedical applications using periodogram. Cepstrum analysis: The cepstra, power capstrum, complex cepstrum, homomorphic filtering, Biomedical applications of cepstrum analysis.Adaptive noise canceling: Introduction, General structure of adaptive filters, Principles of adaptive noise canceling with LMS and RLS adaptation algorithm.Adaptive line enhancer: Introduction, Adaptive line Enhancer (ALE) method using the LMS and GAL algorithm. Autoregressive (AR) methods: Linear prediction and Autoregressive methods, Auto correlation (Yule Walker) method, Adaptive AR methods, Biomedical applications of AR methods.Autoregressive Moving Average (ARMA) method: The MLE, Akaike, Durbin models, Adaptive ARMA method based on the LMS algorithm.Wavelet representations of signals: Introduction to wavelets, Filter banks and discrete wavelet transform.

Reference:

1. M. Akay, "*Biomedical signal Processing*", Academic press, 1994.
2. Arnon Cohen, *" Biomedical signal processing: Volume 1"*,CRC Press, 1986.
3. Arnon Cohen, *" Biomedical signal processing: Volume 2"*,CRC Press, 1986.
4. AkayMetein "*Time-frequency and wavelets in biomedical signal processing*" IEEE press, 1997
5. C.SidneyBurrus, R.A.Gopinath, HaitaoGho, "*Introduction to wavelets and wavelet transforms*", Prentice Hall, 1998.

BME 403 Advanced Medical Image Processing [4-0-0-4]

Mathematical Preliminaries: Review of 2D Signals & systems, Probability Theory, Linear Algebra; Matrix-representation of Filtering/convolution; Orthogonal and unitary transforms, examples, Affine transformation and applications: Geometric transformation of objects in images. Image enhancement: Histogram Equalization & matching, Morphological Approach to image processing/enhancement, Image Restoration: Introduction to Stochastic Processes, Image degradation model, pseudo-inverse & Wiener filters. Image Segmentation: Detection of edges/boundary, lines and curves; Object representation & recognition: Boundary-description, Fourier descriptor, moments, invariants, elements of Pattern-recognition/classification. Colour-image processing: Fundamentals, Colour Models, Biomedical Engineering Applications.

References:

1. R. C. Gonzalez and R.E. Woods, *Digital Image Processing*, Addison Wesley, 3rd Edition, 2000.
2. A.K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall, 1989.
3. J.S. Lim, *Two-dimensional Signal and Image Processing*, Prentice Hall, Englewood Cliffs, New Jersey, 1990.
4. R.M. Rangayyan, *Biomedical Image Analysis*, CRC Press (Biomedical Engineering Series), New York, 2000.
5. Papers / Hand-outs / Notes given in the class.

BME 405 SIGNAL AND IMAGE PROCESSING LAB[0-0-6-2]

Introduction to MATLAB. Generation of sequences: Unit sample, unit step, real/complex exponential, sinusoidal; LSI systems: Investigation of linearity& time-invariance, Computation of impulse response, Convolution, Stability; Computing and plotting the frequency response from the transfer function/unit-sample response; pole-zero plot from the transfer function. DFT: Illustration of circular shift of a sequence, circular time-shifting & circular convolution property, linear convolution via circular convolution; Computation of the DFT / FFT of a 1D signal.Implementation of FIR and IIR filters. Power spectrum estimation: Periodogram& Welch's method. ECG: QRS detection, extracting the RRI series and calculation of heart rate; the utility of Auto correlation & Cross correlation for template matching.ECG signal compression using Turning Point algorithm& DCT. Image Processing - Display and simple manipulations:flipping, rotation, and scaling; Decimation & interpolation; Effects of thresholding; Bit-plane mapping. Histogram of an image; Contrast enhancement: Application of manually specified transforms, Contrast Stretching; Computation of the 2D DFT, 2D FFT. Image Filtering - Spatial domain techniques: Neighbourhood averaging & Median Filtering; Frequency-domain techniques: High passand low pass filtering. Edge detection: Sobel, Prewitt & Robert's operators. Image Compression using DCT. The Radon Transform (RT): The RT of the Shepp-Logan Phantom; The inverse RT and image reconstruction from projections; Effects ofthe number of projections. Implementation of CBP algorithm, Hough transform & Geometric transformations.

