



PADMASHREE DR. D. Y. PATIL UNIVERSITY

(Estd. u/s 3 of the UGC Act 1956, GOI vide notification No. F.9.21/2000.U.3 dt. 20-06-2002)

Plot No- 50, Sector- 15, C.B.D Belapur, Navi Mumbai- 400614.

**BACHELOR OF TECHNOLOGY (B.TECH) BIOMEDICAL ENGINEERING
SYLLABUS**



DEPARTMENT OF BIOTECHNOLOGY AND BIOINFORMATICS

Plot No. 50, Sector 15, CBD Belapur, Navi Mumbai – 400 614.

Department of Biotechnology & Bioinformatics
 Padmashree Dr. D. Y. Patil University
 Plot No.50, Sector 15, CBD Belapur, Navi Mumbai-400614

B.Tech (Biomedical Engineering)

	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Sem VII	Sem VIII
Paper I	Applied Sciences I	Applied Sciences II	Applied Mathematics III	Applied Mathematics IV	Biological Modelling And Simulation	Microprocessor II	Hospital Management And Information Systems	P R O J E C T
Paper II	Molecules of Life	Applied Mathematics II	Electronics Circuit analysis & designing I	Electronics Circuit analysis & designing II	Microprocessor I	Analog Integrated circuits & Applications	Principles Of Image Processing	
Paper III	Introduction to Modern Biology	Human Anatomy	Electrical Network Analysis and Synthesis.	Medical Biochemistry	Logic Circuits I	Biomechanics	Advanced Biomedical Instrumentation	
Paper IV	Applied Mathematics	Introduction to Biotechnology	Human Physiology	Logic Circuits	Medical Microbiology	Medical Imaging II	Nuclear Medicine	
Paper V	Basic Electricity and Electronics	Introduction to Bioinformatics	Electronic Instruments	Transducers in Biomedical Instrumentation	Biomedical Instrumentation I	Biomedical Instrumentation II	Advanced Medical Imaging	
Paper VI	Engineering Mechanics	Engineering Drawing	Bioengineering materials & components	Genetics	Medical Imaging I	Digital Signal Processing	Introduction to Medical Informatics	

BBE -101

Applied Sciences I

CHEMICAL THERMODYNAMICS 9hrs

Definition of free energy and spontaneity, Maxwell Relations, Gibbs- Helmholtz equation, Van't Hoff equations, Stoichiometry and energy balances in Chemical reactions.

DYNAMICS OF CHEMICAL PROCESSES 9hrs

Basic concepts, composite reactions (opposing, parallel and consecutive reactions), collision theory, Thermodynamic formulation of reaction rates, unimolecular reactions, chain reactions(Stationary and non- stationary).
Enzyme kinetics, Michaelis- Menten equation.

ELETRODICS 9hrs

Type of electrodes and Cells, Nernst equation, emf measurement and its applications. Principles of chemical and electrochemical corrosion, corrosion control(Sacrificial anode and impressed current methods).

WATER 9hrs

Water quality parameters, definition and expression, estimation of hardness(EDTA method), Alkalinity(Titrimetry), water bsoftening(zeolite), Demineralisation(Ion exchanges) and desalination(RO), Domestic water treatment.

POLYMERS 9hrs

Monomers, Functionality, degree of polymerization, classifications based on source and applications, addition, condensation and copolymerization, mechanism of free radical polymerization, thermoplastics and thermosetting, mechanism of plastic processing, Injection moulding, blow moulding and extrusion processes.

Total No of periods: 45

TEXT BOOKS :

1. Atkins P.W., " Physical Chemistry ", ELBS, IV Edition, 1998, London.

REFERENCES :

1. Balasubramanian M.R., Krishnamoorthy S. and Murugesan V., "Engineering Chemistry", Allied Publisher Limited., Chennai, 1993.

2. Karunanidhi M., Ayyaswamy N., Ramachandran T and Venkatraman H., "Applied Chemistry", Anuradha Agencies, Kumbakonam, 1994.
3. Sadasivam V., "Modern Engineering Chemistry - A Simplified Approach", Kamakya Publications, Chennai, 1999.
4. Kuriakose, J.C. and Rajaram J., "Chemistry in Engineering and Technology", Vol. I and II, Tata McGraw-Hill Publications Co. Ltd, New Delhi, 1996.
5. Jain P.C. and Monica J., "Engineering Chemistry", Dhanpat Rai Publications Co., (P) Ltd., New Delhi, 1998.

BBE-102

MOLECULES OF LIFE

FUNDAMENTALS IN MOLECULES OF LIFE

4hrs

Properties of water, acids, bases and buffers.

THERMODYNAMICS

3hrs

First and Second Laws of Thermodynamics: Free energy as an indicator of spontaneity; Chemical equilibrium.

BIOMOLECULES

15hrs

Monosaccharides and Polysaccharides; Glycoproteins; Lipids and cell membranes; Amino acids and proteins; Nucleic Acids.

PROTEIN STRUCTURE PREDICTION

10hrs

Optical activity; Primary structure determination of proteins; Three dimensional structure of proteins; Secondary structure; Fibrous proteins, Globular proteins; Quaternary structure.

ENZYMES

13hrs

Mechanism of enzyme action, substrate specificity, Coenzymes; Regulation of enzyme activity; Enzyme kinetics; Inhibition; effects of pH; Catalytic mechanisms.

Total No of periods: 45

TEXT BOOKS:

1. Nelson., Cox. & Lehninger.; "Principles of Biochemistry".
2. Lubert Stryer.; "Biochemistry".
3. A. C. Deb.; "Biochemistry".
4. S. C. Rastogi.; "Biochemistry".
5. Satyanarayan. U.; "Fundamentals of Biochemistry".

BBE-103

INTRODUCTION TO MODERN BIOLOGY

CONCEPTS AND METHODS IN BIOLOGY 9hrs

Energy and life's organization, evolutionary view of diversity, nature of biological enquiry- observations, hypothesis and tests.

Principles of cellular life, chemical foundation for cells, carbon compounds in cells, cell structure and function, ground rules for metabolism, source of energy for cells.

PRINCIPLES OF INHERITANCE 9hrs

Cell Division, patterns of inheritance, chromosomes and genetics, DNA to protein, Nature of the genetic material, transcription and translation.

Fundamentals of protein structure.

PRINCIPLES OF EVOLUTION 9hrs

Microevolution, speciation, macro-evolutionary puzzle, Evolution and diversity, Origin and evolution of life, prokaryotic and eukaryotic life forms.

PLANT STRUCTURE AND LIFE FORMS 4hrs

Plant tissues, nutrition and transport.

ANIMAL STRUCTURE AND FUNCTION 14hrs

Tissues and organs, sensory reception, endocrine control, circulation, immunity, respiration, digestion, nutrition and reproduction; Cell differentiation, morphogenesis and pattern formation.

TEXT BOOKS:

1. Verma & Agarwal.; " Cell Biology, Molecular Biology, Genetics, Ecology & Evolution".
2. Turner.; " Instant Notes on Molecular Biology".

BBE -104

APPLIED MATHEMATICS I

MATRICES

9hrs

Characteristic equation - Eigen values and eigen vectors of a real matrix. Some properties of eigen values, Cayley-Hamilton theorem, Orthogonal reduction of a symmetric matrix to diagonal form - Orthogonal matrices - Reduction of quadratic form to canonical form by orthogonal transformation.

THREE DIMENSIONAL ANALYTICAL GEOMETRY

9hrs

Direction cosines and ratios - Angle between two lines - Equation of a plane - Equation of a straight line – Coplaner lines - Shortest distance between skew lines - Sphere - Tangent plane - Plane section of a sphere - orthogonal spheres.

GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS

9hrs

Curvature - cartesian and polar coordinates - Circle of curvature - Involutives and Evolutes - Envelopes - properties of envelopes - Evolute as envelope of normals.

FUNCTIONS OF SEVERAL VARIABLES

9hrs

Functions of two variables - Partial derivatives - Total differential - Differentiation of implicit functions - Taylor's expansion - Maxima and Minima - Constrained Maxima and Minima by Lagrangean Multiplier method - Jacobians - differentiation under integral sign.

ORDINARY DIFFERENTIAL EQUATIONS

9hrs

Simultaneous first order linear equations with constant coefficients - Linear equations of second order with constant and variable coefficients - Homogeneous equation of Euler type - equations reducible to homogeneous form - Method of reduction of order - Method of variation of parameters.

Total No of periods: 45

TEXT BOOKS:

1. Kreyszig, E., " Advanced Engineering Mathematics " (8th Edition), John Wiley and Sons (Asia) Pte Ltd., Singapore, 2001
2. Veerarajan, T., " Engineering Mathematics ", Tata McGraw Hill Publishing Co., NewDelhi, 1999.
3. Grewal, B.S., " Higher Engineering Mathematics " (35th Edition), Khanna Publishers, Delhi , 2000.

REFERENCES:

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., " Engineering Mathematics ", Volume I
2. (4th Revised Edition), S. Chand & Co., New Delhi, 2000.
3. Narayanan, S., Manicavachagom Pillay, T.K., Ramanaiah, G., " Advanced Mathematics for
4. Engineering Students ", VolumeI (2nd Edition), S. Viswanathan (Printers & Publishers), 1992.
5. Venkataraman, M.K. " Engineering Mathematics - First year " National Publishing Company,
6. Chennai (2nd Edition), 2000.

BBE 105

BASIC ELECTRICITY AND ELECTRONICS

1. DC Circuits

2. AC Circuits

- a) Alternating Current & Voltage
- b) Phasor representation of Alternating Quantity
- c) Mathematical representation of Phasors
- d) Behaviour of Pure Resistor, Pure Capacitor and Pure Inductor in AC Circuits.
- e) Series R-L Circuits
- f) Series R-C Circuits.
- g) Series R-L-C Circuits.
- h) Admittance and its components.
- i) Resonance
- j) Series and Parallel Resonance.

3. Three Phase Circuits:-

- a) Generation of three phase voltage.
- b) Advantage of three phase system.
- c) Interconnection of three phase.
- d) Star or Wye Connection.
- e) Delta or Mesh Connection.
- f) Voltage, Current and Power relations in Balanced Delta connected load.
- g) Balanced y/δ and δ/y conversion
- h) Relation between power in Star and delta connection.
- i) Comparison between Star & delta connection.

4. Semi conductor Devices & Rectifiers:-

- a) Semi Conductor.
- b) P-N Junction diode
- c) Zener diode
- d) Bipolar Junction transistor (BJT).
- e) Rectifiers.
- f) Half wave rectifier.
- g) Full wave rectifier.

BBE- 106
ENGINEERING MECHANICS

BASICS **3hrs**

Introduction - Units and Dimensions - Laws of Mechanics - Vectors - Vectorial representation of forces and moments - Vector operations.

STATICS OF PARTICLES **7hrs**

Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - single equivalent force.

EQUILIBRIUM OF RIGID BODIES **7hrs**

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Equilibrium of rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.

PROPERTIES OF SURFACES AND SOLIDS **9hrs**

Determination of Areas and Volumes - First moment of area and the centroid - second and product moments of plane area - Parallel axis theorems and perpendicular axis theorems - Polar moment of inertia – Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia - relation to area moments of inertia.

