COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY

B TECH DEGREE

in

ELECTRONICS AND BIOMEDICAL ENGINEERING

SCHEME FOR I TO VIII SEMESTERS

(2006 Admission onwards)

NB: For all the practicals from semester I & II to semester VII , 50% weightage is to be given for continuous evaluation and 50% for end semester for end semester exam

Course No	Subject	Hrs./week		Internal Marks	University Marks	Total Marks
		L	T/D/P			
SEMESTER I&II (common to all)						
CE/CS/EB/EC/EE/ EI/IT/ME/SE **101**	Engineering Mathematics I	3		50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **102**	Engineering Physics	2		50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **103**	Engineering Chemistry	2		50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **104**	Engineering Mechanics	3	1	50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **105**	Engineering Graphics	1	3	50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **106**	Basic Civil and Mechanical Engineering	2		50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **107**	Basic Electrical Engineering and Electronics	2		50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **108**	Computer Programming	2		50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **109**	Technical Communication and Social Sciences	3*		50	100	150
CE/CS/EB/EC/EE/ EI/IT/ME/SE **110**	Computer Programming Laboratory		3	100		100
CE/CS/EB/EC/EE/ EI/IT/ME/SE **111**	Electrical and Mechanical Workshops		3	100		100
	Total	**20**	**10**	**650**	**900**	**1550**

*** 1 hour/week for environmental studies**

Course No	Subject	Hrs./week		Internal marks	University marks	Total marks
		L	T/D/P			
SEMESTER III						
CE/CS/EB/EC/EE/ EI/IT/ME/SE 301	Engineering Mathematics II	4		50	100	150
EB/EC/EI/IT/ME 302	Electrical Technology	4		50	100	150
EB 303	Principles of Anatomy & Physiology	4		50	100	150
EB/EC/EI 304	Digital Electronics	4		50	100	150
EB 305	Medical Physics	4		50	100	150
CS/EB/EE 306	Electronic Devices & Circuits	4		50	100	150
EB/EC/EI 307	Basic Electronics Laboratory	-	3	100		100
EB/EC/EI 308	Electrical Machines Laboratory	-	3	100		100
	Total	**24**	**6**	**500**	**600**	**1100**

Course No	Subject	Hrs./ week		Internal marks	University marks	Total marks
		L	T/D/P			
SEMESTER IV						
CE/CS/EB/EC/EE/ EI/IT/ME/SE 401	Engineering Mathematics III	4		50	100	150
CS/EB/EC/EI 402	Microprocessors	4		50	100	150
EB 403	Integrated Circuits & Systems	4		50	100	150
EB 404	Bioelectric Phenomena	4		50	100	150
EB 405	Communication Techniques	4		50	100	150
EB/EC/EE/EI 406	Industrial & Power Electronics	4		50	100	150
CS/EB/EC/EE/EI 407	Digital Electronics Laboratory	-	3	100		100
EB 408	Analog Circuits Laboratory	-	3	100		100
Total		**24**	**6**	**500**	**600**	**1100**

Course No	Subject	Hrs./week		Internal marks	University marks	Total marks
		L	T/D/P			
SEMESTER V						
CE/CS/EB/EC/EE/ EI/IT/ME/SE 501	Engineering Mathematics IV	4		50	100	150
EB 502	Biomaterials	4		50	100	150
EB 503	Hospital Engineering	4		50	100	150
EB 504	Biosignal Processing - I	4		50	100	150
EB 505	Bioinstrumentation – I	4		50	100	150
EB 506	Microprocessor based System Design	4		50	100	150
CS/EB/EC/EI 507	Microprocessor Laboratory	-	3	100		100
EB 508	Medical Electronics Laboratory - I	-	3	100		100
Total		**24**	**6**	**500**	**600**	**1100**

Course No	Subject	Hrs./week		Internal marks	University marks	Total marks
		L	T/D/P			
SEMESTER VI						
EB 601	Biosensors and Transducers	4		50	100	150
EB 602	Biomechanics	4		50	100	150
EB 603	Bioinstrumentation – II	4		50	100	150
EB 604	Principles of Object Oriented Programming	4		50	100	150
CS/EB/EC/EI 605	Control Systems Engineering	4		50	100	150
EB 606	Biosignal Processing - II	4		50	100	150
EB 607	Medical Electronics Laboratory - II	-	3	100		100
EB 608	Mini Project	-	3	100		100
Total		**24**	**6**	**500**	**600**	**1100**