BME 407 SEMINAR[0-0-3-1]

Students will have to present a topic related to advanced biomedical field. The duration of the presentation is limited to one hour, with the report of the topic to be submitted in advance. Presentation should be done using OHP/LCD projector.

BME 320 BIOFLUIDS & BIOMECHANICS[4-0-0-4]

Bio-fluid mechanics: Newton's laws, stress and strain, viscosity, Relationship between diameter, velocity and pressure of blood flow, Resistance against flow.Flow properties of blood: Physical, Chemical and Rheological properties of blood, Blood viscosity variation, Problems associated with extra corporeal blood flow. Bioviscoelastic fluid: Viscoelasticity Viscoelastic Models: Maxwell, Voigt and Kelvin Models, Bio-Viscoelasticfluids. Rheology of blood in microvessels: Fahreus-Lindquist effect and inverse effect, hematocrit in very narrow tube.Cardiac mechanics: Cardiovascular system, Mechanical properties of Blood vessels, Blood flow, Physics of cardiovascular diseases, Prosthetic heart valves. Respiratory mechanics: Alveoli mechanics, Interaction of blood and lung, P-V curve of lung, Breathing mechanism, airway resistance, Physics of lung diseases. Soft tissue mechanics: Mechanical Properties, Structure, function and mechanical properties of skin, ligaments and tendons. Measuring principles of Cutometer, Durometer, Ballistometer. Orthopaedicmechanics: Mechanical properties of cartilage, Mechanical properties of bone, Kinetics and Kinematics of joints. Fundamental concepts of Gait analysis.

References:

1. Y.C. Fung, "*Biomechanics, Mechanical Properties Of Living Tissues*", Springer Verlag, Edition 2, 1993.
2. David O Cooney, "*Biomedical Engineering Principles*", Marcel Dekker, 1976.
3. Frederick H Silver, "*Biomaterials, Medical Devices And Tissue Engineering*", Chapman & Hall.
4. Peter Elsner, "*Bioengineering of the skin*", CRC Press, 2002.
5. Whittle & Michael W, *"Introduction to Gait analysis*", Butterworth Heinemann, 1997.

BME 322 PHYSIOLOGICAL CONTROL SYSTEMS[4-0-0-4]

Introduction tofeedbackcontrol systems, transfer functions, Block diagrams and simplification, Signal flow graphs, mechanical modeling,time domain analysis, Routh-Hurwitz criteria, Root Locus Techniques, Bode plots, Introduction to physiological control system, different regulations in the body, physiological system differential equations, modeling the body as compartments, Urea distribution model, the human thermal systems, heat productionand heat loss, Human eye tracking,pupil control system, Respiratory system, Cardiovascular system.

References:

1. Howard T Milhorn, "*The applications of control theory the physiological systems*", W B Saunders, 1966.
2. David O Cooney, "*Biomedical Engg. Principles*", Marcel Dekker, 1976.
3. Benjamin C Kuo, "*Automatic Control Systems*", Prentice Hall, Edition 7, 1997.
4. Joseph, Alan, Ivan J, "*Feedback and Control Systems*", McGraw Hill.

BME 324 ARTIFICIAL NEURAL NETWORKS[4-0-0-4]

Basics of Artificial Neural Networks: Introduction, Pattern and data, methods for pattern recognition tasks, Artificial neural networks: Terminology, Models of neurons, Topology.Activation and synaptic dynamics: Activation dynamic models, synaptic dynamic models, learning methods.Functional units of ANN for pattern recognition tasks: Pattern recognition problems, basic functional units. Feed forward neural networks: Analysis of pattern association networks, analysis of pattern classification networks.Feedback neural networks: Analysis of linear associative, FF Networks. Competitive learning neural networks: Components of competitive learning network, analysis of pattern clustering network.Biomedical applications of ANN: Modeling and diagnosing the cardiovascular system, Pattern recognizing of pathology images, ultrasound and magnetic resonance medical images textures analysis using ANN.