FRICTION **3hrs**

Frictional Force - Laws of Coloumb friction - Simple Contact friction - Rolling Resistance - Belt Friction.

DYNAMICS OF PARTICLES **9hrs**

Displacement, Velocity and acceleration their relationship - Relative motion - Curvilinear motion - Newton's Law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

ELEMENTS OF RIGID BODY DYNAMICS **7hrs**

Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid Body - Work energy equation.

Total No of periods: 45

TEXT BOOKS:

1. Beer and Johnson, " Vector Mechanics for Engineers ", Vol. 1 " Statics " and Vol. 2 " Dynamics ", McGraw Hill International Edition, 1995.
2. Merriam, " Engineering Mechanics ", Vol.1 " Statics " and Vol.2 " Dynamics 2/e ", Wiley International, 1988.

REFERENCES:

1. Rajasekaran S. and Sankara Subramanian, G., " Engineering Mechanics - Statics and Dynamics ".
2. Irving, H., Shames, " Engineering Mechanics - Statics and Dynamics ", Thrid Edition, Prentice-Hall of India Pvt.Ltd., 1993.
3. Mokoshi, V.S., " Engineering Mechanics ", Vol.1 " Statics " and Vol.2 " Dynamics ", Tata McGraw Hill Books, 1996.
4. Timoshenko and Young, " Engineering Mechanics ", 4/e, McGraw Hill, 1995.
5. McLean, " Engineering Mechancis ", 3/e, SCHAUM Series, 1995.

Practical I

1. Introduction to computer
2. Introduction to MS-Office (MS-Word, Excel, PowerPoint),
3. MS-DOS
4. Internet and Web browsing
5. Database Searching using Entrez and SRS search Engine.
6. Study of Databases and Data retrieval:
7. Genome Databases,
8. Sequence Database,
9. Secondary Databases,
10. Taxonomy Databases,
11. Bibliographic Database,
12. Metabolic Pathway Databases

Practical II

1. Preparation of 1% glucose, 100ppm and 1000 ppm CuSO_4 , use of pipettes and their Calibration.
2. Determination of Lambda max, verification of Beer's Law & determination of molar absorption coefficient.
3. Qualitative tests for carbohydrates.
4. Estimation of sugar by DNSA method.
5. Estimation of RNA (ribose) by orcinol method.
6. Biochemical test for the presence of protein and amino acid.
7. Separation of amino acids and sugar by paper chromatography.
8. Acid and Alkaline hydrolysis of pure protein casein and determination of its component by one dimensional paper chromatograph.
9. Estimation of protein by Biuret – Method.
10. Extraction of starch from potato.

BBE 201
APPLIED SCIENCES II

PHYSICS

1. PROPERTIES OF MATTER 9hrs

Elasticity - stress-strain diagram-factors affecting elasticity - twisting couple on a wire-shafts-torsion pendulum-depression of a cantilever- young's modulus by cantilever-uniform and non uniform bending-i shape girders-production and measurement of high vacuum-rotary pump-diffusion pump-pirani gauge-penning gauge-viscosity-oswald viscometer-comparison of viscosities.

2. LASER AND FIBRE OPTICS 9hrs

Principle and lasers-laser characteristics-ruby-ndyag, he-ne, co2 and semiconductor lasers-propagation of light through optical fibers-types of optical fibre-applications of optical fibres as optical waveguides and sensors.

3. ELECTROSTATICS AND ELECTROMAGNETISM 9hrs

Electric field and potential - Gauss theorem - Applications - dielectrics - capacitance - energy stored in a dielectric medium - types of capacitors - Loss of energy due to sharing of charges by the capacitors - electrical conductivity in conductors - Carey Foster's bridge - Maxwell's equations - Free space wave equation – Characteristic impedance.

4. QUANTUM AND NUCLEAR PHYSICS 9hrs

Development of quantum theory - Dual nature of matter and radiation - Compton effect - Pair production - Uncertainty principle - Equivalence of mass and energy Schrodinger's wave equation - Particle in a box - Electrons in a metal.

Characteristics of atomic spectra - molecular spectra - vector atom model - Stern and Gerlach experiment - Raman Effect and its applications - Liquid drop model - Explanation for Nuclear fusion - Shell model – Chain reaction - Criticality - Four factor formula - Q value - Power reactors - Laser induced Nuclear fusion.

5. NON DESTRUCTIVE TESTING 9hrs

Liquid penetrant, Magnetic particle and eddy current methods - X-ray radiography - Fluoroscopy - Gamma ray radiography - Ultrasonic scanning methods - Ultrasonic flaw detector - Thermography.

Total No of Periods: 45hrs

TEXT BOOKS :

1. Arumugam.M., "Engineering Physics", Anuradha Publications, 1998.

REFERENCES :

1. Resnik R. and Halliday D., "Physics", Wiley Eastern, 1986.
2. Nelkon M. and Parker.P., "Advanced Level Physics", Arnold-Heinemann, 1986.
3. Vasudeva A.S., "Modern Engineering Physics", S. Chand and Co., 1998.
4. Gaur, R.K., and Gupta, S.L., "Engineering Physics", Dhanpat Rai and Sons, 1988.
5. Mathur, D.S, "Elements of properties of Matter", S.Chand & Co., 1989.
6. Beiser, A., " Perspective of Modern Physics ", John Wiley, 1985
7. Tayal, D.S., " Nuclear Physics ", Himalayan Publishers, 1998
8. Vasudeva, D.N., " Fundamentals of Electricity and Magnetism ", S.Chand & Co., 1985.
9. Hull, B. and John V., " Nondestructive Testing ", McMillan Education Ltd, London, 1988

BBE 202
APPLIED MATHEMATICS II

MULTIPLE INTEGRALS

9hrs

Double integration in Cartesian and polar coordinates - Change of order of integration - Area as a double integral - Triple integration in Cartesian coordinates - Change of variables - Gamma and Beta functions.

VECTOR CALCULUS

9hrs

Curvilinear coordinates - Gradient, Divergence, Curl - Line, surface & volume integrals - Statements of Green's, Gauss divergence and Stokes' theorems - Verification and applications.

ANALYTIC FUNCTIONS

9hrs

Cauchy Riemann equations - Properties of analytic functions - Determination of harmonic conjugate - Milne- Thomson's method - Conformal mappings : Mappings $w = z + a$, az , $1/z$, z^2 and bilinear transformation.

COMPLEX INTEGRATION

9hrs

Cauchy's theorem - Statement and application of Cauchy's integral formulae - Taylor's and Laurent's expansions - Singularities - Classification - Residues - Cauchy's residue theorem - Contour integration - Circular and semi Circular contours (excluding poles on real axis).

STATISTICS

9hrs

Moments - Coefficient of correlation - Lines of regression - Tests based on Normal and t distributions, for means and difference of means - Chi Square test for goodness of fit.

Total No of

periods: 45

TEXT BOOKS:

1. Kreyszig, E., " Advanced Engineering Mathematics " (8th Edition), John Wiley and Sons, (Asia)Pte Ltd.,Singapore, 2000.
2. Grewal, B.S., " Higher Engineering Mathematics " (36th Edition), Khanna Publishers, Delhi 2001

REFERENCES:

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., " Engineering Mathematics ", Volumes I & II(4th Revised Edition), S. Chand & Co., New Delhi, 2001.
2. Narayanan, S., Manicavachagom Pillay, T.K., Ramanaiah, G., " Advanced Mathematics forEngineering Students ", Volumes I & II (2ndEdition), S.Viswanathan (Printers & Publishers,Pvt, Ltd.), 1992.
3. Venkataraman, M.K. " Engineering Mathematics III - A ", National Publishing Company,Chennai, (13th Edition), 1998.

BBE 203
HUMAN ANATOMY

UNIT –I

8hrs

Cell structure and Organelles Description- Circulatory System- Heart, Pericardium, Chambers, Major Blood Vessels, Blood supply.

UNIT-II

10hrs

Digestive System- GI Tract, parts, stomach, Intestine, Liver and Panchreas, Respiratory System- Trachea and Lungs.

UNIT-III

12hrs

Excretory and Urinogenital System – Parts, Reproductive System –Male and Female Reproductive Organs. Nervous System – Functions of Neurons, Synapse, Reflexes and Receptors, Brain, Brainstem, Ventricles and Spinal cord. Peripheral Automatic Nervous System

UNIT –IV

8hrs

Musculo Skeletal System – Muscle Tissue, Structure of Skeletal Muscle, Types of Muscle, Types of Joints, Major Muscles of Limbs and their actions.

UNIT –V

7hrs

Eye, Ear, Endocrine Glands

Total No of periods : 45

REFERENCES:

1. Ranganathan, T.S. “ Text Book of Human Anatomy”, S.Chand &Co. Ltd., Delhi, 1996
2. Tobin, C.E., “Basic Human Anatomy”, McGraw-Hill Publishing Co. Ltd., Delhi, 1997
3. J.Gibson, “Modern Physiology and Anatomy for Nurses”, Blackwell SC Publishing 1981.

BBE 204
INTRODUCTION TO BIOTECHNOLOGY

1. CELL BIOLOGY

CELL STRUCTURE AND FUNCTION OF THE ORGANELLES **6hrs**

Principles of cell membrane organisation, membrane proteins, cytoskeletal proteins, Extra cellular matrix, cell cycle and molecules that control cell cycle.

TRANSPORT ACROSS CELL MEMBRANES **5hrs**

Passive and Active transport, permeases, sodium potassium pump, Ca²⁺ ATPase pumps, lysosomal and vacuolar membrane ATP dependent proton pumps, Co Transport Symport, Antiport, transport into Prokaryotic cells endocytosis and Exocytosis. Entry of viruses and toxins into cells.

2. GENETICS **16hrs**

Classical Genetics Mendelian Laws, monohybrid, and dihybrid inheritance. Chromosome structure and organisation in prokaryotes and eukaryotes. Multiple alleles and blood group antigens. Sex chromosomes and sex linked inherited disorders. Linkage, crossing over and genetic mapping of chromosomes. Identification of the genetic material - classical experiments, Hershey Chase, Avery McLeod etc. Genetic transfer: Conjugation, Transduction and Transformation.

3. IMMUNOLOGY **18hrs**

Introduction to immunology; Cells involved in immune response; Antigen receptor molecules; Generation of diversity; Antigen recognition; Cell mediated immune reactions; Regulation of immune response; Complement; Immunity to viruses, bacteria, fungi, protozoa and worms; Tumor immunology; Immunodeficiency; Hypersensitivity; transplantation and rejection; Autoimmunity and autoimmune disease; Immunological techniques.

Total No of periods: 45

TEXT BOOKS:

1. Kindt, Goldby and Osborne.,”Kuby”; 6th edition.
2. Lydycud, Whelan & Fangee.; “Instant Notes in Immunology”.
3. C. V. Rao.; “Introduction to Immunology”.
4. C. B. Powar.; “Cell Biology”.
5. Alberts., Johnson., Lewis., Raff., Roberts. & Walter.; “ Molecular Biology of the Cell”. 4th edition.
6. Gerald Kay.; “Cell & Molecular Biology”; 4th edition.
7. P. K. Gupta.; “Genetics”; 3rd edition.
8. Peter J. Russell.; “iGenetics”; 2nd edition
9. Winter., Hickey. & Fletcher.; “Instant notes in Genetics”; 2nd edition.

