

3BM1 MATHEMATICS-III

UNIT 1: LAPLACE TRANSFORM: Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficients with special reference to the wave and diffusion equations.

UNIT 2: FOURIER SERIES & Z TRANSFORM: Expansion of simple functions in fourier series. Half range series, Change of intervals, Harmonic analysis. Z TRANSFORM - Introduction, Properties, Inverse Z Transform.

UNIT 3: FOURIER TRANSFORM: Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant co-efficient with special reference to heat equation and wave equation.

UNIT 4: COMPLEX VARIABLES: Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy's theorem. Cauchy's integral formula.

UNIT 5: COMPLEX VARIABLES: Taylor's series Laurent's series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.

3BM2 ELECTRONIC DEVICES & CIRCUITS

UNIT 1: SEMICONDUCTOR PHYSICS : Mobility and conductivity, charge densities in a semiconductor, Fermi Dirac distribution, carrier concentrations and fermi levels in semiconductor, Generation and recombination of charges, diffusion and continuity equation, Mass action Law, Hall effect.

UNIT 2: Junction diodes, Diode as a circuit element, load line concept, clipping and clamping circuits, Voltage multipliers. Construction, characteristics and working principles of UJT

UNIT 3: Transistor characteristics, Current components, Current gains: alpha and beta. Operating point. Hybrid model, h-parameter equivalent circuits. CE, CB and CC configuration. DC and AC analysis of CE, CC and CB amplifiers. Ebers-Moll model. Biasing & stabilization techniques. Thermal runaway, Thermal stability.

UNIT 4: JFET, MOSFET, Equivalent circuits and biasing of JFET's & MOSFET's. Low frequency CS and CD JFET amplifiers. FET as a voltage variable resistor.

UNIT 5: SMALL SIGNAL AMPLIFIERS AT LOW FREQUENCY : Analysis of BJT and FET, DC and RC coupled amplifiers. Frequency response, midband gain, gains at low and high frequency. Analysis of DC and differential amplifiers, Miller's Theorem. Cascading Transistor amplifiers, Darlington pair. Emitter follower, Source follower.

3BM3 ANATOMY AND PHYSIOLOGY

UNIT 1: Structure and function of cell, Basic tissues and their functions, structures of cardiovascular system, respiratory system, alimentary system, central nervous system reproductive system urinary system skeletal system, muscular system endocrine system,

UNIT 2: Skeleton, Anatomical position, terminology, region & planes Systemic anatomy (General) Organ of body Functional aspects of bones & joints Joint: Shoulder & elbow joint, radiolunar and wrist joints, joints of hand, hip joint, knee joint, ankle & foot, spine joint of neck. Lumbosacral joint: Vertebral column, mechanism of locomotion.

UNIT 3: Eye and ear, Introduction: Internal environment, homeostatic balance, positive and negative feedback, system, Physiology, survival needs (oxygen, water & food), metabolic activities (in brief). Eye – physiology of sight. Ear – Physiology of hearing and physiology of balance.

UNIT4: BLOOD: composition of blood, Blood cells and their function, blood group, coagulation blood transfusion

UNIT 5: DENTAL STRUCTURE AND FUNCTIONS: Mandible, dental Paranasal sinuses.

3BM4 ELECTRONIC MEASUREMENTS & INSTRUMENTATION

UNIT 1: THEORY OF ERRORS: Accuracy & precision, Repeatability, Limits of errors, Systematic & random errors Modeling of errors, Probable error & standard deviation, Gaussian error analysis, Combination of errors.

UNIT 2: ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS: Electronic Voltmeter, Electronic Multimeters, Digital Voltmeter, Component Measuring Instruments, Q meter, Vector Impedance meter, RF Power & Voltage Measurements. Measurement of frequency. Introduction to shielding & grounding.

UNIT 3: OSCILLOSCOPES: CRT Construction, Basic CRO circuits, CRO Probes, Oscilloscope Techniques of Measurement of frequency, Phase Angle and Time Delay, Multibeam, multi trace, storage & sampling Oscilloscopes. Curve tracers. Digital CRO.

UNIT 4: SIGNAL GENERATION: Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators. Signal Analysis - Measurement Technique, Wave Analyzers, Frequency - selective wave analyzer, Heterodyne wave analyzer, Harmonic distortion analyzer, Spectrum analyzer.

UNIT 5: TRANSDUCERS: Classification, Selection Criteria, Characteristics, Construction, Working Principles, Application of following Transducers- RTD, Thermocouples, Thermistors, LVDT, RVDT, Strain Gauges, Bourdon Tubes, Bellows. Diaphragms, Seismic Accelerometers, Tachogenerators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.

3BM5 BIOCHEMISTRY & HISTOLOGY

UNIT 1: Introduction to biochemistry: Water pH & buffer Atom & chemical bonds Biomolecules.

UNIT 2: Carbohydrate Protein Lipid Nucleic acid Enzymes, vitamins Hormones.

UNIT 3: Metabolism: Metabolic concepts. Applied biochemistry: biochemical techniques, biosignalling, and regulation of gene expression, protein targeting & degradation, genetic code, bioenergetics. Introduction to histology, classification of glands.

UNIT 4: Connective tissue: definition and classification of connective tissues. Embryological and adult forms of connective tissue, specialized connective tissue. Cartilage – structure and types.

UNIT 5: Histology of bone, blood cells, tissues, neural structures. Histology of systemic body parts.

3BM6 DATA STRUCTURES & ALGORITHMS

UNIT 1: PERFORMANCE MEASUREMENT: Space complexity and Time complexity, big oh, omega and theta notations and their significance. LINEAR LISTS : Array and linked representation, Singly & Doubly linked lists. Concept of circular and multiply linked lists.

UNIT 2: ARRAY & MATRICES: Row and Column Major mapping & representation, irregular 2D array, Matrix operations, Special matrices: diagonal, tridiagonal, triangular, symmetric. Sparse matrices representation and its transpose.

UNIT 3: STACKS: ADT, representation in array & linked lists, basic operation, Applications of stacks in parenthesis matching, towers of Hanoi etc. Queues - ADT, representation in array & linked lists, applications, circular queues.

UNIT 4: TREES: Binary Tree, representation in array & linked lists, basic operation on binary trees, binary tree traversal (preorder, postorder, in order). SEARCH TREES : Binary search tree, basic operation, Introduction to AVL tree and B-tree.

UNIT 5: GRAPHS: Representation of unweighted graphs, BFS, DFS Minimum Spanning Trees, Single Source Shortest Path. Sorting - Bubble sort, insertion sort, merge sort, selection sort, shell, quick sort, heap sort.

3BM7 ANATOMY AND PHYSIOLOGY LAB

Anatomy:

Through slide /demonstration and charts: -

1. Skeletal system- Appendicular and axial skeleton, Cranial structure
2. Special organs eye, ear, teeth
3. Muscular system, Gastrointestinal system, Respiratory system, Circulatory system, Renal system
4. Nervous system, Reproductive system.

Physiology

5. Microscopy – Blood (haemogram), RBC, WBC, HB, ESR, differential counts, identification of cells.
6. Kymograph – Recording of resting membrane potential, action potential-demonstration.
7. Muscle contraction and effect of drug – demonstration.
8. B.P. monitoring, blood group analysis, bleeding time, clotting time.
9. Visits to medical college.

3BM8 BIOCHEMISTRY & HISTOLOGY LAB

List of experiments (Biochemistry)

1. Preparation of solutions of different molarities and normalities., buffers of different pH
2. Qualitative tests for carbohydrates-Molich's test, Barford's rest etc.
3. Estimation of blood glucose by colorimetric method-total serum protein, gelatin test.
4. Quantitative analysis of caesin-milk protein. Determination of isoelectric point of casein.
5. Visit to Biochemistry laboratory of a major hospital or clinical laboratory.

List of experiments (Histology)

6. Study of compound microscope, its parts.
7. Demonstration/slide study of various epithelium, gland, fiber cells, cartilage and bone, pituitary gland, pineal gland, thyroid gland, parathyroid gland, adrenal gland, thymus gland, lymph node and spleen.
8. Histology of the muscular and nervous tissue lip, tooth, tongue, salivary glands esophagus & stomach
9. Demonstration/slides study of small intestine, large intestine, liver, pancreas, nasal cavity, trachea, bronchi & lungs, kidney, urinary bladder & urethra, artery, vein, heart.
10. Histology of testis, epididymis, vas deferens, penis, accessory sex glands. ovary, oviduct, uterus, vagina, mammary gland.