Course No	Subject	Hrs./week		Internal marks	University marks	Total marks
		L	T/D/P			
SEMESTER VII						
CS/EB/EC/EE/EI/IT 701	Industrial Organization & Management	4		50	100	150
EB 702	Therapeutic Equipments	4		50	100	150
EB 703	Principles of Radio diagnosis and Radiotherapy	4		50	100	150
EB 704	Medical Imaging Techniques	4		50	100	150
EB 705	Elective I	4		50	100	150
EB 706	Biosignal Processing Laboratory	-	3	100		100
EB 707	Bioengineering Laboratory	-	3	100		100
EB 708	Seminar	-	2	50		50
EB 709	Main Project - Design		2	50		50
Total		**20**	**10**	**550**	**500**	**1050**

ELECTIVE I

EB /EE 705 (A) Computer Communications

EB 705 (B) Biostatistics & Design of Experiments

EB/CS/IT 705 (C) Artificial Neural Networks

EB /EC/EI 705 (D) Mechatronics.

EB 705 (E) Embedded Systems and Applications

Course No	Subject	Hrs./ week		Internal marks	University marks	Total marks
		L	T/D/P			
SEMESTER VIII						
EB 801	Medical Image Processing	4		50	100	150
EB 802	Telemedicine	4		50	100	150
EB 803	Biophotonics	4		50	100	150
EB 804	Elective II	4		50	100	150
EB 805	Main Project		14	300		300
EB 806	Viva Voce				100	100
Total		**16**	**14**	**500**	**500**	**1000**
Grand Total				**3700**	**4300**	**8000**

ELECTIVE II

EB 804 (A) Modelling of Physiological Systems

CS/EB/EC/IT 804 (B) Bioinformatics

EB 804 (C) Computer Graphics and Volume Visualisation

EB 804 (D) VLSI Design

EB 804 (E) BioMEMS & Nanotechnology

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SYLLABUS FOR I TO VIII SEMESTERS
(2006 Admission onwards)

CE/CS/EB/EC/EE/EI/IT/ME/SE 101 ENGINEERING MATHEMATICS I

MODULE I

Ordinary differential equations: First order differential equations-Methods of solution and Simple applications- Linear differential equations of higher orders with constant co-efficients- Methods of solution of these equations. Cauchy's linear differential equations. Simultaneous linear differential equations- Simple applications of linear differential equations in engineering problems –Electrical Circuits, Mechanical Systems

MODULE II

Infinite series: Integral test, comparison test, ratio test, Cauchy's root test, Raabe's test, series of positive and negative terms, concept of absolute convergence, alternating series, Leibniz test (No proofs for any of the above tests)

Power series : Internal of convergence of power series, Taylor and Maclaurin series of functions, Leibniz formula for the nth derivative of the product of two functions (No proof),use of Leibniz formula for the determination of co-efficients of the power series.

MODULE III

Partial differentiation: Partial differentiation-Concept of partial derivative - Chain rule- Total derivative- Euler's theorem for homogeneous functions, Differentials and their applications in errors and approximations, Jacobians - Maxima minima of functions of two variables(Proof of the result not required)-Simple applications.

Taylors series expansion for a function on two variables-Simple problems

Co-ordinate systems: Rectangular co-ordinates-Polar co-ordinates-In plane and in Space-Cylindrical polar co-ordinates-Spherical polar co-ordinates.

MODULE IV

Integral calculus: Application of definite integrals: Area, Volume, Arc length, Surface area. Improper Integrals-Beta function-Gamma function

Multiple integrals: Evaluation of double integrals-Change of order of integration. Evaluation of triple integrals-Change of Variables in integrals. Applications of multiple integrals Plane Area, Surface area &Volumes of solids

TEXT BOOKS:

1. Engineering mathematics -Vol1:S.S.Sastry, PHI publishers
2. Advanced Engineering Mathematics: Erwin Kreyzig, Wiley Eastern

REFERENCES:

1. Mathematical Techniques: Oxford University Press
2. Engineering Mathematics: T.Veerarajan, TMGH Publishers
3. Higher Engineering Mathematics: B.S.Grewal, Khanna Publishers

CE/CS/EB/EC/EE/EI/ME/IT/SE 102: ENGINEERING PHYSICS

Module I:

Interference of light – Michelson interferometer – Applications-Interference in thin films – Antireflection coatings – Interference filters – Fringes produced by air wedge – Testing of flat surfaces-Diffraction of light –Zone plate - Plane diffraction grating - Reflection and transmission gratings – Determination of wavelength of light – Dispersive and resolving powers - Polarization of light – Double refraction – Nicol's prism – Quarter and half wave plates – Elliptically and circularly polarized light – Optical activity – Specific rotation – Half-shade polarimeter – Applications of polarized light.