BBE 205
INTRODUCTION TO BIOINFORMATICS

WHAT IS BIOINFORMATICS

5hrs

Scope of Bioinformatics-Elementary commands and Protocols, ftp, telnet, http. Primer on information theory.

SEQUENCING ALIGNMENT AND DYNAMIC PROGRAMMING

10hrs

Introduction-Strings-Edit distance two strings-string similarity local alignment gaps-parametric sequence alignments-suboptimal alignments-multiple alignment-common multiple alignment methods.

SEQUENCE DATABASE AND THEIR USE

10hrs

Introduction to databases-database search-Algorithms issues in database search-sequence database search-FASTA-BLAST-Amino acid substitution matrices PAM and BLOSSUM.

EVOLUTIONARY TREES AND PHYLOGENY

10hrs

Ultrasonic trees-parsimony-Ultrametric problem-perfect phylogeny-phylogenetic alignment-connection between multiple alignment and tree construction.

SPECIAL TOPICS IN BIOINFORMATICS

10hrs

DNA Mapping and sequencing-Map alignment-Large scale sequencing and alignment-Shotgun-DNA sequencing-Sequence assembly-Gene predictions-Molecular predictions with DNA strings

Total No of periods: 45

TEXT BOOKS:

1. Dan Gusfield, " Algorithms on Strings Trees and Sequences ", Cambridge University Press, 1997.
2. P.Baldi,S Brunak, Bioinformatics; " A Machine Learning Approach ", MIT Press, 1998.

**BBE 206
ENGINEERING DRAWING**

PRINCIPLES OF GRAPHICS **10hrs**

Two dimensional geometrical construction - Conic sections, involutes and cycloids - Representation of three dimensional objects - Principles of projections - standard codes of principles.

ORTHOGRAPHIC PROJECTIONS **26hrs**

Projections of points, straight line and planes - ' Auxiliary projections ' - Projection and sectioning of solids - Intersection of surfaces - Development of surfaces.

PICTORIAL PROJECTIONS **5hrs**

Isometric projections - ' Perspectives ' - Free hand sketching.

COMPUTER GRAPHICS **4hrs**

Hardware - Display technology - Software - Introduction to drafting software.

Total No of periods: 45

TEXT BOOKS:

1. Narayanan, K.L., and Kannaiah, P., " Engineering Graphics ", Tata McGraw-Hill Publishers Co., Ltd., 1992.

REFERENCES:

1. William M. Neumann and Robert F.Sproul, " Principles of Computer Graphics ",McGraw Hill, 1989.
2. Warren J. Luzzadder and John M. Duff, " Fundamentals of Engineering Drawing ",Prentice-Hall of India Private Ltd., Eastern Economy Edition, 1995.
3. Natarajan K.V., " A Text Book of Engineering Drawing ", Private Publication, Madras, 1990.
4. Mathur, M.L. and Vaishwanar, R.S., " Engineering Drawing and Graphics ", Jain Brothers,New Delhi, 1993.

PRACTICAL I

Computer Programming Lab

MULTIUSER OPERATING SYSTEM

4hrs

Unix: Introduction - Basic Commands - Vi editor - filters - Input/output redirection - piping - transfer of data between devices - shell scripts.

FUNDAMENTALS OF NETWORKING

3hrs

Working on a networked environment - Accessing different machines from one node - concept of E-mail - Uses of Internet.

HIGH LEVEL LANGUAGE PROGRAMMING

8hrs

C Language: Introduction - Operator - Expressions - Variables - Input/output statements - control statements - function arrays - pointer - structures - unions - file handling - case studies.

TUTORIAL

30hrs

Total No of periods: 45

Text Books and References:

1. Stephan J. Kochen & Patrick H. Wood, " Exploring the UNIX System ", Techmedia, 1999.
2. Maurice J. Bach, " The design of UNIX Operating Systems ", Prentice Hall of India, 1999.
3. Ramos, " Computer Networking Concepts ", Prentice Hall International, 1999.
4. Balagurusamy, " Programming in ANSI C ", Tata McGraw Hill, 1999.
5. Kernighan and Ritchie, " The C Programming Language ", Prentice Hall of India, 1999.
6. Gottfried, " Programming with C ", Tata McGraw Hill, 1999.
7. Kutti, " C and UNIX Programming: A Conceptual Perspective ", Tata McGraw Hill, 1999.
8. Eric Nagler, " Learning C++ ", M/s. Jaico Publishing Co., 1998-99.

PRACTICAL II
Basic Workshop Practice

SHEET METAL

5hrs

Tools and Equipments - Fabrication of tray, cone, etc., with sheet metal

WELDING

5hrs

Tools and Equipemts - Arc Welding of butt joint, Tap Joint, Tee fillet etc., Demonstration of gas welding.

FITTING

10hrs

Tools and Equipments- Practice in Chipping, Filing, Drilling - making Vee joints, square and dove tail joints.

CARPENTRY

10hrs

Tools and Equipments-Planning Practice-making halving joint and dove tail joint models.

FOUNDRY

5hrs

Tools and Equipments Preparation of moulds of simple objects like flange, gear V-grooved pulley etc.

SMITHY

10hrs

Tools and Equipments - Demonstration for making simple parts like keys, bolts etc.

Total No of periods: 45

REFERENCES:

1. Venkatachalapathy V.S., " First Year Engineering Workshop Practice ",Raamalinga Publications, Madurai, 1999.
2. Kanaiah P.and Narayana K.C., " Manual on Workshop Practice Scitech Publications ",Chennai, 1999.

BBE 301

- APPLIED MATHEMATICS – III

1. Laplace Transform (11 hrs)

Functions of bounded variation

Laplace transforms of $1, t^n, e^{at}, \sin at, \cos at, \sinh at$ and $\cosh at, \operatorname{erf}(t)$ Linear property of L. T. First shifting theorem, Second shifting theorem $L\{t^n f(t)\}, L\{f(t)/t\}, L\{\int f(u)du\}, L\{d^n/dt^n f(t)\}$. Change of scale property of L.T. Unit step functions, Heaviside, Dirac delta functions, periodic function and their Laplace Transforms.

Inverse Laplace Transforms.

Evaluation of Inverse L.T, partial fractions method, Convolution theorem

Applications to solve initial and boundary value problems involving ordinary diff. Equations with one dependent variable.

2. Matrices (1) (8 hrs)

- 2.1 Types of matrices, Adjoint of a matrix, Inverse of a matrix, Rank of Matrix, Linear dependence and independence of rows and columns of a matrix over a real field, Reduction to normal form and partitioning of a matrix.
- 2.2 System of Homogenous and non-homogenous equations, their consistency and solutions.

3. Complex Variables. (13 hrs)

- 3.1 Functions of complex variables, Continuity and derivability of a function, Analytic functions, Necessary condition for $f(z)$ to be analytic, sufficient condition (without proof), Cauchy –Riemann condition in polar forms. Analytical and Milne -Thomas method to find analytic functions $f(z) = u +iv$ where (i) u is given (ii) v is given (iii) $u +v$ (iv) $u- v$ is given, Harmonic functions and orthogonal trajectories.
- 3.2 Mapping
Conformal mapping, Bilinear mapping, Fixed points and standard transformation, inversion, reflection, rotation and magnification.

4. Fourier series: (13 hrs)

- 4.1 Orthogonality and orthonormal functions, Expression for a function in a series of orthogonal functions, Dirichlet's condition, Fourier series of periodic function with period 2π and $2l$

(Derivations of Fourier coefficients a_0 , a_n , b_n is not expected) Dirichlet's Theorem Even and Odd functions. Half range sine and cosine expansions Parseval's Identities (without proof)

4.2 Complex form of Fourier Series

Fourier integral and Fourier transform with properties in detail.

References:

1. P. N. Wartikar /J. N. Wartikar, Text book Applied Mathematics, Pune Vidyarthi Griha prakasha, 1981.
2. Matrices Shantinayakan
3. Vector Analysis Murray R. Spiegel, Schaum Series.

BBE 302

ELECTRONIC CIRCUIT ANALYSIS & DESIGN I

Semiconductor Materials and Diodes

(6 hrs)

Review of Semiconductor Materials and Properties, The PN Junction, Introduction to Semiconductor Diode Theory Diode Circuits: DC Analysis and Models, AC Equivalent Circuits, other Diode Types – Solar Cell, Photodiode, Light – Emitting Diode, Schottky Barrier Diode, Zener Diode, Temperature Effects, Understanding Manufacturer's Specifications.

Diode Circuits

(5 hrs)

Design of Rectifier Circuits, Half Wave Rectification, Full Wave Rectification, Filter, Ripple Voltage and Diode Current, Voltage Doubler Circuit, Zener Diode Circuits, Clipper and Clamper Circuits, Multiple – Diode Circuits, photodiode and LED Circuits.

The Bipolar Junction Transistor

(7 hrs)

Basic Bipolar Junction Transistor, Transistor Structures, NPN Transistor : Forward-active mode Operation, PNP Transistor : Forward – active Mode Operation, Circuits Symbols and Conventions, Current – Voltage Characteristics, Non ideal Transistor Leakage Current and Breakdown, DC Analysis of Transistor Circuits, Common- Emitter Circuits, Load Line and Modes Of Operation, Common Bipolar Circuits: DC Analysis, Basic Transistor Applications – Switch, Amplifier, Bipolar Biasing and Bias Stability, Integrated Circuit Biasing, Multistage Circuits.

Basic BJT Amplifiers

(6 hrs)

Analog Signals and Linear Amplifiers, The Bipolar Linear Amplifier, Graphical Analysis and AC Equivalent Circuit, Small Signal Hybrid- π Equivalent Circuit of the Bipolar Transistor, Hybrid- π Equivalent Circuit Including the Early Effect, Expanded Hybrid- π Equivalent Circuits, Other Small- Signal Parameters and Equivalent Circuits, Basic Transistor Amplifier Configurations. Common Emitter Amplifiers, Ac Load Line Analysis, Common Collector Emitter Follower Amplifier Common Base Amplifier, The Three Basic Amplifier configurations: Summary and Comparison , Multistage Amplifiers, Power Considerations, Environmental Thermal Considerations in Transistor Amplifiers, Manufacture's Specifications.

The Field Effect Transistor

(7 hrs)

Junction Field- Effect Transistor, MOS Field- Effect Transistor, MOSFET DC Circuit Analysis, Basic MOSFET Applications: Switch, Digital Logic Gate and Amplifier. Temperature effects in MOSFETs, Input Protection in MOSFET. The power FET (VMOS).

Basic FET Amplifier**(7 hrs)**

The MOSFET Amplifier, Basic Transistor amplifier Configuration, the common source amplifier. The source follower amplifier, the common gate configuration : summary and configuration, Single- Stage Integrated Circuit. MOSFET amplifier, multistage amplifiers, Multistage amplifier, Basic JFET Amplifiers.