3BM9 ELECTRONICS LAB

1. Study the following devices: Analog & digital multimeters, Function/ Signal generators, Regulated d. c. power supplies (constant voltage and constant current operations)
2. Study of analog CRO, measurement of time period, amplitude, frequency & phase angle using Lissajous figures.
3. Application of diode as clipper and clamper.
4. Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, Reverse Saturation current and static & dynamic resistances.
5. Plot V-I characteristic of zener diode and study zener diode as voltage regulator.
6. Observe the effect of load changes and determine load limits of the voltage regulator.
7. Plot frequency response curve for single stage amplifier and to determine gain bandwidth product.
8. Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of I_{dss} & V_p
9. Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their h-parameters.
10. Study half wave rectifier and effects of filters on wave. Also calculate ripple factor.
11. Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.

3BM10 ELECTRONIC MEASUREMENT & INSTRUMENTATION LAB

1. Measure earth resistance using fall of potential method.
2. Plot V-I characteristics & measure open circuit voltage & short circuit current of a solar panel.
3. Measure unknown inductance capacitance resistance using following bridges
(a) Anderson Bridge (b) Maxwell Bridge
4. To measure unknown frequency & capacitance using Wein's bridge.
5. Measurement of the distance with the help of ultrasonic transmitter & receiver.
6. Measurement of displacement with the help of LVDT.
7. Draw the characteristics of the following temperature transducers:
(a) RTD (Pt-100) (b) Thermistors (c) Thermocouple
8. Draw the characteristics between temperature & voltage of a K type thermocouple.
9. Measurement of strain/ force with the help of strain gauge load cell.
10. Study the working of Q-meter and measure Q of coils.
11. To study the working of Spectrum analyzer and determine the bandwidth of different signals.

4BM1 BIOPHYSICS

UNIT 1: CHEMICAL BONDING: energies, forces and bonds, rates of reactions, transport processes.

UNIT 2: BODY FLUID: Properties of body fluid, determination of conduction of body fluid, measurement of EMF of cells, temperature and reaction rates: Arrhenius equation. Photochemical reaction, law of photochemistry, fluorescence and phosphorescence, Beer-Lambert's law, Jablonski diagram. Principles of colorimeter, spectrophotometer and spectrofluorimeter. Introduction to electrical bioelectrical properties: Impedance & current distribution, dielectric properties, of biological materials, skin impedance, total body impedance, impedance at high frequencies,

UNIT 3: BIOPHYSICAL ACTIVITY OF HEART: electrical activity of the heart, propagation of cardiac tissue, monophasic and biphasic recordings, original and propagation of excitation, refractoriness, regular and ectopic pacemakers.

UNIT 4: BIOPHYSICAL ACTIVITY OF BRAIN: electrical activity of brain, waveform and electroneurography, nerve conduction studies, Biophysical activity eyes; image construction and formation, electroretinography, electrooculography.

UNIT 5: BIOLOGICAL POLYMERS: Nucleic acids and proteins, DNA and RNA, biological membranes. Modern techniques of biophysics: X ray diffraction, Scanning Tunneling Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, IR spectroscopy Optical Tweezers.

UNIT 5: STANDARDS: BIS standards, ISO regulations, electrical safety and safety and regulation to keep the hospital environment safe, medical ethics.

4BM2 BIO MEDICAL INSTRUMENTATION-I

UNIT 1: Introduction to biomedical instrumentation: Concept of biomedical engineering, development of biomedical instrumentation, biometrics, sources, of biomedical signals, medical instrumentation system, physiological systems of body, general constraints in design of medical instrumentation systems.

UNIT 2: Bioelectric signals and electrodes: Origin of bioelectric signals, electrode theory, electrodes types and uses, electrical conductivity of electrical jellies, and creams, bioelectric potentials cresting & action potential, propagation of action potential.

UNIT 3: Transducer & Biomedical recording system: Introduction, transducers, transduction principles,, classification of transducers, biosensors, transducers for biomedical application. Basic recording system, general consideration of signal conditioners, preamplifiers, sources of noise in low level measurements, biomedical signal analysis techniques, signal processing techniques, writing and recording systems, biomedical recorders.

UNIT 4: Cardiovascular system and measurement: Heart and cardiovascular system; blood pressure; blood flow, heart sounds; cardiac monitor, measurement of blood pressure, blood flow and cardiac output, plethysmography.

UNIT 5: Electrocardiography, waveform and measurement, ECG in diagnosis, arrhythmias, flutter, fibrillation, phonocardiography, ballistocardiography.

4BM3 DIGITAL ELECTRONICS

UNIT 1: NUMBER SYSTEMS, BASIC LOGIC GATES & BOOLEAN ALGEBRA: Binary Arithmetic & Radix representation of different numbers. Sign & magnitude representation, Fixed point representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and vice-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion.

UNIT 2: DIGITAL LOGIC GATE CHARACTERISTICS: TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET. Interfacing logic families to one another.

UNIT 3: MINIMIZATION TECHNIQUES: Minterm, Maxterm, Karnaugh Map, K map upto 4 variables. Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions. Variable mapping. Quinn-Mc Klusky minimization techniques.

UNIT 4: COMBINATIONAL SYSTEMS: Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders. BCD adder. Binary multiplier. Decoder: Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, demultiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers.

UNIT 5: SEQUENTIAL SYSTEMS: Latches, flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops. Counters: Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications. Registers: buffer register, shift register.

4BM4 TRANSDUCERS IN INSTRUMENTATION

UNIT 1: Role of transducers in Instrumentation - Transducer construction, classification and characteristics, analogue and digital transducers, Principle of operation and characteristics of transducers for measurement of displacement, strain, velocity, acceleration, torque etc. Potentiometric, LVDT, strain gauge, capacitance gauge, piezoelectric transducers and accelerometers.

UNIT 2 : Principle of operation and characteristics of transducers for measurement of pressure and force, Pirani gauge, ionization gauge, LVDT, strain gauge as pressure sensing device, force summing devices like bourden tube, bellows, diaphragms etc.

UNIT 3 : Principle of operation and characteristics of transducers for temperature transduction, bimetallic thermometer, resistance thermometer, Radiation and optical pyrometers. Transducers for Measurement of humidity and moisture. Sensors for measurement of pH, Thermal conductivity and Thickness.

UNIT 4 : Principle of operation and characteristics of transducers for measurement of flow and level. Turbomagnetic, Electromagnetic and other flowmeters. Various methods of level measurements, ultrasonic level gauge.

UNIT 5: Electronic Display: principle of LED matrix and alpha numeric displays, gas discharged plasma panels, flat panel CRT, LCD, electro-luminiscent and electrophoretic displays.

4BM5 ANALOG COMMUNICATION

UNIT 1: INTRODUCTION: Noise effects in Communication System, Resistance Noise, Noise in Reactive Circuits, Noise Figure & Noise Temperature in cascaded Circuits. Basic component of communication systems. Comparison of analog and digital communication.

UNIT 2: AMPLITUDE MODULATION: Need of modulation, Frequency spectrum of AM wave. Power relations. Single side band and vestigial side band techniques. ANGLE MODULATION - Mathematical representation and freq. spectrum of FM and PM, Comparison of AM, FM and PM, Pre-emphasis & D-emphasis.

UNIT 3: DEMODULATION & RADIO RECEIVERS: Basic concepts of AM & FM demodulation, Sensitivity, Selectivity, Image Frequency, Double Spotting, AGC of Receiver, TRF & Superhetrodyne radio receivers, AM & FM Receivers..

UNIT 4: TRANSMISSION LINE: Types of Transmission line equation, Equivalent circuit, Losses in TL. Reflection & SWR of line with different types of terminations. Distortion less line. Characteristic impedance. Line terminated with any impedance. Voltage and current at any point in a line. Coaxial cables. Measurement of parameter-Attenuation, Reflection Co-efficient and SWR of line.

UNIT 5: BROAD BAND COMMUNICATION & RADAR: Basic concepts & block diagram of satellite communication, fiber optical communication, mobile communication & Radar.