References:

1. B Yegnanarayana, "*Artificial Neural Networks*", Prentice Hall, 2001.
2. D L Hudson and M E Cohen, "*Neural Networks and Artificial Intelligence for Biomedical Engineering*", Prentice Hall, 2001.

BME 421 PATTERN RECOGNITION [4-0-0-4]

Pattern recognition system, Applications, Feature, Feature space, Class, Feature vector, Classifier, Classification and approaches, and Design cycle, Probability theory basics, Statistical decision making: Bayes theorem, Multiple features, conditionally independent features, Decision boundaries, unequal costs of error, Estimation of error rates, the leaving one-out technique, characteristic curves, and Estimating the composition of populations, Clustering: Hierarchial clustering, Agglomerative clustering algorithm, Single, Average and Complete linkage algorithms, Partitional clustering, K means, and Ward's algorithm, Artificial Neural Networks: Introduction, nets without hidden layers, Nets with hidden layers, the back propagation algorithm, Hopfield nets, Special networks, Applications: PR approach for biological signals (eg: ECG,EEG, etc), Blood sample image analysis, biometric systems, DNA analysis and other case studies.

References:

1. Earl Gose, Richard, Johnson baugh and Steve Jost, "*Pattern recognition and Image analysis*", Prentice Hall, 2002.
2. Schalkoff Robert J, "*Pattern recognition*", John Wiley, 1992.
3. Richchard O Duda,Peter E. Hart,David G.Strok,"*Pattern Classification",*Wiley edition, 2001.
4. S N Sivanandam, S Sumathi and S N Deepa, "*Introduction to Neural Networks using MATLAB 6.0*" ,TataMcGraw Hill 2006.

BME 423 HEALTH CARE MANAGEMENT [4-0-0-4]

Introduction: ABC of Hospital Administration, Principles of Management

Human Resources: Motivation, Time Management, Leadership and Supervision, Nursing Services, Effective Communication,Conflicts, Monitoring and Control, Public Relations, Medical Social Service department, Professional Hazards, Clinical Services: Indoor Services, Outpatient Department, Casualty and Emergency Wing, Intensive Care areas, Operating room and post-operative units, Support Services: Laboratories, Blood Bank, Radiology Services, Pharmacy, Central sterile supply department, Medical Record department, Materials Management, House keeping and maintenance, Linen and laundry, Dietary Services, Hospital Information system and computerization, Security and safety, Finance and Budget, Costing, Medical Ethics, Law and medical profession, Hospital acquired infections, Waste disposal, Quality assurance and medical audit, Disaster Management.

References:

1) PragnaPai, 'Effective Hospital Management' – National Series(Text Book)
2) Colonel (Retd) B.M.Sakharkar, 'Principles of Hospital Administration and Planning' (Jaypee Brothers)
3) C M Francis, "Hospital Administration", Jaypee Brothers Edition 2, 1995.
4) S L Goel, R Kumar, "Hospital Administration and Management, Vol 1,2,3", Deep & Deep.
5) Humble John W, "Management By Objectives in Action", McGraw Hill, 1970.

BME 425 ARTIFICIAL INTELLIGENCE[4-0-0-4]

Introduction to Artificial Intelligence - Architecture of Artificial Intelligence System-The AI Problems-AI Technique.**Problems & problem spaces**: State space search, Production systems, Control strategies, Searching the problem space, Problem characteristics ,Production system characteristics.**Problem solving methods: F**orward and Backward reasoning, Problem graph Matching, Weak methods, Search techniques using heuristic functions.**Knowledge representation:** Representation using predicate logic, Introduction to Predicalculus-Resolution. Resolution in prepositional and predicate Logic-Unification algorithm- Question Answering, Natural deduction, Knowledge representation using other logics, Structured representation of knowledge.**Game playing**: An Overview, Minimax search procedure- Alpha –Beta cutoffs-Additional refinements-Limitations**.**

Reference:

1. Elaine Rich, "*Artificial Intelligence*", McGraw Hill, Edition 2, 1991.
2. Charniak E, Mc Dermott D, "Introduction to Artificial Intelligence", Addison Wesley 1998.