Frequency Response of Amplifiers**(7 hrs)**

Amplifier frequency Response, system Transfer functions, s- Domain analysis, first order functions, Bode plots, short – circuit and open- circuit. Time Constants, frequency Response: Transistor amplifier with circuit capacitors, frequency Response: Bipolar Transistor, frequency Response: The FET, High frequency Response of Transistor Circuits. Sinusoidal oscillators. The phase- shift oscillator, The Wein bridge oscillaton, the tuned circuit oscillator , the colpitts oscillator and Hartley oscillator.

Text Books: Donald A. Neamen, Electronic Circuit Analysis and Design edition, McGraw Hill International edition 2001.

Martin Roden, Gordon Carpenter, William Wiserman, Electronic Design, Fourth edition, Shroff Publishers, 2002.

Additional Reading:

Donald Schilling & Charles Belove, Electronic Circuits Discrete and Integrated, Third edition, McGraw Hill International edition, 1989.

BBE- 303

ELECTRONIC NETWORK ANALYSIS & SYNTHESIS

Review

D. C & A. C Circuits.

Mesh & Node Analysis (8 hrs)

Mesh & Node Analysis of circuits with independent & dependent sources.

Circuit Analysis (14 hrs)

Introduction to Graph Theory. Tree link currents, branch voltage, cut set & tie set. Mesh & Node. Analysis, Gauss Elimination Technique, Duality.

Time & Frequency Response of Circuits

First & second Order Different equations. Initial conditions. Evaluation & analysis of transient and Steady state response using Classical Technique as well as by Laplace Transform (for simple circuits only) Transfer function, Concept of poles and zeros. Frequency response of a system (concept only)

Two- Port Networks (9 hrs)

Concept of two- port network. Driving point & Transfer Functions, Open Circuit impedance parameters, Short Circuit admittance (y) parameters, Transmission (ABCD) parameters.

Fundamentals of Network Synthesis (14 hrs)

Positive real functions, Driving point functions, Brono's Positive real functions, Properties of Positive real functions. Testing positive real functions, Testing driving point functions, Maximum modulus theorem, Properties of Hurvitz polynomials, Residue computations, Even & odd functions, Sturm's theorem. Driving point Synthesis with L-C, R- C, R- L and R- L- C networks.

Text books:

- A. Sudhakar & S. P. Shyammohan, Circuits and Networks. Tata McGraw Hill, thirteenth reprint, 2000.
- Willam H. Hayt, Jack E. Kemmerly & Steven M. Durbin, Engineering Circuit Analysis, McGraw Hill International, sixth edition, 2002.
- Raymond A. Decarlo & Pen- Min Lin, Linear Circuit Analysis, Oxford University press, second edition, 2001.
- M. E. Van Valkenburg , Introduction to Modern Network Synthesis, Wiley Eastern Ltd.

Additional Reading:

Artice M. Davis, Linear Circuit Analysis, Thomson Asia Pte. Ltd. Singapore,
first edition, 2001
M. E. Van Vakenburg, Network Analysis, Prentice Hall of India, third edition.

BBE 304

HUMAN PHYSIOLOGY

Physiology:

1. Excretion **(10)**
formation of urine: Glomerular filtration and Tubular Function, Regulation of urine formation and concentration concept of clearance, Functions of urinary bladder urethra.
2. Endocrine Physiology: **(20)**
Functions and disorders of hormones secreted by pituitary gland, Thyroid gland, Adrenal gland, pancreas, Parathyroid glands, Pineal gland
3. Reproductive Physiology **(10)**
Male and Female Reproductive Functions.
4. Physiology of muscle contraction. **(5)**

Text:

1. Anatomy and Physiology in Health and Illness. By: Ross and Wilson. (ELBS Pub.)

References:

1. Physiology of Human Body: Guyton. (Prism Books)
2. Review of Medical Physiology: William Ganong. (Prentice Hall Int)
- Principles of Anatomy and Physiology: Tortora and Grabowski. (Harper collin Pub)

BBE 305

ELECTRONIC INSTRUMENTS

- 1. Electronic Voltmeter: (5 hrs)**
Principles of Operation, Multimeter, Peak Reading, Average Reading, True RMS Reading Voltmeter.
- 2. Digital Voltmeter: (5 hrs)**
Principles of Working of i) Ramp Type, ii) Dual Slope Integrating Type, iii) Successive Approximation Type Digital Voltmeter, Resolution & Sensitivity of a Digital Meter.
- 3. Frequency & Phase Meters: (6 hrs)**
Digital Frequency Meter- Operation (with block diagram)
Digital Phase meter
- 4. Oscilloscopes: (7 hrs)**
Block diagram study of C.R.O., simple C.R.O., vertical amplifier, Horizontal deflecting system, Dual trace, Dual beam, Digital Readout Oscilloscope, Measurement of Frequency and Phase by Lissajous method
Digital Storage oscilloscope,
- 5. Signal Generators: (8 hrs)**
Requirement of a good laboratory type Signal Generator, A.F. Signal Generator, Function Generator
- 6. Transducers For Measurement: (8 hrs)**
Temperature, Velocity, Photoelectric, Photosensitive Devices
- 7. Signal Conditioning and Data Acquisition System: (5 hrs)**
Instrumentation Amplifier, Active Filters, Generalized Data Acquisition System, PC based Data Acquisition System.

References

- 1) Cooper W.D. & Helfrick A.D.-----Electronic Instrumentation & Measurement Techniques, Prentice Hall Of India, 3rd Edition, 1993.
- 2) Kalsi H.S.- Electronic Instrumentation, Tata McGraw Hill, 3rd edition, 1997.
- 3) Rangan, Sharma and Mani- Instrumentation devices and systems, Tata Mcgraw Hill, 1985.

- 4) Doebelin E.O.- Measurement systems- Applications and design, Tata Mcgraw Hill, 4th edition, 1990.
- 5) Jones and Chin- Electronic instruments and measurements, John Wiley and Sons, 1987.
- 6) Jog N.K- Electronic Instrumentation & Control, Nandu Publications, 1st Edition 2001.

BBE 306

- ENGINEERING MATERIALS AND COMPONENTS

Material for Resistors (Carbon, metal film & wire wound) Conductors, Switches and Connectors. Capacitors, Inductors,

(9 hrs)

Soldering, Brazing (methods) and Fluxes used.

(7 hrs)

Material for Photoconductor, Photoemissive device, Solar Cells and IR detectors.

(7 hrs)

Components: Resistor, Transistor, Varistor, Variable Resistors, Potentiometer, Capacitor, Inductor, Relays, Fuses, Heat sink, Color code for Resistors and Capacitors and Tolerance.

(9 hrs)

Applications and Biocompatibility of Materials:

(7 hrs)

Ceramic and metallic biomaterial. Titanium and alloys, Stainless steel, Cobalt based Alloys.

Nitinol, and degradable ceramics.

Text:

- 1 Electrical Engineering materials: A.J. Dekker.. (Premise Hall Int)
- 2 Electrical Engineering materials: Madhuri Joshi (Technical Pub. Pune)
- 3 Biomaterial Science and Engineering: J. V. Park (Plenum Press- New York)

References:

Encyclopedia of Medical Devices and Instrumentation: John G. Webster. Vol I, II, III, IV (Marcel Dekkar Pub)

Encyclopedia- handbook of Biomaterials and BioEngineering: Part- A: Materials Vol I, II (Marcel Dekkar Pub) Part- B: Applications Vol I, II

A Text of Biomedical Engineering: R.M. Kennedy. (Blackie Pub)

Practical I
Electric and Electronic Circuits Lab

1. Thevenin's Theorem
2. Diode Characteristic (p – n junction)
3. Input / output characteristics of Transistor
4. Mesh Analysis
5. Nodal Analysis
6. Rectifier (HWR, FWR, BWR)

Practical II
Human Anatomy

Study of following systems using charts, models and preserved organs:

1. Liver
2. Kidney
3. Heart
4. Brain
5. Endocrine System
6. Menstrual Cycle
7. Teeth
8. Nose
9. Lymphatic System
10. Circulatory System
11. Embryonic Development
12. Skin
13. Skeletal System
14. Autonomous Nervous System

BBE 401

APPLIED MATHEMATICS- IV

1. Vector calculus & Analysis

(13 hrs)

- 1.1 Scalar and vector point functions, Directional derivative, Curl and divergence, Conservative, Irrotational and solenoidal fields.
- 1.2 Line integral, Green's theorem for plane regions and properties of line integral, Stoke's theorem, Gauss's divergence theorem (without proof) related identities and deductions.

2. Matrices (II):

(16 hrs)

Brief revision of vectors over real field, Inner product, Norm, Linear independence and orthogonality of vectors.

Characteristic polynomial, characteristic equation, characteristic roots and characteristic vectors of a square matrix, Properties of characteristic roots & vectors of different Types of matrices such as Orthogonal matrix, Hermitian matrix, Skew- Hermitian matrix, Diagonable matrix, Cayley Hamilton's theorem (without proof), Functions of a square matrix, Minimal polynomial and Derogatory matrix.

Quadratic forms, congruent and orthogonal reduction of quadratic form, Rank, index, signature and class value of quadratic form

3. Complex variables:

(16 hrs)

Line integral of a function of complex variable, Cauchy's theorem for analytic function (with proof), Cauchy's Goursat theorem (without proof) Properties of Line integral, Cauchy's integral formula and deductions

Singularities and poles:

Taylor's and Laurent's development (without proof), Residue at isolated singularity and its evaluation.

Residue Theorem application to evaluate real integrals of type $\int_0^{2\pi} f(\cos\theta, \sin\theta) d\theta$ and $\int \alpha^\alpha f(x) dx$

References:

1. Complex Variable- Churchill, McGraw Hill, 2nd edition, 1960.
2. Theory of Function Complex variable- Shantinayanan, S. Chand & Co. , 1979.
3. Engineering mathematics- S.S. Sastri, Prentice Hall of India, 2nd edition, 1989.
4. Element of Applied mathematics- P.N. Wartikar/ J.N. Wartikar, Pune Vidyarthi Griha Prakashan,

BBE 402

ELECTRONIC CIRCUIT ANALYSIS & DESIGN II

Output Stage and Power Amplifiers

(12 hrs)

Power Amplifiers, Power Transistor- Power BJTs, Power MOSFETs, Heat Sinks, design of heat sinks, Classes Of Amplifiers- Class- A Operation, Class- B Operation, Class- AB Operation, Class- C Operation, Class- A Power Amplifiers, Class- AB push pull Complementary output Stages.

Differential and Amplifiers

(13 hrs)

The Differential Amplifier, Basic BJT Differential Pair, Basic FET Differential pair, Differential Amplifier with Active Load, BICMOS Circuits, Gain Stage and Simple Output Stage, Simplified BJT Operational Amplifier Circuit, Differential Amplifier Frequency Response. The Darlington Amplifier and Cascode Amplifier.