4BM6.1 OBJECT ORIENTED PROGRAMMING

UNIT 1 : OOP FUNDAMENTALS: Concept of class and object, attributes, public, private and protected members, derived classes, single & multiple inheritance,

UNIT 2 : PROGRAMMING IN C++: Enhancements in C++ over C, Data types, operators and functions. Inline functions, constructors and destructors. Friend function, function and operator overloading. Working with class and derived classes. Single, multiple and multilevel inheritances and their combinations, virtual functions, pointers to objects. Input output flags and formatting operations. Working with text files.

UNIT 3 : JAVA: Variation from C++ to JAVA. Introduction to Java byte code, virtual machine, application & applets of Java, integer, floating point, characters, Boolean, literals, and array declarations.

UNIT 4 : OPERATORS AND CONTROL STATEMENTS: Arithmetic operators, bit wise operators, relational operators, Boolean logic operators, the assignment operators, ?: operators, operator precedence. Switch and loop statements.

UNIT 5: PACKAGE AND INTERFACES: Packages, access protection, importing & defining packages. Defining and implementing interfaces.

4BM6.2 ELECTROMAGNETIC FIELD THEORY

UNIT 1: INTRODUCTION: Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's & Stoke's theorems.

UNIT 2: ELECTROSTATICS: Electric field intensity & flux density. Electric field due to various charge configurations. The potential functions and displacement vector. Gauss's law. Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field mapping and concept of field cells.

UNIT 3: MAGNETOSTATICS: Magnetic field intensity, flux density & magnetization, Faraday's Law, Bio-Savart's law, Ampere's law, Magnetic scalar and vector potential, self & mutual inductance, Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cells.

UNIT 4: TIME VARYING FIELDS: Displacement currents and equation of continuity. Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflection & refraction of UPW, standing wave ratio. Pointing vector and power considerations.

UNIT 5: RADIATION & EMI AND EMC: Retarded Potentials and concepts of radiation, Radiation from a small current element. Radiation resistance: Introduction to Electromagnetic Interference and Electromagnetic compatibility, EMI coupling modes, Methods of eliminating interference, shielding, grounding, conducted EMI, EMI testing: emission testing, susceptibility testing.

4BM6.3 MATHEMATICS -IV

UNIT 1: NUMERICAL ANALYSIS - Finite differences – Forward, Backward and Central differences. Newton's forward and backward differences, interpolation formulae. Stirling's formula, Lagrange's interpolation formula.

UNIT 2: NUMERICAL ANALYSIS- Integration-Trapezoidal rule, Simpson's one third and three-eighth rules. Numerical solution of ordinary differential equations of first order - Picard's method, Euler's and modified Euler's methods, Milne's method and Runge-Kutta fourth order method.

UNIT 3: SPECIAL FUNCTIONS – Bessel's functions of first and second kind, simple recurrence relations, orthogonal property of Bessel's , Transformation, Generating functions, Legendre's function of first kind. Simple recurrence relations, Orthogonal property, Generating function.

UNIT 4: STATISTICS AND PROBABILITY - Elementary theory of probability, Baye's theorem with simple applications, Expected value, theoretical probability distributions-Binomial, Poisson and Normal distributions. Lines of regression, co-relation and rank correlation.

UNIT 5: CALCULUS OF VARIATIONS - Functional, strong and weak variations simple variation problems, the Euler's equation.

4BM7 HUMANITIES AND SOCIAL SCIENCE

UNIT 1: INDIA: Brief History of Indian Constitution- framing, features, fundamental rights, duties, directive principles of state. History of Indian national movement, Socio economic growth after independence.

UNIT 2: SOCIETY: Social Groups- Concepts and types, socialization- concept and theory, social control; concept, social problem in contemporary India, status and role.

UNIT 3: THE FUNDAMENTALS OF ECONOMICS : Meaning, definition and importance of economics, Logic of choice, Central Economic Problems, Positive and Normative approaches, economic systems- socialism and capitalism.

UNIT 4: MICROECONOMICS: Law of demand and supply, Utility approach, Indifference curves, Elasticity of demand & supply and applications, Consumer surplus, Law of returns to factors and returns to scale.

UNIT 5: MACROECONOMICS: Concept relating to national product-National income and its measurement, Simple Keynesian theory, Simple multiplier, Money and banking, Meaning, Concept of international trade, Determination of exchange rate, Balance of payments. Characteristics of Indian Economy.

4BM8 DIGITAL ELECTRONICS LAB

1. To study and perform the following Operation of digital multiplexer and demultiplexer, Binary to decimal encoder Characteristics of CMOS integrated circuits.
2. To study and perform experiment- Compound logic functions and various combinational circuits based on AND/NAND and OR/NOR Logic blocks.
3. To study and perform experiment -Digital to analog and analog to digital converters.
4. To study and perform experiment- Various types of counters and shift registers.
5. To study and perform experiment - Interfacing of CMOS to TTL and TTL to CMOS ICs.
6. To study and perform experiment- BCD to binary conversion on digital IC trainer.
7. To study and perform experiment -
(a) Astable (b) Monostable (c) Bistable Multivibrators and the frequency variation with different parameters, observe voltage waveforms at different points of transistor.
8. To study and perform experiment -Voltage comparator circuit using IC-710.
9. To study and perform experiment- Schmitt transistor binary circuit.
10. Design 2 bit binary up/down binary counter on bread board.

4BM9 BIOMEDICAL INSTRUMENTATION LAB- I

List of experiments

1. To study the construction and characteristics of various types of electrodes & their usage.
2. To study the construction and characteristics of various types of sensors and transducers and their application.
3. To study the various types of biomedical instruments and their applications ECG, EEG recorders, Cardio scope b.
4. To study Patient monitoring system and its application
5. Respiratory gas analyzer
6. To study biochemical instruments Colorimeter, Spectrophotometer, Automatic biochemical analyzer
7. Estimation and analysis of physiological fluids: urine, blood, serum and CSF.
8. Measurement & analysis of blood pressure, blood flow, and cardiac out put and their analysis.

4BM10 COMMUNICATION ENGINEERING LAB

1. Harmonic analysis of a square wave of modulated waveform.
2. Observe the amplitude modulated waveform & measure modulation index. Demodulation of the AM Signal.
3. To modulate a high frequency carrier with sinusoidal signal to obtain FM signal Demodulation of the AM Signal.
4. To observe the following in a transmission line demonstrator kit.
 - i. The effect of losses in Transmission line.
 - ii. Transmission with standing waves on a Transmission line.
 - iii. The resonance characteristics of half wave length long x-mission line.
5. To study & observe the operation of a super hetrodyne receiver.
6. To modulate a pulse carrier with sinusoidal signal to obtain PWM signal & demodulate it.
7. To modulate a pulse carrier with sinusoidal signal to obtain PPM signal & demodulate it.
8. To observe pulse amplitude modulated waveform & its demodulation.
9. To observe the operation of a PCM encoder & decoder. To consider reason for using digital signal x-missions of analog signals.
10. Produce ASK signals, with and without carrier suppression. Examine the different process required for demodulation in the two cases.
11. To observe the FSK wave forms & demodulate the FSK Signals based on the properties of (a) A tuned circuits (b) on a PLL.

5BM1 SIGNAL AND SYSTEMS

UNIT 1: INTRODUCTION: Continuous time and discrete time systems, Properties of systems. Linear time in variant systems - continuous time and discrete time. Properties of LTI systems and their block diagrams. Convolution, Discrete time systems described by difference equations.

UNIT 2: FOURIER SERIES REPRESENTATION OF SIGNALS: Fourier series representation of continuous periodic signal & its properties, Fourier series representation of Discrete periodic signal & its properties, Continuous time filters & Discrete time filters described by Diff. equation.

UNIT 3: FOURIER TRANSFORM: The continuous time Fourier transform for periodic and aperiodic signals, Properties of CTFT. Discrete time Fourier transform for periodic and aperiodic signals. Properties of DTFT. The convolution and modulation property.

UNIT 4: Z-TRANSFORM & LAPLACE TRANSFORM: Introduction. The region of convergence for the Z-transform. The Inverse Z-transform. Two dimensional Z-transform. Properties of Z transform. Laplace Transform, Properties of Laplace Transform, Application of Laplace transform to system analysis.

UNIT 5: SAMPLING: Mathematical theory of sampling. Sampling theorem. Ideal & Real sampling. Interpolation technique for the reconstruction of a signal from its samples. Aliasing. Sampling in freq. domain. Sampling of discrete time signals.