BME 427 DATA MINING FOR BIOMEDICAL ENGINEERS [4-0-0-4]

Data mining :basics and concepts. Data preprocessing – motivation, dirty data, importance of preprocessing, measure of data quality, Mining data descriptive features, measuring data central tendencies, measuring dispersions, normal distributions, box plot analysis, histogram analysis, quartile plots (Q-plots). Data warehousing and OLAP technology - basics, DW vs. Heterogeneous DBMS, DW vs. Operaqtional DBMS, OLTP vs. OLAP, why separate DW, Tables, spreadsheets, data cubes, conceptual modelling of DW, Measuring data cubes.Classifications & predictions-concepts and necessities, classification vs. prediction, steps of classification, What is a cluster analysis? Clustering-an amalgamation of rich applications and multidisciplinary efforts, examples of clustering applications, Mining time-series data: concepts, principles and applications, categories of time-series movements, trend curve estimations, moving average, estimation of seasonal variations, similarity search in time-series analysis, data transformation – discrete fourier transform, Hidden Markov model: concept, Hidden Markov chain model, working principle and applications in biological data, Graph mining: introduction and concepts, importance of graph mining, graph pattern mining, graph mining algorithms, SUBDUE, WARMR, frequent subgraph mining approaches, properties of graph mining algorithms.

REFERENCES:

1. J. Han, M. Kamber. Data Mining Concepts and Techniques. Elsevier. ISBN 81-312-0535-5 [available at MIT library]
2. J. Han & Others. Data Mining. Elsevier. New Delhi India [available at MIT library].

BME 429EMBEDDED SYSTEMS [4-0-0-4]

Introduction to Embedded systems, processor and memory organization, Devices and buses for device networks, Device drivers and interrupts servicing mechanisms. Programming concepts, and embedded programming in C. Real Time Operating systems, and Serial and Parallel Buses. PIC Architecture and Instruction set, MPASM assembler and its usage, Analog-to-Digital Conversion, UART.

References:

1. Raj Kamal, "Embedded systems – Architecture, programming and Design" TaTa McGraw Hill, 4th Reprint 2008.
2. Frank Vahid and Tony Givargis, "Embedded system Design – a Unified Hardware/Software Introduction" Wiley India Pvt. Ltd.
3. Tim Wilmshurst, "An Introduction to the design of Small Scale Embedded Systems" Palgrave, NewYork 2003.
4. John B. Peatman, "Design with PIC Microcontrollers", first Edition, Pearson Education.

BME 330 BIOMEDICAL INSTRUMENTATION [3-0-0-3]

Study of Bio-electric signals & Electrodes, Transducers, Blood pressure & Blood flow measurements; Study of therapeutic equipments: Pacemakers, Haemodialyser, Lithotriptor, Anesthesia machine, Ventilator, Infusion pump, Infant Incubator; Study of Surgical devices: ESU, LASER & Endoscope; Cardiac-assist devices: Heart lung machine & Defibrillator; Study of Audiometer & Hearing-aids; Medical Imaging Systems: CT, MRI, Ultrasonography, Thermography & PET.

Reference Books:

1. R.S.Khandpur, ”Handbook of Biomedical Instrumentation” Tata McGraw Hill,1980.
2. Leslie Cromwell, et.al., ”Bio Medical Instrumentation”PHI,1990.
3. Geddes and Baker, ”Principles of Applied Bio-Medical Instrumentation”John Wiley,1989.
4. J.G.Webster, ”Medical Instrumentation, Application and Design” Houghton Miffin Co. Boston.
5. R. Aston,”Principles of Biomedical Instrumentation and Measurement” Merril Purl Co.1991.

BME 332 BIO-MECHANICS [3-0-0-3]

Introduction to biomechanics, Kinematic concepts for analyzing human motion, kinetic concepts for analyzing human motion, Linear and Angular Kinematics of human movement, Linear and Angular Kinetics of human movement. Application of Aerodynamics in Sports- Aerodynamic drag force, Effects of drag on the body and objects in sports, Aerodynamic Lift force, Effects of Lift on projected objects and the body, Lift force produced by Spin: The Magnus effect. Application of Hydrodynamics in swimming- Buoyancy and Floatation, Resistance and Propulsion, Resistive forces in swimming skills, propulsive forces in swimming skills, Swimming efficiency and Speed.