Feedback and Stability

(14 hrs)

Introduction to Feed Back, Basic Feedback Concepts, ideal Close- Loop Gain, Gain Sensitivity Bandwidth Extension, Noise Sensitivity, Reduction of Nonlinear Distortion, Ideal Feedback Topologies, Series- Shunt Shunt – Series , Series- series, Shunt- Shunt Configurations, Voltage (Series- Shunt) Amplifiers. Current (Shunt- Series) Amplifiers, Trans Resistance (Shunt- Shunt) Amplifiers, Loop Gain, Stability of The Feedback Circuit, The Stability Problem, Bode Plots: One- Pole, Two – Pole, and Three- Pole Amplifiers, Nyquist Stability Criterion, phase and Gain Margins, Frequency Compensation Basic Theory, Closed Loop Frequency Response, Miller Compensation.

Basics of OPAMP

(6 hrs)

Basic OP.AMP Configurations, Ideal op. AMP circuits Analysis, Negative Feedback, Feedback in OP- AMP circuits, the Loop Gain, Op- AMP Powering.

Text Books:

1. Donald A. Neamen, Electronic Circuit Analysis and Design, Second edition, McGraw Hill international edition 2001
2. Martin Roden, Gordon Carpenter, William Wieserman, Electronic Design, Fourth edition, Shroff publishers, 2002.

Additional Reading:

1. Donald Schilling & Charles Belove, Electronic Circuits Discrete and Integrated, Third edition, McGraw Hill International edition, 1989.
2. Adel Sedra & Kenneth Smith, Microelectronic Circuits, Fourth edition, Oxford University Press, 1998.

BBE 403
MEDICAL BIOCHEMISTRY

- 1. CELLULAR BIOCHEMISTRY** **9 hrs**
Biochemistry of living cell, Sub cellular fractionation using the different centrifugation method. Function of each organelle Redox Potential, Oxidative Phosphorylation, Transport of substances across biological membrane.
NUCLELIC ACID: Composition and Function, Genes, Outline of DNA Structure, Re- Combinant DNA and its applications.

- 2. ENZYMES AND HORMONES** **9 hrs**
Enzymes: Chemical Nature, General Properties, Spectrophotometric measurement of enzymes, Isolation techniques, Diagnostic enzymes.
Enzyme biotechnology.
Hormones: Chemical Nature, Properties of hormones, Hormonal Assay and their Significance.

- 3. CARBOHYDRATE, LIPID, PROTEIN** **9 hrs**
 - (i) **Carbohydrate-** Classification , Metabolism of carbohydrate and its dysfunction. Uses of Carbohydrates.
 - (ii) **Lipids:** Classification, Metabolism of lipids, Cholesterol, bile acids, Transport of lipids, Lipid metabolism dysfunction.
 - (iii) **Protein:** Classification, Amino acids, Chromatography, electrophoresis and architecture of protein molecules.

- 4. BIO CHEMISTRY OF BLOOD AND BODY FLUIDS** **9hrs**
 - (i) Liver Function tests, Renal Function Tests, Blood gas Analysis, Measurement of Electrolytes. Their abnormal Values and Conditions.
 - (ii) Biochemistry of Urine and Stools testing.

- 5. DIAGNOSTIC TOOL** **9hrs**
Principle and Application of Photometry, Spectrophotometry, Flurometry, flame Photometry, Densitometry, Calorimetry, Automation in Clinical Laboratory. Use of Isotopes in Biochemistry.

Total No of periods: 45

TEXT BOOK

1. Dr. Ambiga Shamugam, 'Fundamentals of Bio Chemistry for Medical Student', Karthic Printers, Madras 1997.

BBE 404

LOGIC CIRCUITS

- 1: **Introduction:** (3 hrs)
Number systems, Binary, Octal, Hexadecimal and others. Conversion from one system to another, Binary, BCD and Hexadecimal.
2. **Binary Codes:** (4 hrs)
Weighted, Reflective, Sequential, Gray, Error detecting codes, Odd, Even parity, Hamming codes, Alphanumeric, Morse, Teletypewriter ASCII, EBCDIC codes, Covering Binary to Gray & Gray to Binary and XS3.
3. **Boolean Algebra Logic Gates:** (5 hrs)
AND, OR, NOT, XOR, XNOR, operation NAND, NOR use of the universal gate for performing different operations. Laws of Boolean algebra. De- Morgan's theorems. Relating a Truth Table to a Boolean Expression. Multi level circuits.
4. **Combinational Circuits:** (5 hrs)

K- Maps and their use in specifying Boolean Expressions, Minterm, Maxterm SOP and POS implementation. Implementing a logic function using universal gates. Variable entered maps for five six variables function Quine Mc Clusky tabular techniques.
5. **Sequential Logic Circuits:** (6 hrs)
Comparison of Combinational & Sequential Circuits, Multi-vibrators (Astable, Monostable and Bistable), Flip- Flops, SR, T, D, JK, Converting one flip- flop to another,

Reference

- (1) R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 1984.
- (2) M. Morris Mano, "Digital Design", Prentice Hall International- 1984
- (3) Malvino & Leach, "Digital Principles and Applications," Tata McGraw Hill. 1991
- (4) Malvino, "Digital Electronics", Tata McGraw Hill, 1997.
- (5) James Bignell & Robert Donovan, "Digital Electronics," Delmar, Thomas Learning, 2001
- (6) Jog N. K. , "Logic Circuits", 2nd edition, Nandu Publishers & Printers Pvt. Ltd. 1998.
- (7) Alan b. Marcovitz, "Introduction to Logic Design," McGraw Hill International, 2002.

BBE 405

TRANSDUCERS IN BIOMEDICAL INSTRUMENTATION

Lectures: 3 Hours/ Week

Practical: 2 Hours/ Week

Theory Exam : (3 hrs.: 100 Marks)

T/W: 25 Marks

Oral : 25 Marks

1. Generalized Instrumentation System, general properties of input transducers **(5 hrs)**
 - 1.1 Static Characteristics: Accuracy, Precision, Resolution, Reproducibility, Sensitivity, Drift.
Hysteresis, Linearity, Loading effect, Input Impedance and Output Impedance
 - 1.2 Dynamic Characteristics: First and Second Order characteristics, Time delay, Error free instrument, Transfer functions, design criteria, generalized instrument specifications.
2. Displacement and Pressure measurement : **(5 hrs)**
Resistive- Potentiometers, Strain Gauges, Bridge circuits.
Inductive – Variable Inductance and L V D T
Capacitive type, piezoelectric transducers.
Types of diaphragms, bellows, bourdon tubes.
3. Temperature measurement : Thermistor, Thermocouple, Resistive Temperature detector, Radiation Thermometry, Fiber Optic sensor, Optical measurement Geometrical **(5 hrs)**
4. Flow measurement : Thermistor , Thermocouple, Resistive Temperature detector, Radiation Thermometry , Fiber Optic sensor, Optical measurement. Geometrical. **(5 hrs)**
5. Chemical transducers : Blood gas and Acid – Base physiology, reference electrode, pH, pO₂, pCO₂, electrodes, ISFETS, Transcutaneous arterial oxygen tension, carbon dioxide tension monitoring, enzyme electrode. **(5 hrs)**
6. Biopotential electrodes: Electrode electrolyte interface, half cell potential polarization , polarizable and non polarizable electrodes, Calomel electrode, electrode circuit model, electrode skin interface and motion artifact. Body surface electrodes. **(5 hrs)**
7. Internal electrodes: Needle and wire electrodes (different types) **(3 hrs)**
8. Micro electrodes: metal, supported metal, micropipette (metal filled glass and glass micropipette electrodes), microelectronic, properties of microelectrodes, method of use. Electrodes used for measurement of ECG, EEG and EMG. **(7 hrs)**

Text: 1. Medical Instrumentation, applications and design by John G. Webster (Marcel Dekkar Pub)

References:

1. Biomedical Sensors : Fundamentals and applications – By Harry N. Norton (plenum press)
2. Biomedical Instrumentation and measurements – by Leslie Cromwell, Fred J. Weibell.

BBE- 406
GENETICS

Essential Principles of Genetics: The Principles of inheritance and selection of experimental method. **(8 hrs)**

Extension of Mendelism: Gene action (genotype to phenotype) Gene interaction. The genetic basis of phenotypic variation. Epistasis. Linkage recombination and Gene mapping X linked inheritance, sex determination, Dose compensation. **(15 hrs)**

Evolution of concept of the gene: one gene one enzyme hypothesis, defining gene by complementation test Genetic Code. Genetics of prokaryotes: Genetic of Virus/phage, mapping of phage genotype, Genetic analysis bacteria, transformation, conjugation and Transduction, Generation of genetic diversity. Mutation, recombination, transposition, extra chromosomal inheritance. Techniques of genetic analysis. Morphological/Molecular markers, Mutagenesis, Reporter genes, Mitotic recombination, Deletion mapping, cytological mapping, Identification of a gene; phenotype to cloning. **(18 hrs)**

Books:

1. "Cell Biology, Genetics, Molecular Biology, Evolution & Ecology"
P.S.Varma & V.K.Agarwal
2. "Genetics" by P.K.Gupta
3. "Genetics" by Cuming
4. "Microbial Genetics"- David Freifelder

Practical I
Biochemistry

- a. To test the presence of sugar / proteins in urine or blood sample.
- b. Estimation of total soluble proteins & sugar in given sample using spectrophotometer.
- c. Study of effect of ionic changes on frog heart perfusion.
- d. Estimation of hemoglobin in blood sample
- e. Study peripheral smear
- f. Study for urine smear
- g. Gross – matching of blood
- h. Gram – Staining
- i. Simple stain test of micro – organism
- j. ELISA test for disease diagnosis

Practical II

Biomedical Transducers and Logic Circuits

1. Introduction to lab equipment
2. Implementation of Basic Logic gates
3. Implementation of Universal gates and verify all basic logic gates using Universal gates.
4. To study and implement Ex – OR gate using Universal gate
5. To study and implement Ex – NOR gate using Universal gate.
6. To study operation of strain gauge
7. To study operation of LVDT
8. To study characteristic of Thermistor
9. To study the operation of Thermocouple
10. To study the operation of photoelectric Transducer
11. To study biopotential electrodes

BBE- 501
BIOLOGICAL MODELLING AND SIMULATION

- 1 . Open and Closed loop systems, basic concepts of feedback control systems, stability criteria, speed of response. **(8 hrs)**
2. Physiological Modeling: Modeling, technology and Techniques, linear modeling, Distributed- parameter versus Lumped parameter models, Models with combinations of system elements compartmental modeling and inverse problem. Modeling of physiological systems like Circulatory system and Respiratory system. **(8 hrs)**
3. Thermoregulatory system: Thermoregulation, Controller model, model validation and variations. **(8 hrs)**
4. Neuromuscular system: Stretch reflex, control of joint angle by antagonist muscles, two control mechanism, golgi tendon organs, experimental validation of the models, parkinsons syndrome. **(8 hrs)**
5. Models of Human movement: Four Eye movement, Quantitative eye movement models, and techniques for validating models, parameter estimation, linearising the model. **(8 hrs)**
6. Model of neurons: Hodgkin- Huxley model, Iron wire model. **(5 hrs)**

Text Books and Reference Books:

Bioengineering, Biomedical, Medical and Clinical Engg.- By A. Teri Bahil.
Mathematics and Computers in Biomedical Applications- by J. Elseafedel, C. Delisi.
Encyclopedia of Medical Devices and Instrumentation: John G. Webster. Vol I, II, III, IV
(PH Pub)

BBE 502
MICROPROCESSOR I

1. Introduction to Microprocessors: **(2 hrs)**
Features, Programmer's Model, External and Internal Organization.

 1. 8085 Architecture: **(5 hrs)**
8085 organization and architecture, Instruction Cycle , Machine Cycles and T-States, Address decoding techniques, Minimum system design, Memory Interfacing with timing consideration, Clock, Reset and buffering, circuits.
 3. 8085 Instruction Set: **(6 hrs)**
Instruction Format, Addressing Modes, Classification of instruction set.