5BM2 LINEAR INTEGRATED CIRCUITS

UNIT 1 : OPERATIONAL AMPLIFIERS: Basic differential amplifier analysis, Single ended and double ended configurations ,Op-amp configurations with feedback, Op-amp parameters, Inverting and Non-Inverting configuration, Comparators, Adder.

UNIT 2 : OPERATIONAL AMPLIFIER APPLICATIONS:

Integrator, Differentiator, Voltage to frequency & Frequency to voltage converters. Oscillators: Phase shift, Wien bridge, Quadrature, square wave, triangular wave, sawtooth oscillators. Voltage controlled oscillators.

UNIT 3 : ACTIVE FILTERS: Low pass, high pass, band pass and band reject filters, All pass filter, Switched capacitor filter, Butterworth filter design, Chebyshev Filter design.

UNIT 4 : PHASE-LOCKED LOOPS: Operating Principles of PLL, Linear Model of PLL, Lock range, Capture range, Applications of PLL as FM detector, FSK demodulator, AM detector, frequency translator, phase shifter, tracking filter, signal synchronizer and frequency synthesizer, Building blocks of PLL, LM 565 PLL.

UNIT 5 : LINEAR IC's: Four quadrant multiplier & its applications, Basic blocks of linear IC voltage regulators, Three terminal voltage regulators, Positive and negative voltage regulators. The 555 timer as astable and monostable multivibrators. Zero crossing detector, Schmitt trigger.

5BM3 BIOMEDICAL INSTRUMENTATION- II

UNIT1: MEDICAL RECORDING INSTRUMENTS: Recording System: Basic recording system, General consideration for Electronic recorder amplifiers, Ultraviolet recorder, Electrostatic recorder, Thermal array recorder, Instrumentation Tape recorder. X-Y recorder Medical oscilloscope.

UNIT2: PATIENT MONITORING SYSTEM: System concepts, Heart rate Meter & Alarm. Respiration rate meter, Blood pressure meter, temperature indicator. Foetal Mentoring System: - Cardiotacography Method Foetal heart Rate (FHR) measurement.

UNIT3: PHYSIOTHERAPY & ELECTROTHERAPY EQUIPMENT: Short wave diathermy machine microwave diathermy machine Ultrasonic therapy Unit. Pain relief through electrical stimulation.

UNIT4: ANALYTICAL EQUIPMENTS: Blood gas analyzer, Blood pH measurements, Measurement of Blood PCO₂ & PO₂. Blood cell counters: Method of cell counting coulter counters, Differential counting cell. Impedance Plethysmography & Electrical safety.

UNIT5: PULMONARY FUNCTION ANALYZER: Pulmonary Function Measurement, Spirometry, Pulmonary Function Analyzer, Respiratory Gas Analyzer

5BM4 BIOMATERIALS AND COMPONENTS

UNIT1: INTRODUCTION TO DIFFERENT TYPES OF BIOMATERIALS: Polymers, Plastics, Metallic and Ceramic Materials, Carbon and Polymers, Absorbable and Porous Biomaterials. Surface chemistry of biomaterials, thermal and chemical phenomenon, and piezoelectric effect.

UNIT2: MECHANICAL PROPERTIES AND TESTS: For elasticity, plasticity, inelasticity, desolation, deformation and fracture

UNIT3: POLYMER AND PLASTICS: Classification, thermal properties, factor influencing polymer properties. Polymer compatibility, polymer degradation, restorable polymers, tissue adhesives, dialysis membrane, sutures

UNIT4: METALLIC AND CERAMIC BIOMATERIALS: Properties and use to titanium alloys stainless steel, cobalt based alloys, degradable ceramics Carbon and polymeric biomaterials: Carbon, polythene, polypropylene, silicones rubber, acrylic implants, hydro gels.

UNIT5: DENTAL IMPLANTS: Alveolar bone replacements, orthopedic implants – types of orthopedic function devices, permanent joint replacements, hip joints, bone cement, biological testing of biomaterials

5BM5 MICROPROCESSOR

UNIT 1: INTRODUCTION: 8085 Microprocessor Architecture and Operations. Memory, Input/Output, Buffers, Encoders, Latches. Internal Data Operations, Registers, Pins and Signals, Memory Organisation. CISC and RISC architecture overview

UNIT 2: 8085 MICROPROCESSOR INSTRUCTION: Data Transfer, Arithmetic, Logic, Branch Instructions. Additional 16 Bit arithmetic instructions. Programming techniques. Looping, Counting, Indexing.

UNIT 3: 8085 MICROPROCESSOR INTERFACING: Basic interfacing Concepts, Interfacing Output Displays, Input Keyboards, and Interfacing Memory 8085 Interrupts.

UNIT 4: INTERFACING PERIPHERAL: Interfacing Data Converters, 8155, 8355 Programmable Devices, 8279 Programmable Keyboard/Display Interface.

UNIT 5: PROGRAMMABLE PERIPHERALS DEVICES: 8255 Programmable peripheral interface, 8253 Programmable interval timer, 8259 Programmable interrupt controller, 8257 DMA controllers, Basic concepts in serial I/O.

5BM6.1 INTELLECTUAL PROPERTY RIGHTS (IPR)

UNIT 1 Patent Claims and Legal decision-making process: Brief Study

UNIT 2: Importance of IPR Patentable subject matter, Novelty and Public Domain.

UNIT 3: Intellectual Property Right and Developing World, Intellectual Property Management, Case studies- Basmati rice, Neem

UNIT 4: International conventions and Treaties (WIPO), patenting a biological material

UNIT 5: Introduction of Patents and patent application process (national and International), Trade Secrets, Copy Rights, Geographical Indicators, Trade Marks, PBR in UPOV, GATT and TRIPS.

5BM6.2 HOSPITAL ENGINEERING & MANAGEMENT

UNIT 1: 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, and cleaning, sterilizing, laundry, storage and operation theatre systems. Philosophy. Design of wards, intensive care units, theatre etc. Management of services in clinical, OPD, Causality, Operation theatre, Radiology, Central labs, Blood banks etc.

UNIT 2: 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.

UNIT 3: Basics of air conditioning and refrigeration systems for small and large areas. Air changes, filtering and sterility, deodorization and disinfections and dehumidification. Principles and techniques of sterilization Sterilizing systems, Steam, formaldehyde & EO sterilization. Specification & working of Cryogenic systems for hospitals.

UNIT 4: 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. Operation theatre lighting, operating tables, wheel chairs & stretchers.

UNIT 5: Costing and financial planning of hospital systems. Preparation of estimates, specifications, tender details etc. Planning of biomedical engineering (BME) department, 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.

5BM6.3 OPTIMIZATION TECHNIQUES

UNIT 1: INTRODUCITON - Introduction, Engineering applications of optimization, Statement and Classification of optimization problems, Single variable and multivariable optimization with and without constraints.

UNIT 2: LINEAR PROGRAMMING – Formations of Linear Programming, Problem, Graphical approach, General Linear Programming Problem, Simplex Method, duality in Linear Programming and Transportation Problems.

UNIT 3: PROJECT SCHEDULING – Project scheduling by PERT and CPM. Network Analysis.

UNIT 4: SEQUENCING THEORY – General sequencing problems – N-Jobs through 2 machines and 3 machines & 2-Jobs through M-machines.

UNIT 5: DYNAMIC PROGRAMMING – Introduction, Principles of optimality, Formulation and solution of Dynamic Programming problems, Traveling salesman's problems. Applications to Transportation problems and Linear programming problems.

5BM7 ANALOG ELECTRONICS LAB

To design the following circuits, assemble these on bread board, test them and make measurements.

- 1) Study of op-amp in inverting and non-inverting modes.
- 2) Use of op-amp as scalar, summer and voltage follower.
- 3) Use of op-amp as differentiator and integrator.
- 4) Study op-amp characteristics and get data for input bias current, measure the output-offset voltage and reduce it to zero and calculate slew rate.
- 5) Active filters using op-amp 741. (i) Band pass (ii) Band reject
- 6) Astable (ii) Monostable (iii) Bistable multivibrators using IC-555 timer
- 7) Triangular & square wave generator using 555 timer.
- 8) Audio amp, using bipolar junction transistor.