Module II:

Lasers and Holography – Properties of laser light – Coherence of light – Principles of laser action – Population inversion – Optical pumping – Metastable states – Conditions for laser action – Types of lasers – Helium-Neon, Ruby and Semiconductor lasers – Applications of lasers – Principles of holography – Recording and Reconstruction of holograms – Applications of holography- Fiber optics – Light transmission through optical fiber – Numerical aperture – Multi and single mode fibers – Step index and graded index fibers – Fiber drawing – Fiber optic communication (basic ideas) – Ultrasonics – Generation of ultrasonic waves – Applications of Ultrasound.

Module III:

Quantum mechanics – Heisenberg's uncertainty principle - Experimental illustrations – Quantum mechanical wave equation – Time independent Schrodinger equation – Physical significance of wave function – Properties of the wave function – Solution of Schrodinger equation - Atomic and nuclear physics – The Vector atom model – Quantization of orbital angular momentum – Electron spin - Magnetic moment of orbital electron – Pauli's exclusion principle– Zeeman effect – Stark effect – Raman effect. Nuclear physics – Nuclear forces – Properties of the nucleus - Nuclear reactions-Nuclear reaction cross section-Artificial radioactivity – Nuclear reactors – Nuclear fusion – Thermonuclear reactions-Controlled thermonuclear reactions.

Module IV:

X-rays – Production of X-rays – Origin of X-rays and X-ray spectra – Moseley's law – Properties of X-rays – Applications of X-rays – Diffraction of X-rays by crystals – Bragg's law – Crystallography – Unit cell – Seven crystal systems – Bravais space lattices - Packing factor – Lattice planes and Miller indices – Energy bands in solids – Conductors, semiconductors and insulators – Intrinsic and extrinsic semiconductors – Conductivity of semiconductors – Fermi level - Applications of semiconductors – p-n junctions – solar cells – Hall effect and its applications – Superconductivity – Superconducting transition – The Meissner effect – Type I and Type II superconductors – Isotope effect - High temperature superconductors – Josephson effect – SQUIDS – Applications of superconductors

Text and Reference Books :

1. *Jacob Philip – A text book of Engineering Physics, Educational Publishers and Distributors 2002*
2. *A.S. Vasudeva – Modern Engineering Physics, S. Chand & Co.*
3. *M.R. Sreenivasan – Physics for Engineers – New Age International*

CE/ CS/EB/EC/EE/EI/ME/IT/SE 103 ENGINEERING CHEMISTRY

Module I

Solid state chemistry: Fundamentals, Bonding in solids, Born-Haber cycle, Point defects, Methods to improve reactivity of solids, Free electron theory, Band theory, Fermi level in semiconductors, Molecular field theory of magnetic materials, Conventional and organic superconductors, High temperature superconductors, Liquid crystals, Applications. Solid surface characterisation: Electron spectroscopy for chemical analysis, Chemical shift, BET isotherm, Thermodynamics of adsorption.

Module II

Electrochemistry: Fundamentals, Electrode potentials, Types of electrodes, Salt bridge, emf measurement, Concentration cells, Acids and bases, Buffer solutions, pH measurements, Polarisation, Overvoltage. Power generation: Secondary cells, Fuel cells, Photovoltaic effect, Solar cells. Corrosion: Different forms of corrosion, Prevention of corrosion.

Chemical Kinetics: reaction rate, rate constant, rate law, reaction order, first order, second order, pseudo-first order reactions, integrated rate laws, half-life of a reaction and its relation to rate constant. Molecularity, simple unimolecular and bimolecular reactions. Arrhenius equation. Fast reactions – flash photolysis, flow techniques and relaxation methods.

Module III

Chemical Thermodynamics: Fundamentals, Molecular interpretation of internal energy, enthalpy and entropy, Heat of reaction, Kirchhof.s equation, Trouton.s rule, Entropy changes accompanying different processes, Nernst heat theorem, Third-law. Free energy: Dependence on pressure and temperature, Gibbs-Helmholtz equation, Free energy changes and equilibrium constant, Chemical potential, Fugacity, Thermodynamics of biochemical reactions.