 4. 8085 Programming: **(7 hrs)**
Assembly language, programming:- Basic structure, Data transfer, Arithmetical, Logical, Transfer of control and miscellaneous instruction types.
- Stack & Subroutines: **(6 hrs)**
Stack operations, limitations, Subroutine concepts, parameter passing techniques, Subroutine design, Delay Subroutine- design and applications, Re-entrant & Recursive subroutines, concept of counters and timers.
- I/O Data Transfer Techniques: **(7 hrs)**
I/O Interface concepts, speed consideration, program controlled I/ O, asynchronous and synchronous I/O techniques, Interrupt driven program controlled I/O, Direct Memory Access data transfer controlled techniques handshake signals, concepts of serial communications, Matrix keyboard and multiplexed display interfacing.
- Interrupts: **(6 hrs)**
Requirements, Single level interrupt, Multilevel interrupt and Vector interrupt system, 8085 interrupt structure and its operation, 8259A interrupt controller.
- I/O Controllers: **(6 hrs)**
Features, Organization & operating modes of 8155 Multi function device, 8255 Programmable Peripheral interface and its operation, 8254 Programmable Timer, 8237 Programmable DMA Controller.

Term Work: Each student shall appears for atleast one written test during the term. Report on atleast 8 experiements based on the above syllabus duly graded and graded answer- books for the test shall be submitted as term- work.

BOOKS

Microprocessor By R. S. Gaonkar.

Microprocessors and Programmable logic by By K Short.

Microprocessor' By II P. P. Tawade & P. Borole.

8085 Assembly level programming' By Leventhal.

Microprocessor' by Gilmore.

BBE 503
LOGIC CIRCUITS II

- 1 Combinational Logic Circuit Design:** **(9 hrs)**
- Designing code converter circuits e.g. Binary to Gray, BCD to Seven segment, Parity Generator. Binary Arithmetic circuits:- Adders, Subtractors (Half and Full) BCD adder- Subtractor, carry Lookahead adder, Serial adder, Multiplier Magnitude Comparators, Arithmetic Logic units.
- 2 Use of Multiplexers in Logic Design:** **(9 hrs)**
- Multiplexer (ULM). Shannon's theorem. ULM trees. De- Multiplexers, Hazards in combinational circuits.
- 3 Registers:** **(9 hrs)**
- Serial input serial output, Serial input parallel output; Left Right shift register, Use of register ICs for sequence generator and counters.
- 4 Memories:** **(9 hrs)**
- RAM, ROM the basic cell IC bipolar, CMOS, RAM dynamic RAM cell Magnetic core NVRAM, bubble memory CCD, PAL, PLA.
- 5 Logic Families:** **(9 hrs)**
- RTL, DTL, schotkey clamped TTL, Tristate gate ECL, IIL. MOS devices CMOS comparison of logic families. TTL with CMOS, NMOS TTL, ECL & TTL, IIL & TTL.

Reference

- (8) R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 1984.
- (9) M. Morris Mano, "Digital Design", Prentice Hall International- 1984
- (10) Malvino & Leach, "Digital Principles and Applications," Tata McGraw Hill. 1991
- (11) Malvino, "Digital Electronics", Tata McGraw Hill, 1997.
- (12) James Bignell & Robert Donovan, "Digital Electronics," Delmar, Thomas Learning, 2001
- (13) Jog N. K. , "Logic Circuits", 2nd edition, Nandu Publishers & Printers Pvt. Ltd. 1998.
- (14) Alan b. Marcovitz, "Introduction to Logic Design," McGraw Hill International, 2002.

BBE 504

Medical Microbiology

1. **NORMAL CELL STRUCTURE** **9hrs**
Cell Degeneration and regeneration- Inflammations, apoptosis, Neoplasia. Classification, Difference benign and malignant tumors- Etiology of tumors- Spread of Tumors.
2. **FLUID AND HEAMODYNAMIC DERANGEMENT** **9hrs**
Edema , Shock, Hemorrhage – Thrombus- Embolism- Disseminated intra vascular Coagulation- Hematological disorders. Bleeding Disorder- Leukemia- lymphoma.
3. **GENETIC DISORDERS, INFECTION AND IMMUNITY** **9HRS**
Autosomal and Sex linked disorders- Storage disorder- Types of hypersensitivity reactions- Immune deficiency Syndrome- Primay – HIV- Viral disease. Chlamydial- Bacterial- mycoplasma- Rickettsial disease- Fungal, protozola.-Helminthic disease.
4. General Structural Organization of Bacterial, Viral Cell- Growth and Identitafication of Bacteria, Observation of culture.
Microscopy: Light Microscopy- Dark field Microscopy- phase contrast microscopy- electron microscopy. **9hrs**
5. Identification of disease producing organism, Simple Stain, Gram Stain, AFB Stain. Fluorescent techniques, Antigen- Antibody Techniques. **9 hrs.**

Total No of periods: 45

TEXT BOOK:

1. Robbins S. L & Ramzi S. C, 'Pathologic Baiss of Diseases,' W. B. Saunders Co. 1999
2. Anatha Narayannan. R & Jayaram Panicker C. R, 'Text Book of Microbiology, Orient Laongman' 1998.

BBE 505

BIOMEDICAL INSTRUMENTATION I

1. Basic Principles, working and applications of Analytical and Laboratory Instruments: **(18 hrs)**
 - A. Spectrophotometer
 - B. Colorimeter.
 - C. pH meter
 - D. Centrifuge.
 - E. Flame Photo meter.
 - F. Blood cell counter
2. Blood Gas Analyser: **(7 hrs)**
Measurements of Blood pH, pCO₂, pO₂ and Complete Blood gas analyser.
3. Blood Flow Measurement: **(10 hrs)**
Electromagnetic, Ultrasonic, NMR and Laser Doppler flowmetry, cardiac output measurement, Impedance plethysmography.
4. Oximetry. **(7 hrs)**

Text:

1. Handbook of Analytical Instruments: R.S. Khandpur(TMh Pub)
2. Medical Instrumentation, Application & Design: J.G.Webster(John Willey)

References:

- Encyclopedia of Medical Devices and Instrumentation: John G. Webster (John Willey), Vol I, II, III, IV
- Introduction to Biomedical Equipment Technology: Carr – Brown. (Pearson Education Pub)
- Various Instruments Manuals.

BBE 506
MEDICAL IMAGING – I

1. Ultrasound Imaging: **(17 hrs)**
Ultrasound transducer, measurement of imaging system, application of A – scan, M – scan and B – scan, scattering and propagation of ultrasound in biological material with application to imaging and tissues, sector scan, mechanical sector transducer, linear scan using multi element linear array scanner, annular array system. Theory and construction of array transducer for imaging, Doppler ultrasound system and their application to the study of blood flow continuous wave and pulsed system, Doppler imaging.

2. X-rays: **(16 hrs)**
Properties of x-rays, production of x-rays, x-ray tubes, x-ray apparatus, engineering principles of x-ray system: Image Intensifier, X-ray Generators, X-ray tube filament circuit, Attenuators and filters, Fluoroscopy, Digital radiography

3. Computed Tomography
Basic Principle, different generations ,applications

4.MRI
Basic principle, gradient coils, Applications

Text:

1. Text book of Radiology – Christensens. (Lippincott William and Willkins Pub)

References:

1. Medical Radiation Physics – edited by William Hendee. (Academic Press)
2. Instrumentation in Nuclear medicine – edited by G. Hine – Vol I and II. (Academic Press)
3. Clinical Scintigraphy – edited by P. M. Johnson and L. Freeman – Vol I, II and III. (Plenum Pub)

Practical I

Microprocessor I

1. Know your microprocessor Laboratory.
2. Addition of two 8 bit binary numbers and addition of two 16 bit binary numbers.
3. 8-bit binary subtraction.
4. 8-bit binary multiplication.
5. Binary division.
6. Decimal Subtraction.
7. Find largest & smallest number from the given series of number.
8. Peripheral 8155 (I/O mode and generation of square wave using internal timer).
- 9.
10. Voltage Measurement Using ADC.
11. Microprocessor Based Temperature Controller.
12. Microprocessor Based Stepper Motor Control.
13. Opcode Sheet
14. Data transfer technique
 - a) Speed consideration
 - b) Program controlled I/O
 - c) Matrix keyboard and multiplexed display interfacing

Practical II
Medical Microbiology

- 1. 'Diagnostic cycle' of any one infection of each of the above systems**
 - a) Respiratory track: *C. diphtheriae*
 - b) Urinary tract: *pseudomonas*
 - c) GI tract: *Salmonella / E. coli*
 - d) Skin: *Stapholococcus / streptococcus*

2. Isolation of the above organisms on selective and differential media like Mac conkey, mannitol salt agar, Cetrimide agar, blood agar
3. Rapid identification tests for the identification of above organisms (Gram staining, capsule staining, staining of metachromatic granules, oxidase and catalase test)
4. Rapid identification kits for the identification of above organisms (Hi media kits can be used)

BBE- 601
MICROPROCESSORS II

1. Overview of microcomputer systems. Hardware and software principles.
(3 hrs)
2. Introduction to single chip microcomputer Intel 'MCS 51 family, Architectural and Operational features. Its instruction set. CPU timing and machine cycles. Interrupt structure and priorities. Internal Timers/ counters, serial interface Connection of external Memory. Power saving modes EPROM programming for EPROM versions.
(8 hrs)
3. Architecture and Organisation of 8086/ 8088 microprocessor family. Study of its Instruction set. Assembly language programming. Introduction to mixed language programming using C and Assembly, language.8086 family minimum mode connection. Study of 8288 bus controller. 8086 interrupt structure.
(8 hrs)
4. Memory system design for 8086 family including interface of dynamic Read/write memory, timing considerations for memory interfacing. Connections of I/O Controllers 8255 AII Programmable peripheral interface, Programmable Interrupt Controller 8259 A UART 8250, Programmable D. M. A. Controller 8237. Data Communications, E. IA RS 232C serial interface and IEEE, 488 General purpose interface Error detection and correction- parity and Cyclic redundancy check.
(9 hrs)
5. Study of architecture of 8087 floating point co- processor, Data types supported by 8087 Host and co- processor interface, Assembly language programming for 8086, 8087 based.
(8 hrs)
6. Introduction to Multiprocessor systems. Multiprocessor configurations. Study of 8289 bus arbiter. Design of 8086 based multiprocessor systems(Without timing considerations)
(9 hrs)

Books:

1. 8086/ 8088 interface, Programming and Design- John Uffenback (PHI)
2. Experimentation with the Intel SDK 51 By Boyet and others (Hayden Publishing)
3. Microprocessor interface and Programming – Douglas Hall (McGraw Hill)
4. Microprocessors system 8086/80836 family- Liu & Gibson (PHI)
5. Intel Microprocessors by Goody (Mc Graw Hill)
6. Data Manuals from Intel Corporation.
7. Intel Microprocessors – Tabak (Mc Graw)

BBE- 602

Analog Integrated Circuits & Applications

Circuits with Resistive Feedback

(5 hrs)

Current-to- Voltage Converter, Voltage-to-Currents Converters, Current Amplifiers, Difference Amplifier, Instrumentation Amplifier, Instrumentation Applications, Transducer Bridge Amplifiers.