5BM8 BIOMEDICAL INSTRUMENTATION LAB-II

- 1) Measurement of Blood pressure.
- 2) Study of various Transducers.
- 3) Study & design of Instrumentation Amplifies.
- 4) Study of ECG Machine.
- 5) Study of EMG Machine.
- 6) Study of EEG Machine.
- 7) Study of various stimulators: Nerve and Muscle stimulators, Ultrasonic stimulator, Electrosurgical stimulator, Functional electrical stimulator
- 8) Study of Spirometry, Plathysmograph
- 9) Servicing of circuit boards of biomedical instrument.

5BM9 MICROPROCESSOR LAB

1. Study the hardware, functions, memory structure and operation of 8085 microprocessor kit.
2. Program to perform integer division: (i) 8-bit by 8-bit (ii) 16-bit by 8-bit.
3. Transfer of a block of data in memory to another place in memory in the direct and reverse order.
4. Searching a number in an array and finding its parity.
5. Sorting of array in: (i) Ascending (ii) Descending order
6. Programme to perform following conversion: (i) BCD to ASCII (ii) BCD to Hexadecimal
7. Programme to multiply two 8-bit numbers.
8. Programme to generate and sum 15 fibonacci numbers.
9. Programme for rolling display of message "INDIAN".
10. To insert a number at correct place in a sorted array.
11. Serial and Parallel data transfer on output port 8155 & 8255 & designing of disco light, running light, and sequential lights on off by above hardware.
12. Generation of different waveform on 8253/ 8254 programmable timer.

5BM10 TRANSDUCER LAB

1. To draw the characteristics of following temperature transducers:
(a) PT 100 (b) Thermistor (c) Thermocouple
2. Load Cell Kit.
(a) To perform experiment and plot curve between load and strain.
(b) To study about excitation.
(c) To plot error curve at different loads.
3. To study Piezo electric vibration pickup.
4. LVDT
a) To study excitation and balancing network.
b) To study phase difference.
c) To plot curve between displacement and output voltage.
5. Torque measurement
(a) To study about unbalanced strain.
(b) To plot the curve between torque vs strain.
6. To draw characteristics of speed vs voltage on various transducers (For e.g. Magnetic pickup, Hall effect, Inductive pickup,).
7. To draw characteristics of LDR.
8. To Draw characteristics of variable capacitance type transducer.
9. To draw characteristics of variable Inductance type transducer.
10. To study various pressure sensors like Bourdon tube, Diaphragms, Pressure switches, bellows etc.

6BM1 BIOINFORMATICS

UNIT 1: BIOINFORMATICS: Objectives of Bioinformatics; Data integration; Data Analysis; Bioinformatics databases and tools; Molecular approach versus Bioinformatics approach; Overview of Bioinformatics application.

UNIT 2: MOLECULAR BIOLOGY AND INFORMATION: Basic chemistry of nucleic acids; Structure of DNA; Genes-The functional elements in DNA; DNA sequencing and Polymerase chain reaction; Cloning methodology; Amino acids; Protein structure; Protein folding; Protein function.

UNIT 3: SEQUENCE ALIGNMENT: Introduction to Sequence Analysis; Models for sequence analysis and their Biological motivation; Methods of alignment; usage of gap penalties and Scoring matrices; Tools for sequence alignment; Tools for multiple sequence alignment; Applications of Multiple alignment.

UNIT 4: GENE MAPPING AND GENE EXPRESSION: Applications of Gene mapping; DNA sequencing; DNA micro arrays; Algorithms for gene alignment; Gene prediction tools; Tools for DNA/RNA structure and function analysis.

UNIT 5: MEDICAL TRANSCRIPTION: Understanding Medical Terminology; Basics of Document Formatting; Advanced Formatting; Organization of the Data; Working with Multiple page documents; Drawing tools; Advanced tools and effects; Advanced Word processing; Enhancing Documents with Graphics.

6BM2 CLINICAL SCIENCE AND ENGINEERING

UNIT 1: CARDIOLOGY: Heart lung machines, Application, Clinical significance, CPV and SWAN catheters fibrillation Atrial, ventricular, Application of cardiac assist devices cardiac catheterization echocardiography cine angiography, treadmill Ergo meter, Applications clinical significance open heart surgery grafts, bypass surgery instruments used for open heart surgery.

UNIT 2: ANESTHESIOLOGY: Basic physical principles and their applications in anesthesia and intensive care. Description of general and regional anesthetic techniques fundamentals to the practice of anesthesia before describing the anesthesia machine.

UNIT 3: ENT: Anatomy of ear central connection. Mechanics of hearing and equilibrium. Auditory receptors and genesis of different potential changes in the internal ear. Audiometer. Principles of equipment & technique of audiometry including floera and impedance, Hearing aids, Electronystography. Brief introduction to cochlear implant.

UNIT 4: OPHTHALMOLOGY: Physiology of Eye, Snellens Chart, keratometer, Reflectometer, Colour Vision, Ophthalmoscope, Retinoscope

UNIT 5: NEPHROLOGY: Acute Renal Failure, Hematuria, Scintigraphy, Principle of Lithotripsy.

6BM3 TELEMEDICINE

UNIT 1: INTRODUCTION: General and operational communication: meaning & significance of telemetry, Remote control and remote signaling/supervision. Messages and signals, signal formation, conversion and transmission.

UNIT 2: SIGNAL TRANSMISSION AND TRANSMISSION MEDIA: Physical and radio links, communication lines. Noise in transmission channels, reliability and efficiency of transmission; Multiplexing: time division and frequency division multiplexing, modulation and demodulation sinusoidal and pulse modulation techniques, frequency, bandwidth and transmitter power considerations.

UNIT 3: TELEMETRY: Telemetry errors, proximity and remote action telemetry systems, analog and digital telemetry, short range radio telemetry, intensity telemetry systems-current intensity, voltage intensity and ratio systems; a.c. telemetry systems-freq. And phase systems, pulse telemetry systems-pulse freq., phase and duration systems, digital telemetry: sampling and quantization, encoding decoding, synchronization pulse code systems, error detecting and errors correcting codes.

UNIT 4: REMOTE CONTROL & REMOTE SIGNALING: Principles of independent messages and combinations (coding) for formation of signals; Disposition of remote stations; Remote control and remote signaling systems; Multiwire, Frequency division and time division systems.

UNIT 5: COMPUTER APPLICATIONS AND BIOTELEMETRY: Real time computer application, data acquisition and processing, remote data recording and management, Mobile Health care Van

6BM4 DATA BASE MANAGEMENT SYSTEM

UNIT 1: NEED, PURPOSE AND GOALS OF DBMS: Three scheme architecture. Introduction to Relation data model, relational algebra.

UNIT 2: DATABASE DESIGN: Conceptual Data Base design. Theory of normalization Primitive and composite data types, concept of physical and logical databases, data abstraction and data Independence, data aggregation. relational calculus. SQL: DDL and DML. Constraints assertions, views data base security. Data models-ER and object oriented models.

UNIT 3: APPLICATION DEVELOPMENT USING SQL: Host language Interface, embedded SQL programming, 4 GL's, Forms management and report writers. Stored procedures and triggers.

UNIT 4: INTERNAL OF RDBMS: Physical data organization in sequential, indexed, random and hashed files. Inverted and multilist structures. Query optimization. Join algorithm, statistics and cost base optimization.

UNIT 5: TRANSACTION PROCESSING: concurrency control and recovery management. Transaction model properties and state serialisability. Lock base protocols, two phase locking.

6BM5 MICROCONTROLLER AND EMBEDDED SYSTEM

UNIT 1: THE 8051 MICROCONTROLLER: Introduction, The 8051 microcontroller hardware, I/O pins, Port, External memory, Counters and Timers, Serial data. Interrupts.

UNIT 2: 8051 ASSEMBLY LANGUAGE PROGRAMMING: Addressing modes, External data moves, push and pop opcodes, Logical operations, Byte level and bit level logical operations. Arithmetic operations, Jump and call instructions, Interrupts & returns.

UNIT 3: REAL TIME CONTROL: Interrupts, Multiple sources of interrupts, Non maskable sources of interrupts, Interrupt structure in 8051, Timers, Free running counter & Real Time control .

UNIT 4: SYSTEM DESIGN: Serial I/O interface, Parallel I/O ports interface, Digital and Analog interfacing methods, LED array, keyboard, Printer, Flash memory interfacing.