Reference books:

1. Duane Knudson, *Fundamental of Biomechanics*, Kluwer Academic/Plenum Publishers.
2. Ellen Kreighbaum, Katharine M Barthels, *Biomechanics-A QualitativeApproach for Studying Human Movement*Macmillion Publishing Company second edition.
3. Susan J. Hall, *Basic Biomechanics*.

BME 334 REHABILITATION ENGINEERING [3-0-0-3]

Introduction to rehabilitation engineering and assistive technology:principles of assistive technology assessment and rehabilitation engineering. Rehabilitation Engineering, Science and Technology: rehabilitation concepts, engineering concepts in sensory rehabilitation, motor rehabilitation and communication disorders.Orthopedic Prosthetics &Orthosis in Rehabilitation Technology: fundamentals of design of upper and lower extremity prosthetic and orthotic devices, applications.Mobility Aids: mobility aids for the blind, discussion of design and function of robotic aids, wheel chairs.Sensory Augmentation & Substitution: visual, auditory and tactile sensory augmentation & substitution.Conversion Aids for Non-vocal Physically Impaired Persons: characteristics of nonvocal physically impaired persons, design considerations for conversion aids, biofeedback in communicative disorders, artificial larynx.Principles and Applications of Electrical Stimulation: artificial electrical stimulation of nerves and muscles,applications. Conceptual frameworks, Education and Quality assurance.

References:

1. Joseph D Bronzino, "*The Biomedical Engineering handbook*", Volume II, CRC press, Edition 2, 2000.
2. John G. Webster, Albert M. Cook, Willis J. Tompkins, Gregg C. Vanderheiden, *"Electronic devices for Rehabilitation"*, Chapman and Hall Ltd, 1985.
3. John Enderle, Susan Blanchard, Joseph Bronzino, *"Introduction to Biomedical Engineering"*, Academic press, 2000.

BME336 PHYSIOLOGICAL SIGNAL PROCESSING [3-0-0-3]

Review of digital signals, systems, and transforms; linear filtering; elements of probability, random variables and random processes; correlation and power spectrum density (PSD); PSD estimation. The action potential, ENG, EMG, ECG, EEG, PCG, EGG, Speech signal, VMG, VAG, cardio-respiratory interaction, the knee-joint and muscle vibration signals, segmentation of the PCG into systolic and diastolic parts, random noise, structural noise and physiological interferences. ECG signal averaging, Data reduction techniques: Turning point algorithm, Huffman coding, ECG QRS detection, ECG interpretation.

References:

1. AV Oppenheim, Willskey and Young, Signal Analysis,
2. A. V. Oppenheim and R.W. Schafer, Digital Signal processing, Prentice Hall India Ltd, 1991.
3. Willis J Tompkins, " *Biomedical Digital signal Processing*" Prentice Hall India ltd , 2001.
4. Rangaraj M Rangayyan, "*Biomedical Signal Analysis – A case study"* John Wiley and Sons.

BME 402 INDUSTRIAL TRAINING /TOUR [0-0-3-1]

Students will undergo training/tour for a period of at least three weeks at reputed hospitals/concerns pertaining to the biomedical field. A report then has to be submitted, once the training is completed.

BME 499 PROJECT WORK / PRACTICE SCHOOL [0-0-0-20]

The project work is carried out in the institution/ hospital/ industry/ research laboratory or any other competent institutions.

The duration of project work should be a minimum of four months.

There will be a mid-semester evaluation of the project work done after about 2 months,. An interim project work is to be submitted to the department during the mid-semester evaluation. The mid-semester evaluation will be done by the department /project guides and will be out of 100 marks.

Each student has to submit to the department a project report in proper format after completing the work. The final evaluation and viva-voce will be after submission of the report.

Each student has to make a presentation on the work carried out, before the departmental committee for project evaluation, using OHP/ multimedia projects. The end semester evaluation will be done by the departmental committee including the guides. The final evaluation will be out of 300 marks, the break-up, which is as follows:

Project work evaluation (end semester evaluation):	200 marks.
Project work evaluation (mid semester evaluation):	100 marks.
Viva-Voce:	100 marks.
Total marks for the project work:	400 marks.