Active Filter

(5 hrs)

The Transfer function, First- Order Active Filters, Audio Filter Applications, Standard Second- Order Responses, KRC Filters, Multiple- Feedback Filters, State- Variable and Biquad Filters. Sensitivity, Filter approximations, cascade design, generalized impedance converters, direct design.

Static Op Amp Limitations

(4 hrs)

Simplified Op Amp Circuits Diagram, Input Bias and Offset Currents, Low- Input-Bias-Current Op-Amps, Input Offset Voltage. Low-Input-Offset-Voltage Op Amps, Input Offset- Error Compensation, Maximum Ratings.

Dynamic Op Amp Limitations

(3 hrs)

Open Loop Response, Closed- Loop Response, Input and Output Impedances, Transient Response. Effect of Finite GBP on Integrator Circuits. Effect of Finite GBP on Filters. Current Feedback Amplifiers.

Noise

(4 hrs)

Noise Properties, Noise Dynamics, Sources of Noise, Op Amp Noise, Noise in Photodiode Amplifiers, Low-noise Op Amps.

Stability

(5 hrs)

The Stability Problem, Stability in Constant- GBP Op Amps Circuits, Internal Frequency Compensation. External Frequency Compensation, Stability in CFA Circuits Composite Amplifiers.

Nonlinear circuits

(4 hrs)

Voltage Comparator, Comparator Applications, Schmitt Triggers, Precision rectifiers, Analog Switches, Peak Detectors, Sample-and-Hold Amplifiers.

Waveform Generators

(7 hrs)

Sine wave generators using Op-Amps, Monolithic Timer-NE555, Triangular wave generator using Op-Amps, Saw tooth Wave Generator using Op-Amps, Monolithic Waveform generators-ICL8038, V-F and F-V Converters.

D-A and A-D Converters

(5 hrs)

Sample and Hold Circuits, D-A Conversion Techniques, Multiplying DAC Applications, A-D Conversion Techniques, Performance Specifications, over sampling converters.

Nonlinear Amplifiers and Phase-Locked Loops

(3 hrs)

Log/ Antilog Amplifiers, Analog Multipliers, Operational Trans-conductance Amplifiers, Phase Locked loops, monolithic PLLs.

Text Books:

1. Operational amplifiers – Gaikwad.
2. Sergio Franco, Design with Operational amplifiers and Analog Integrated circuits, Third edition(MC Graw Hill).
3. Op-Amp and Linear Integrated circuits – James M.Fiore

BBE 603
BIO MECHANICS

Biomechanics:

General principles of Biomechanics Analysis of biological sub system from biomechanical view and rise modeling, Instrumentation. **(5 hrs)**

Tissue Biomechanics: Direct, shear, bending and torque actions and the corresponding stresses, strains in biological tissues. Stress relaxation and creep, stability and instability. Biomechanical characterization of bone and the soft connective (Skin, Tendon, Ligaments) covering structure, function and physiological factors. **(7 hrs)**

Movement Biomechanics: Gait Analysis, body and limb mass and motion characteristic actions, forces transmitted by joints. Joints forces results in the normal and fast gait on the level. Strain and ramp ascent and descent. Joint replacement.

Prosthetics and Orthotics: **(2 hrs)**

Principles in designing orthosis and prostheses: Principles of three point pressure, total contact, partial weight relieving. **(5 hrs)**

Positions of anatomical axis and corresponding movements of the body part. International conventions with respect to above. **(5 hrs)**

Purpose for providing Prostheses and Orthoses : Various aspects regarding diagnosis, prognosis, stature and socio-economic conditions. **(5 hrs)**

Classification in Prothetics and Orthetics : Lower Extremity orthosis and prostheses, Upper Extremity Orthoses and Prostheses, Spinal Orthoses. **(5 hrs)**

Recent developments in prosthetics and Orthotics. **(1 hrs)**

Material Technology in Prosthetics and Orthotics : **(1 hrs)**

Indigenous metals and their alloys. **(1 hrs)**

Different types of leather and leather tanning. **(1 hrs)**

Types of rubber **(1 hrs)**

Thermoplastics and thermosetting resins, moulding/lamination techniques. **(1 hrs)**

Wood and Binding materials. **(1 hrs)**

Research and development in orthotics and prosthetics. **(1 hrs)**

4. Artificial machines and Implants : Introduction, basic transport theory. **(3 hrs)**
Artificial Lungs / Respirator, Artificial Kidney, Intra Aortic Ballon Pump.

Text & References:

1. A textbook of Biomedicl Engineering- Edited by R. M. Kenedy. (Blackie Pub)
2. Handbook on Bioengineering – by Ruchard Skalak and Shu Chien
3. Human limbs and their substitutes- Atlas
4. American Atlas of Orthopedics- Lower Extremity Prosthetics
Upper Extremitty Prosthetics.
Orthitics.
5. Biomechanics- by Prof. Ghista. (Private Publication UAE)
6. Biomechanics –by White and Puyator. (Private Publication UAE)

BBE-604
MEDICAL IMAGING II

1. Basic Nuclear physics: Radioactivity, properties of radiation. Radiation detectors, scintillation detectors, pulse height analysis **(15 hrs)**

2. Nuclear Medicine Instrumentation: **(15 hrs)**

Collimators functional parameters of various types of collimators.
Functional block diagram of thyroid uptake systems.
Rectilinear scanners and Scintillation cameras. (Gamma camera)

- 3 Positron Emission Tomography. **(10 hrs)**
Single Photon Emission Computer Tomography.

Text:

Text book of Radiology- Christensens(Lippincott William and Willkins pub)

References:

1. Medical Radiation Physics- edited by William Hendee. (Academic press)
2. Instrumentation in Nuclear medicine- edited by G. Hine- Vol I and II (Academic press)
3. Clinical Scintigraphy- edited by P. M. Johnson and L. Freeman- Vol I, II and III (Plenum Pub)

BBE- 605

BIOMEDICAL INSTRUMENTATION- II

1. **(11 hrs)**
Generation of Bioelectric potentials.
Recording techniques of Bioelectric signals: ECG, EMG, EEG, EOG, ERG.
Biophysical Amplifiers and recorders (with technical specifications). Basic recording system. General consideration for electronic recorder amplifiers. Sources of noise in low level recording circuits. Recording systems for ECG, EMG, EEG and Phonocardiography. Measurement of skin resistance.
Writing Systems:
Ink jet, Potentiometric, UV, Thermal, Light gate, Magnaetic, Laser optics and Instrumentation tape recorders.
2. Patient Monitoring system **(8 hrs).**
Measurement of Heart rate, Blood pressure, Temperature and Respiration rate.
Apnoea Detector.
3. Arrhythmia and Ambulatory Monitoring Instruments: **(5 hrs)**
Cardiac Arrhythmias. Ambulatory monitoring instruments.
4. Foetal Monitoring System: **(5hrs)**
Cardiotocograph. Methods of monitoring foetal heart rate and labour activity
Foetal scalp pH measurement.
5. Biotelemetry. **(3 hrs)**
6. Biofeedback techniques. **(2 hrs)**
7. Electrical safety in biophysical measurements **(5 hrs)**

Text:

1. Handbook of Biomedical Instrumentation: R. S. Khandpur. (TMH pub)
2. Medical Instrumentation, Application and Design: J. G. Webster. (John Willey pub)

References:

- Encyclopedia of Medical Devices and Instrumentation: John G. Webster. Vol I, II, III, IV. (John Willey Pub)
- Introduction to Biomedical Equipment Technology: Carr- Brown. (PH Pub)
- Various Instruments Manuals.

BBE- 606

SIGNAL PROCESSING FOR BIOMEDICAL APPLICATIONS- II

1. Digital signals and Systems: Classification of systems: causal, timevarying, time, Invariant, lumped. Introduction to Digital Signals Systems. Convolution, Auto-correlation and Cross- correlation. Sampling. Allasing, Nyquist criteria.
(8 hrs)
2. Z Transform: Introduction, Defenition, Convergence, Inverse Z Transforma, Analysis of discrete time systems using Z transforms: Solutions of Differential equations, Transfer functions and Stability.
(8 hrs)
3. Fourier transform for continuous signals, energy spectrum, Properties (Without proof), Gibbs phenomena, Auto and cross correlation. Discrete Fourier transforms, properties (without proof), Inverse DFT, FFT: Decimation in time and Decimation in frequency.
(8 hrs)
4. Digital Filter design: Introduction, Realisation of digital systems, Canonical form Direct form and cascade realization of IIR and FIR filters. Design of IIR and FIR filters, Low pass, high pass, band pass filters using windows-Kaiser windows. FIR filter design using Frequency sampling.
(7 hrs)
5. Study of DSP hardware: DSP chips from Texas and Motorola, Implementation of digital filters using the above chips.
(7 hrs)
6. Adaptive Noise canceling Introduction, Principles, LMS, RLS adaptation, algorithm Adaptive line enhancer (ALE). Introduction, Principles, LMS, GAL, algorithm.
(7 hrs)

Text:

1. Digital Signal processing: Proakis (PH Pub)
2. Digital Signal processing : Oppenheim and Schafer (PH Pub)
3. Biomedical signal processing: Metin Akay (Academic press)

Reference:

1. Biomedical signal processing: Tompkins (Academic press)
2. Theory and applications of Digital Signal processing: Rabiner and Gold (EEE Pub)

Practical I

1. Perform current to voltage converter
2. perform voltage to current converter
3. Study and perform instrumentation amplifier
4. Study of OP-AMP
5. Perform adder using OP-AMP
6. perform subtractor using OP-AMP
7. study and perform filters
8. Perform Schmitt trigger
9. perform precision rectifier
10. Perform triangular and saw tooth wave generator using OP-AMP

Practical II

Microprocessor II

1. Interfacing
 - a) UART 8250
 - b) DMA controller 8237
 - c) RS 232 C serial interface
 - d) IEEE interfacing
 - e) 488 general purpose interface- error detection and correction and CRC
2. Study of IC 8255 programmable peripheral interface (I/O mode & BSR mode).
3. Interfacing of DAC with 8085.
4. Study of proportional integral derivative controller.
5. Study of Synchro Characteristics.
6. Synchro As Error Detector.