UNIT 5: INTRODUCTION TO EMBEDDED SYSTEM: Application of Microcontrollers in interfacing, Robotics, MCU based measuring instruments. Real Time Operating System for System Design, Multitasking System, Task Definition in a Multitasking System, Round Robin Scheduling, Full Pre-emptive Scheduling, Basic study and Features of Commercial RTOS : WINCE and Embedded Linux.

6BM6.1 MEDICAL SAFETY AND WASTE MANAGEMENT

UNIT 1: Electrical and radiation hazards. Electrical Shock and treatment and safety. high voltage and transient properties, patient safety, electrical shocks and hazards, leakage currents, types and measurement, protection against shocks, burn and explosion hazards, measurement of bioelectric fields, extra cellular fields.

UNIT2: Radiation detector system, counting radioactivity, biological effect of radiation, radiation dosimetry

UNIT 3: Radiation waste disposal techniques, medical waste disposal, degradable and biodegradable wastes. RF hazards and Microwave Hazards.

UNIT 4: Clean room technology, Air filtration techniques, water systems for waste management

UNIT 5: Recycle of medical waste products its advantages and disadvantages, Sterilization techniques.

6BM6.2 BIOSTATISTICS

UNIT 1: Sets of numbers, significant figures and decimal places, laws of indices trigonometric ratios, inverse trigonometric functions, sequences and series, AP, GP and HR Binomial theorem for integral and genial index polynomials functions, limits, elementary differentiation and integration, logarithmic and exponential series, Descriptive statistics, experimental design, ANOVA, multiple comparisons, factorial experiments.

UNIT 2: Poisson distributions and their applications in biology, Positive and negative correlation and calculation of Karl Pearson's coefficient of correlation. Linear regression equations. Prediction of an unknown variable using regression equation.

UNIT 3: Correlation, regression analysis of variance and non-parametric tests, Use of computer packages for data analysis. Descriptive statistics, Gaussian probability models, point and interval estimation for means and proportions.

UNIT 4: Hypotheses testing including test and chi-square tests, regression and correlation techniques, one way and two analysis of variance. Analysis of variance and multiple regressions for biotechnological data estimation, testing, prediction underlying assumptions, model selection, application

UNIT 5: Analyzing categorical data emphasizes log linear models and interference from observational data methods and applications of logistic regression and survival analysis including Cox's proportional hazards model

6BM6.3 CARDIOVASCULAR INSTRUMENTATION

UNIT 1: CARDIAC CATHETERIZATION TECHNIQUE: Heart function monitoring, Types of Catheters, Swan-Ganz catheter, arterial blockage treatment.

UNIT 2: Angiography and Angioplasty (PTCA and PTMC), risk and complications

UNIT 3: COLOR DOPPLER: Block Diagram, Working Principle, and applications, Echocardiography, Color Doppler

UNIT 4: HEART LUNG MACHINE: Block Diagram, Working Principle, and applications in open heart surgery

UNIT 5: C-ARM: Block Diagram, Working Principle and application in cardiology.

6BM7 MICROPROCESSOR & MICROCONTROLLER LAB

1. Using assembly programme check whether a given string is a palindrome or not.
2. Write a program to reverse a given string, the string is stores in the data segment.
3. Write a program to count 0 to 20H with a delay of 100 ms between each count.
4. Write a program to convert a 4 digit decimal number to its binary equivalent using a procedure for dividing a number by two.
5. Define a macro `SQUARE' that calculates square of a number.
6. Write a program to display message `Study of microprocessors is interesting,
Programs based on 8051 .
7. Implement given boolean function using 8051.
8. Interface 8 bit ADC with microcontroller.
9. Generate a square wave with 50% duty cycle by using data transfer and branching instructions.
11. Configure timer of 8051 for preliminary studies of a timer.

6BM8 CLINICAL SCIENCE LAB

1. Visit to hospital clinical chemistry lab. Operation of auto analysis, Spectrophotometer, Flame photometer
2. Study of different equipments : ECG recorder, PMS,
3. Ultrasonic fetal monitor, pulse oximeter, respiratory gas analyzer, audiometer, cardioscope etc.,
4. Estimation of constituents of physiological fluids (urinary blood, serum, CSF)
5. Study and operation of various pacemakers, DC defibrillators,
6. Heart-lung machine, hypothermia unit.
7. Blood oxygenator, electrolyte analyzer
8. ICU visit and study of different monitors

6BM9 INTRODUCTION TO GOOD LABORATORY PRACTICE

1. Introduction to GLP
2. Fundamental points of GLP. Brief study of Recourses, Rules, Characterization,
3. Rules for conduct of studies, Plan, Protocol,
4. Standard Operating Procedures (SOPs)
5. Documentation
6. Quality Assurance
7. Monitoring process
8. Application of GLP principles in drug development and Biomedical Engineering

6BM10 ELECTRONIC WORKSHOP & PCB LAB

1. Winding Shop: Step down transformer winding of less than 5VA
2. Soldering Shop: Fabrication of DC unregulated power supply.
3. Artwork & Printing of a Simple PCB
4. Etching & drilling of PCB
5. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet
6. Testing and fabrication of power supply using voltage regulator.
7. Breadboard implementation of circuits (like ECG Amplifier, EMG Amplifier, nerve stimulator etc.)

7BM1 NEURAL NETWORKS AND FUZZY LOGIC CONTROL

UNIT 1 : NEURAL NETWORKS - Introduction Motivation, Biological neural networks and simple models, The artificial neuron model, Hopfield nets, Perceptrons & threshold logic devices, Single and multilayer networks, applications.

UNIT 2 : LEARNING ALGORITHMS- Supervised and unsupervised learning, Hebbian learning, delta learning, competitive learning. Back propagation and feedforward methods, Recent trends and future directions.

UNIT 3 : FUZZY LOGIC- Introduction -Uncertainty & precision, Statistics and random process, Uncertainty in information, Fuzzy sets and membership.

MEMBERSHIP FUNCTIONS: Features of membership function. Standard forms and boundaries, Fuzzification, Membership value assignment – Intuition, Inference, Neural networks.

FUZZY TO CRISP CONVERSIONS: Maximum membership principle.

UNIT 4 : DEFUZZIFICATION METHODS- Centroid method, Weighted average method, Meanmax membership.

FUZZY RULE BASED SYSTEMS: Natural language, linguistic hedges, Rule based system – Canonical rule forms, Decomposition of compound rules, Likelihood and truth qualification Aggregation of Fuzzy rules. Graphical techniques of reference.

UNIT 5 : FUZZY CONTROL SYSTEM- Simple Fuzzy Logic controller, General FLC, Special forms of FLC system models, Industrial application

7BM2 BIO-SIGNAL PROCESSING

UNIT 1: Signal conversion: Sampling basics, simple signal conversion system, conversion requirements for biomedical signals, signal conversion circuits. Basics of digital filters: Digital filters, the z transform, Elements of digital filters, types of digital filters, Transfer function of a differential equation, Z-plane pole zero plot. The rubber membrane concept.

UNIT 2: Finite impulse response. Filters Characteristics, Smoothing Filters, Notch Filters, Derivatives, window design, Frequency sampling minimax design. Infinite impulse response filters : Generic equation of HR filter simple one pole example, integrator, Design method of two pole filters, HR. filter for ECG Analysis.

UNIT 3: Integer filter: Basic Design Concept, LP, HP BP and Band reject filters, The effects of filter cascades, Other applications of adaptive filtering. Adaptive filters: Principle of noise canceler model, 60 Hz adaptive canceling using a sine wave model, other applications of adaptive filtering.

UNIT 4: Signal Averaging: Basics of Signal Averaging, Signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging. Data reduction techniques: Turning point algorithm, AXEC algorithm, CORTES, Fan algorithm, Huffman algorithm.

UNIT 5: ECG QRS Detection: Power spectrum of ECG, Bandpass filtering Techniques, Differentiation techniques, Template matching techniques, QRS detection algorithm. ECG Analysis System: ECG interpretation, ST segment analyzer, portable arrhythmia monitor,

7BM3 BIOMECHANICS

UNIT 1: GENERAL PRINCIPLES OF BIOMECHANICS : Analysis of biological sub system from the biomechanical point of views and rise modeling. Cardio- vascular and pulmonary mechanics. Rheology of blood circulation System . Mechanics of heart valves and heart assist devices Instrumentation . measurement of rheological parameters of blood and other body fluids.

UNIT 2: TISSUE BIOMECHANICS : Direct, shear, bending and torque actions, and the corresponding stresses and strains in biological tissues. Stress relaxation and torque actions, and the corresponding stresses and strains in biological tissues. Stress relaxation and creep, stability and instability. Bio-mechanical characterization of bone and the soft connective (skin, tendon, ligaments etc.) converging structure function, and physiological factors.

UNIT 3: MOVEMENT BIOMECHANICS : Gait Analysis, body and limb mass and motion characteristics, muscle actions, forces transmitted by joints. Joint forces results in the normal and disabled human body. Slow normal and fast gait on the level. Strain and ramp ascent and descent. Joint replacements.

UNIT 4: Classification in Prosthetics and Orthotics Lower Extremity orthoses and prestheses Positions of anatomical axis and corresponding movements of the body part. Material Technology in Presthetics and Orthotics.

UNIT 5: PRINCIPLES IN DESIGNING ORTHESIS AND PRESTHESES: Principles of three point pressure, total contact, partial weight relieving etc. Positions of anatomical axis and corresponding movements of the body part International conventions with respect to above. Purpose for providing prostheses and Orthoses.

7BM4 BIOSENSORS AND MEMS

UNIT 1: Biosensor architecture and Classification; medically significant measurands, functional specifications of medical sensors.

UNIT 2: Biosensor characteristics: linearity, repeatability, hysteresis, drift; sensor models in the time & frequency domains.

UNIT 3: Biosensor for physical measurands: strain, force, pressure, acceleration, flow, volume, temperature and biopotentials.

UNIT 4: Biosensor for measurement of chemicals: potentiometric sensors, ion selective electrodes, ISFETS; Amperometric sensors, Clarke electrode; biosensors, catalytic biosensors, immunosensors.

UNIT 5: MEMS: Fundamentals of MEMS, Intelligent and network sensors; intelligent instrumentation systems; case studies on smart sensors, MEMS sensors, intelligent sensors, network sensors and intelligent instrumentation systems; Future trends: neurosensors, smart sensors.

7BM 5 ERGONOMICS

UNIT 1: Process of seeing – visual capabilities-factors affecting visual acuity and contrast sensitivity – human factor aspects of hard copy text and computer screen text, factors in selecting graphic representations symbols, qualitative visual display-process of hearing-principles of auditory display.

UNIT 2: Muscle physiology-muscle metabolism-respiratory response-joint motion study-measure of physiological air-efficiency and energy consumption-work rest cycles-aspects of manual material handling (MMH) Bio-mechanical recommended limits of MMH.

UNIT 3: Spatial compatibility physical arrangement of displays and controls- movement capability- rotary controls and rotar displays movement of displays orientation of the operator and movement relationships control orders and control responses- human limitations in tracking task.

UNIT 4: Anthropometry- anthropometric design principles –work space envelope- factors in design of workspace surfaces- principles of seat design –principles of control panel. Organization classification of human errors theories of accident causation-reducing accidents by altering behavior.

UNIT 5: Case studies: computer design, control panel design of an electronic instrument, computer key board, hand drill etc.

7BM6.1 ROBOTICS

UNIT 1: INTRODUCTION- Introduction, Brief History, Types of Robots, Technology of Robots, Basic Principles in Robotics, Notation, Symbolic Computation and Numerical Analysis. mathematical representation of robots- Introduction, Position and Orientation of a Rigid Body, Transformation Between Coordinate Systems and its properties, Representation of Joints, Representation of Link Using Denavit-Hartenberg, Link transformation Matrices, Homogeneous Coordinates, Lines, Screws, and Twists.

UNIT 2: DYNAMICS OF MANIPULATORS- Introduction, Inertia of a Link, The Lagrangian Formulation, Dynamic Equations in Cartesian Space Inverse Dynamics of Manipulators, Simulation of Equations of Motion, Recursive Formulation of dynamics of Manipulators.

UNIT 3: TRAJECTORY PLANNING AND GENERATION- Introduction, Joint Space Schemes, Joint Space Schemes With Via Points, Cartesian Space Schemes, Some Additional Issues in Trajectory Planning.

UNIT 4: POSITION AND FORCE CONTROL OF MANIPULATORS- introduction, Feedback Control of a Single-link Manipulator, PID Control of a Multi-link Manipulator, Non-linear Control of Manipulators, Simulation and Experimental Results, Non-linear control of constrained and Parallel Manipulators, Cartesian Control of Manipulators, Force Control of Manipulators, Hybrid Position/Force Controller, Stability Analysis of Non-linear Control Schemes, Advanced Topics in Non- linear Control of Manipulators.

UNIT 5: MODELLING AND CONTROL OF FLEXIBLE MANIPULATORS- Introduction, Modelling of a Flexible Joint, Euler--Bernoulli Beam Model, Kinematic Modelling of Multi- link Flexible Manipulators, Discretization Methods, Equations of Motion of Multi-link Flexible Manipulators Control of Flexible Link Manipulators, Other Topics in Flexible Manipulators.

7BM 6.2 VHDL

UNIT 1: INTRODUCTION – Fundamental & history of various hardware description language, Design flow of ASICs and standard logic circuits using software.

UNIT 2: COMBINATIONAL CIRCUIT BUILDING BLOCKS- Multiplexer, Decoders, encoders, Code Converters, VHDL Code for Combinational Circuits.

UNIT 3: SEQUENTIAL CIRCUITS: VHDL code for Flip-Flops, shift registers, Counters.

UNIT 4: SYNCHRONOUS/ ASYNCHRONOUS SEQUENTIAL CIRCUITS: Mealy & Moore type FSMs, VHDL Code for Mealy & Moore Machines, VHDL Codes for Serial Adder, Vending Machine.

UNIT 5: DIGITAL SYSTEM DESIGN- Building Block circuits, Memory organization, SRAM, Design examples of divider, Multiplier, Shifting & Sorting Operations, Clock Synchronization, CPU organization and design concepts.

7BM6.3 FIBER OPTIC INSTRUMENTATION

UNIT 1: OPTICAL FIBERS: Introduction, Ray theory, Optical fibers: multimode, single mode, step index, graded index, plastic & glass fibers. Transmission Characteristics of Optical Fibres - Introduction, Attenuation, Material absorption loss, Fibre bend loss, Dispersion (intermodal & intramodal)

UNIT 2: OPTICAL FIBER SOURCES & CONNECTION: Light Emitting Diode - Structure, Material, Characteristics, Power & Efficiency. Fiber Alignment, Fiber splices, Fiber connectors, Expanded beam connectors

UNIT 3: OPTICAL DETECTORS: Optical detection principles, quantum efficiency, responsivity, PIN photo diode, Avalanche photo diodes, Noise in Detectors, Photo Diode Materials.

UNIT 4: OPTICAL FIBER MEASUREMENTS: Measurements of Fiber Attenuation, Dispersion, Refractive Index Profile, Cut off Wave Length, Numerical Aperture & Diometer.

UNIT 5: LASER: Emission and absorption of radiation, Einstein relation, Absorption of radiation, Population inversion, Optical feed back, Threshold condition. Population inversion and threshold Working of three level & four level laser. Basic idea of solid state, semiconductors, gas & liquid laser. Basic concept of Q-switching & mode locking. Laser applications for measurement of distance, Velocity, Holography.

7BM7 INDUSTRIAL ECONOMICS AND MANAGEMENT

UNIT 1: INTRODUCTION: Nature and significances of Economics. Meaning of Science, Engineering and Technology and their relationship with economic development.

UNIT 2: BASIC CONCEPT: The concept of demand and supply. Elasticity of Demand and supply. Indifference Curve Analysis, Price Effect, Income Effect and Substitution Effect.

UNIT 3: MONEY AND BANKING: Functions of Money, Value of Money, inflation and measures to control it. Brief idea of functions of banking system, viz., Commercial and central banking, Business fluctuations.

UNIT 4: Definition Nature and Significance of Management Evaluation of Management thought, Contributions of Max Weber, Taylor and Fayol.