BBE-701

HOSPITAL MANAGEMENT AND INFORMATION SYSTEMS

1. Organizations & Basic Techniques of Managements. Types of Organization or establishments. (Commercial, non- commercial- companies, shops, hospitals & medical services, trusts/ chairtable organizations, home etc.) Basic principles of managements – Need & Methods Areas of applications in various organization with particular reference to hospitals, nursing homes medical medical centre etc. Applications/ Use of computers in managements or computerization in management. **(9 hrs)**
2. Non- medical or Engineering services in hospitals- overview. General maintenance in hospital – overview Civil, Electrical, Ac & R, Biomedical & Communication, Utilities (like Systems for Sterilizations, Medical Gas supplies, Laundry, Incinerator, Water supply & Sanitary systems, Lifts/ Elevators etc.), and Security & Fire Fighting services. Waste management- with particular ref. To Biomedical waste (Hazards, Risk factors, Precautions/care, Methods etc.) Other supportive services- house keeping etc. **(9 hrs)**
3. Biomedical Engineering dept/services. Basic concept (need & advantage) & responsibilities. Identification of responsibilities. Setup and requirements – Infrastructure- space/ location, Man- power, Office & Workshop facilities (Administration/ Operation setup, tools & equipments, records & documentation, inventory of instruments/ equipments/ systems- Manuals, database engineering stores (spare etc.) Identification of instruments/ equipments /system & test and calibration))& tracing record. Break down/ corrective maintenance – understanding problem & its root cause, trouble- shooting techniques, precautions/ care, logging record. Application of computer in BME Services. **(9 hrs)**
4. Evaluation of instruments/ equipments/ system. Basic configuration, add on peripherals & copst of reapirs & maintenance. Preparation of statement for comparison of terms & conditions for maintenance contract. Up- gradation possibilities & effective cost. Disposal/ substitution. Salvage/ condemn procedure. Waste management- with particular reference to biological/ biomedical waste (Concept, procedures, hazards & risk factors involved.) **(9 hrs)**
5. Application/ use of computers in biomedical engineering services- office management, documentation of all records. Maintenance of computers/ computerized equipments or systems.
Maintenance of communications systems and instruments, PA/ paging systems,
Documentation/ reprographic equipments (phoyocopying machine), items used for entertainment (TV, VCR, Ect) **(9 hrs)**

Text Books and Reference Books:

1. Computers in Medicine. R. D. Lele. (TMH Pub)
2. Hospital planning, Design and Management: Kunders G. D. S. Gopinath, A. Katakam (Private Pub Bangalore)
3. Hospital Care and Hospital Management AICTE Journal Vol 1,2,3 by Dr. Kalanidhi (AICTE pub Bangalore)

BBE- 702

PRINCIPLES OF IMAGE PROCESSING

- 1 . Image acquisition processing, Communication, display, and Visual perception: Structure of the human eye, Image formation in the eye, Brightness, adaptation and discrimination. Image model: Uniform and Non- uniform sampling, quantization. **(6 hrs)**
2. Image Transforms: Fourier transforms, FFT, Discrete cosine transforms, Walsh, Harr transforms. **(5 hrs)**
3. Image Enhancement: Contrast manipulation, Histogram modification, noise cleaning ,edge sharpening, Frequency domain methods, Low pass and high pass filtering, homomorphic filtering. **(8 hrs)**
4. Image Segmentation : Detection of discontinuity, Point Line and Edge detection, and Edge linking and boundary detection , Thresholds, Hough Transforms. **(7 hrs)**
5. Image compression: Fundamentals, Image compression models, Errorfree compression, Lossy compression, Compression standards GIF, TIFF, and JPEG. **(6 hrs)**
6. Representation and descriptions: Boundary descriptors, region descriptors , morphology- dilation, erosion, opening, closing, hit or missfilter. **(6 hrs)**
7. Biomedical Application: Computer Tomography (Radon Transform, Back Projection Operator), MRI Images, processing of Radiograph, Angiogram, Sonography including Doppler Technique.
The applications of the above for processing of images such as brain kidney, liver, thyroid Glands etc. **(7 hrs)**

Text Books and Reference Books:

- Digital Image processing: Rafael C. Gonzalez and Richard E. Woods (Addison Wesley Pub)
Fundamentals of Digital Image Processing : Anil K. Jain (PHI Pub)

Reference Books:

- Digital Image processing : William pratt (John Wiley)

BBE- 703

ADVANCED BIOMEDICAL INSTRUMENTATION

1. Physiotherapy, Electrotherapy and Radiation Therapy Equipments: Basic principle, working and technical specifications of Short wave Diathermy, Ultrasonic therapy unit, Infrared and UV lamps, Nerve and Muscle Stimulator, Radiation and Physical therapy Units. **(8 hrs)**

1. Surgical Instruments: Surgical Diathermy unit, electrodes used for surgery, modes of operation and Safety aspects. Surgical Diathermy Analyzer. Operation table and lights. **(8 hrs)**

3. Ventilators and Respiration therapy equipment. **(6 hrs)**

4. Cardiac Pacemakers: Modes of operation, leads and electrodes. Power supply sources. External and Implantable Pacemakers. Performance aspects of Implantable Pacemakers. **(6 hrs)**

5. Cardiac Defibrillator: Dc defibrillator, modes of operations and electrodes. Performance aspect of dc defibrillator analyzer. **(4 hrs)**

6. Hemodialysis Machine: **(4 hrs)**

Basic principle of dialysis. Different types of dialyser membranes. Portable type.

7. Neonatal Monitoring. **(2 hrs)**

8. Lasers applications in Biomedical Engineering. **(2 hrs)**

9. Telemedicine concepts and its application. **(2 hrs)**

10. Heart rate variability measurement and application **(2 hrs)**

11. Endoscopy and its applications. **(1 hrs)**

Text Books:

1. Handbook of Biomedical Instrumentation: R. S. Khandpur (PH Pub)
2. Medical Instrumentation, Application and Design: J. G. Webster. (John Willey)

Reference Books:

1. Encyclopedia of Medical Devices and Instrumentation: John G. Webster. Vol I, II, III, IV (PH Pub)
2. Introduction to Biomedical Equipment Technology: Carr- Brown. (PH Pub)
3. Various Instruments Manuals.

BBE- 704

NUCLEAR MEDICINE

1. Introduction to Nuclear Medicine (Birds Eye View) **(2 hrs)**
2. Nuclear Medicine Instrumentation : Radiation detectors, gas filled detectors, scintillation detectors, and pulse height analysis, gamma ray spectrometry. Fundamental block diagram of counting systems, measurement of radioactivity, invivo and invitro. **(8 hrs)**
3. Invitro Assays: Principles of Radiommuoassays, quality assurance in RIA and other related Techniques. **(7 hrs)**

4. Radiopharmacy: Introduction to hospital radio pharmacy, ideal characteristics of radiopharmaceuticals, radio nuclide generators. ^{99}Mo - $^{99\text{m}}\text{Tc}$ generators, preparation of $^{99\text{m}}\text{Tc}$ labeled radiopharmaceuticals. Mechanism of localization of Radiopharmaceuticals in Nuclear Medicine. **(8 hrs)**
5. Radiation safety and protection: Concepts of radiation safety. External radiation hazards and prevention, shielding, time, distance. Internal radiation exposure: Injection, inhalation, and ingestion. Biological effects of acute and chronic radiation exposure. Disposal of radioactive biological waste materials. **(10 hrs)**

6. Computers in Nuclear Medicine: Its role as data storage, retrieval. Quantitative Nuclear Medicine : Image reconstruction and quality assurance. **(6 hrs)**
7. Recent trends in Nuclear Medicine: Disease specific radiopharmaceuticals and newer concepts medicine. **(4 hrs)**

Text Books and Reference Books:

1. Medical Radiation Physics- edited by William Hendee. (Academic Press)
2. Instrumentation in Nuclear medicine- edited by G. Hine- Vol I and II (Academic Press)
3. Clinical Scintigraphy- edited by P. M. Johnson and L. Freeman- Vol I, II and III. (John Wiley)

BBE 705

ADVANCED MEDICAL IMAGING

1. Magnetic Resonance Imaging(Recent Developments) **(12 hrs)**
Basic principle of M. R. Spectroscopy, Time domain Vs Frequency Domain, Molecular proton groups observable by M. R. Spectroscopy. Need for separation of the proton water peak, methods for the separation and attenuation of peak, Resonance, Single localized M. R. Spectroscopy, consideration while performing spatially localized M. R. Spectroscopy, Biological Effects of magnetic field. Contrast Agents in MR Imaging.
2. X- Rays (Recent Developments) **(11 hrs)**
Digital Radiography, 3- D Reconstruction Technique, Dynamic Spatial Reconstructor, Imatron or Fast of fastrac electron beam C. T. Digital Mammography Construction, operation, Detection of Benign and Malignant tumors. Interventional Radiography along with subtraction angiography.
3. Ultrasound Imaging (Recent Advancement) **(11 hrs)**
Color Doppler Imaging, Parallel Processing, Ultrasound contrast media and interactive Imaging.
4. Recent Developments in Sonography **(11 hrs)**
Rectal Probe, Ophthalmology probe, Cerebral Imaging in pediatrics.

Textbooks:

- I) Principles of Medical Imaging K. Kirk Shung, Michael B. Smith, Benjamin Tsui (Academic Press)
- II) Christen's Physics of Diagnostic Radiology: Thomas S. Cury, James E. Dowdey, Robert C. Curry (Lippincott Williams)

Reference Books:

- i) Neuro- Imaging Clinics of North America: Burton P. Drayer_ Vol. 8, No. 4, Nov. 1998 (W. B. Saunders Co.)

BBE -706

INTRODUCTION TO MEDICAL INFORMATICS

Data & information capture in health care management and clinical delivery systems, multimodel data, Epidimcology and etiology data, Data quality, importance of data organization. **(10 hrs)**

Organisation and retrieval of health care and clinical data, Data base systems and implementation for medical applications. **(7 hrs)**

Multi-sensor data with particular relevance to the organization of images. **(5 hrs)**

Intelligent systems approaches in medicine paradigms of inferncing, Building of knowledge- based systems. **(8 hrs)**

Treatment of uncertainty, Learn ability & adaptive systems. **(5 hrs)**

Networked system and intelligent retrieval web-based inferencing, Building and use of decision support system for clinical applications. **(10 hrs)**

Texts & References

1. T. Dentsch E. Carson & E. Ludnrig : Dealing with Medical knowledge – computers in clinical. Decision making , plenum press, 1994.
2. J. A Reggia & S. Tuhrim (Eds): computer- Assisted Medical Decision making, volumers 1 & 2, springer
3. T. Linden & M. L Kienholz: Dr. Tom Linden’s Guide to outline Medicine Mc Graw Hill, 1995.
4. J. A Anderson: An introduction to Neural Networks, MIT press, 1995.

Practical I

1. To study UV lamp, nerve and muscle stimulator
2. To study shortwave diathermy and ultrasonic therapy unit
3. To study different types of electrodes used for surgical applications
4. To study Ventilators
5. To study cardiac defibrillators
6. To study LASER

Practical II

1. To study the recording systems ECG, EEG, EMG
2. To study foetal monitoring systems
3. To study the recording techniques of biomedical parameters
4. To study patient monitoring systems
5. To study dialysis machines
6. To study different types of Microscopes