UNIT 5: Human Behavior: Factors of Individual Behavior Perception, Learning and Personality Development Interpersonal Relationship and Group Behavior

7BM 8 PROJECT (STAGE I)

7BM 9 CIRCUIT SIMULATION LAB

Modeling and simulation using MAT LAB

1. Realizing a given block diagram having multiplier, adder/subtractor and system (Discrete/Continuous) with given Impulse response. Calculating output for given input.
2. To simulate the transmitter and receiver for BPSK
3. To design and simulate FIR digital filter (LP/HP).
4. To design and simulate IIR digital filter (LP/HP).

Circuit designing and simulation using any virtual Instrumentation software

5. Designing and implementation circuits and signal processing.
6. Signal processing of ECG and EMG circuits.

7BM10 PRACTICAL TRAINING SEMINAR & INDUSTRIAL VISIT

8BM1 RADIOLOGY AND MEDICAL IMAGE PROCESSING

UNIT 1: ULTRASOUND: basic Principles of Ultrasound transducer, Display Modes, measurement of imaging system. Theory and construction of array transducer for imaging, Doppler ultrasound imaging, Principles of Echo Cardiography.

UNIT 2: COMPUTED TOMOGRAPHY: Properties and production of X-rays, Basic principles of tomography, system components, functions and processing unit of CT. Reconstruction technique of CT.

UNIT 3: TOMOGRAPHIC IMAGING: Principles & Schematic of Magnetic resonance Imaging (MRI), Positron emission tomography (PET), SPECT, Thermography., C-Arm Technique.

UNIT 4: IMAGE TRANSFORMS: The discrete Fourier Transform, properties of two dimensional Fourier Transforms, sine and cosine transform, in medical imaging system

UNIT 5: IMAGE ENHANCEMENT: Image smoothing, point operations, noise clipping, image sharpening, High pass filtering.

8 BM 2 ADVANCES IN BIOMEDICAL ENGINEERING

UNIT 1: ANALYTICAL EQUIPMENTS: Colorimeter principal, UV visible and IR Spectrophotometer, Design of monochromators. Principles and application of atomic absorption photometer, gas and liquid chromatographs.

UNIT 2: MICROSCOPY: Principles of scanning and transmission electron microscopy, confocal microscopy, atomic force microscopy.

UNIT 3: Introduction to Biometrics, eye and finger print recognition techniques, lie detection techniques.

UNIT 4: ENDOSCOPY: Introduction various types of endoscopes, cytosopes, laproscopes, endoscopes with integral TV cameras.

UNIT 5: LASERS AND FIBER OPTICS IN MEDICINE: Surgical instrumentation of CO₂ Ruby, Nd-YAG, He-Ne, Argon ion. Laser dermatology, ophthalmology, dentistry, holography and cosmetic surgery. Application safety with medical Lasers. Transmission of signals light and construction details of optical fiber, application of optical fiber in medical field.

8BM3 REHABILITATION ENGINEERING.

UNIT 1: Introduction to Rehabilitation: Principles involved in the study of rehabilitation Engg.

UNIT 2: Rehabilitation Engineering Science & Technology. Rehabilitation concepts engineering concepts in sensory Rehabilitation. Engineering Concepts in motor rehabilitation Engineering concepts in communication disorders.

UNIT 3: Orthopedic Prosthetics & Orthotics in Rehabilitation Technology Fundamentals. Applications. Summary. The indigenous metals and their alloys Different types of leather and leather tanning Types of rubber Thermosplastic and thermosetting resins moulding / Lamination techniques. Wood and binding materials

UNIT 4: Sensory Augmentation & substitution. Visual System. Auditory System. Tactual System. Rehabilitation Engg. Technologies: Principles of Application:

UNIT 5: The conceptual Framework. Education and quality assurance. Future development. Research and development in prosthetics and orthotics. Various aspects regarding diagnosis, prognosis, stature and Socio-economic conditions.

8BM4.1 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

UNIT 1: INTRODUCTION TO AI KNOWLEDGE- Importance of AI, Knowledge Base System Knowledge organization & manipulation, Conceptual Introduction to LISP and other AI programming Languages.

UNIT 2: KNOWLEDGE REPRESENTATION- Syntax Semantics, Inference Rules, Non-deductive Inference methods, and representations using rules, forward chaining and backward chaining. Fuzzy Logic & Natural languages computations. Probabilistic Reasoning. Object Oriented Representations.

UNIT 3: KNOWLEDGE ORGANIZATION & MANIPULATION- Search & control strategies, matching techniques, knowledge organization & management, Genetic Algorithms based search techniques.

UNIT 4: KNOWLEDGE SYSTEMS ARCHITECTURE- Rule based, non-production, uncertainty knowledge system building tools.

UNIT 5: KNOWLEDGE ACQUISITION- General Concepts, learning by induction.

8BM4.2 ADVANCED MICROPROCESSORS

UNIT 1 : 8086 ARCHITECTURE- Hardware specifications, Pins and signals, Internal data operations and Registers, Minimum and maximum mode, System Bus Timing, Linking and execution of Programs, Assembler Directives and operators.

UNIT 2: SOFTWARE & INSTRUCTION SET- Assembly language programming: addressing mode and instructions of 8086, MACRO programming, 8086 interrupts.

UNIT 3: ANALOG INTERFACING: A/D and D/A converter interfacing, keyboard and display interfacing, RS 232 & IEEE 488 communication standards.

UNIT 4 : DIGITAL INTERFACING: Programmable parallel ports, Interfacing microprocessor to keyboard and alphanumeric displays, Memory interfacing and Decoding , DMA controller.

UNIT 5 : MULTIPROCESSOR CONFIGURATIONS - Multiuser / Multitasking operating system concepts, 8086 based Multiprocessor systems. Introduction and basic features of 286, 386, 486 & Pentium processors.

8BM4.3 IMAGE PROCESSING AND PATTERN RECOGNITION

UNIT 1: INTRODUCTION: Imaging in ultraviolet and visible band. Fundamental steps in image processing. Components in image processing. Image perception in eye, light and electromagnetic spectrum, Image sensing and acquisition using sensor array.

UNIT 2: DIGITAL IMAGE FUNDAMENTALS: Image sampling and quantization, Representing digital images, Spatial and gray-level resolution, Aliasing and Moiré patterns, Zooming and Shrinking digital images.

UNIT 3: IMAGE RESTORATION: Image restoration model, Noise Models, Spatial and frequency properties of noise, noise probability density functions, Noise - only spatial filter, Mean filter Statistic filter and adaptive filter, Frequency domain filters - Band reject filter, Band pass filter and Notch filter.

UNIT 4: IMAGE COMPRESSION: Compression Fundamentals - Coding Redundancy, Interpixel redundancy, Psycho visual redundancy and Fidelity criteria. Image Compression models, Source encoder and decoder, Channel encoder and decoder, Lossy compression and compression standards. color space formats, scaling methodologies (like horizontal, vertical up/down scaling). Display format (VGA, NTSC, PAL).

UNIT 5: EXPERT SYSTEM AND PATTERN RECOGNITION: Use of computers in problem solving, information representation, searching, theorem proving, and pattern matching with substitution. Methods for knowledge representation, searching, spatial, temporal and common sense reasoning, and logic and probabilistic inferencing. Applications in expert systems and robotics.

8BM5 BIOSENSOR LAB

1. Study of PH meter (calibration, operation, maintenance etc.)
2. Ion exchange membrane electrodes
3. Enzyme electrodes, glucose sensor
4. Study of PH electrode and electrode calibration.
5. Different types of gel systems for biosensor
6. Study of Immunosensors
7. Study of MOSFET and ISFET biosensors

8BM6 MEDICAL IMAGING LAB

Study of imaging techniques involved in Medical Instruments:

1. Ultrasound Scanner
2. Color Doppler
3. X-Ray
4. Dental X-Ray
5. CT Scanner
6. Magnetic Resonance Imaging
7. PET/SPECT
8. SEM
9. Confocal Microscopy

8BM7 MEDICAL STERILIZATION TECHNIQUE

1. ETO sterilization technique
2. Gamma radiation in medical sterilization
3. Autoclaving, Pressure chambers in sterilization
4. UV radiation and ultrasonic sterilization techniques
5. Effect of sterilization in material properties
6. deodorization and disinfections and dehumidification
7. cryogenic systems for hospitals.

8BM8 SEMINAR

8BM9 PROJECT (STAGE II)

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