Module IV

Engineering materials: Industrial polymers-polymerization techniques, structure-property relationships, polymer additives, polymer processing methods (extrusion, injection, compression, transfer and blow molding methods). Nanomaterials: definition, classification and applications. Nanometals and nanoceramics – examples and properties.

Lubricants: classification, functions and properties. Mechanism of lubrication.

Refractories: classification and properties. Portland cement, lime and plaster of Paris – manufacture, setting and hardening.

Chemistry of optical fibres, fullerenes and organoelectronic materials (introduction only).

Text Books

1. Peter Atkins and Julio de Paula *Elements of Physical Chemistry*, Oxford University Press, 2005

2. **Shashi Chawla** *A Text Book of Engineering Chemistry* (3rd edn.).; Dhanpat Rai & Co, New Delhi, 2003.

References

1. **Atkins, P.W.,** *Physical Chemistry*, Oxford University Press, UK, 1998
2. **Bhatnagar, M. S.,** *Textbook of Pure & Applied Physical Chemistry*, A. H. Wheeler & Co, Delhi, 1999.
3. **Geoffrey Ozin, Andre Arsenault** *Nanochemistry: A Chemical Approach to Nanomaterials*.; Royal Society of Chemistry, U.K. 2005.

CE/CS/EB/EC/EE/EI/IT/ME/SE 104 ENGINEERING MECHANICS

A) STATICS

MODULE I

Concurrent forces in a plane: Principles of statics. Composition and resolution of forces. Equilibrium of concurrent forces in a plane. Method of projection. Method of moments. Friction.

Parallel forces in a plane: Two parallel forces. General case of parallel forces in a plane. Centre of parallel forces and centre of gravity, Pappus theorems, centroids of composite plane figures and curves. Distributed forces in a plane.

MODULE II

Properties of areas: . Moment of inertia of a plane figure with respect to an axis in its plane. Polar moment of inertia. Product of inertia. Principal axes. Mass moment of inertia of material bodies.

General case of forces in a plane: Composition of forces in a plane. Equilibrium of forces in a plane. Plane trusses - Method of joints. Method of sections. Plane frames : Method of members. **Principle of virtual work:** Equilibrium of ideal systems, stable and unstable equilibrium.

B) DYNAMICS

MODULE III

Rectilinear translation: Kinematics of rectilinear motion. Differential equation of rectilinear motion. Motion of a particle acted upon by a constant force, by a force as a function of time and by a force proportional to displacement. Simple harmonic motion. D'Alembert's principle. Momentum and impulse. Work and energy, ideal systems, conservation of energy. Impact.

MODULE IV

Curvilinear translation: Kinematics of curvilinear translation. Differential equations of motion. Motion of a projectile. D'Alembert's principle in curvilinear motion. Moment of momentum. Work and energy in curvilinear motion.

Rotation of a rigid body: Kinematics of rotation. Equation of motion of a rigid body rotating about a fixed axis. Rotation under the action of a constant moment. Compound pendulum. General case of moment proportional to the angle of rotation. D'Alemberts principle of rotation. Resultant inertia force in rotation. Principle of angular momentum in rotation. Energy equation for rotating bodies.

TEXT BOOK & REFERENCES :

1. Engineering Mechanics - Timoshenko and Young - McGraw Hill Book Company.
2. Mechanics for Engineers (Vol. 1- Statics and Vol.2 -Dynamics) - Beer F. P. & Johnston E. R. - Tata McGraw Hill.
3. Engineering Mechanics (Vol. 1- Statics and Vol.2 -Dynamics) - Merriam H. L. & Kraige L. G. - John Wiley and Sons.
4. Engineering mechanics- Biju N- Educational Publishers.

CE/CS/EB/EC/EE/EI/IT/ME/SE 105 ENGINEERING GRAPHICS

MODULE I

Introduction to engineering graphics. Drawing instruments and their use. familiarisation with current Indian Standard Code of Practice for general engineering drawing.
Scales- plain scale ,vernier scale, diagonal scale.
Conic sections- Construction of ellipse, parabola, hyperbola - construction of cycloid, involute, archimedian spiral and logarithmic spiral- drawing tangents and normals to these curves.

MODULE II

Introduction to orthographic projections- plane of projection- principles of first angle and third angle projections, projection of points in different quadrants.
Orthographic projection of straight lines parallel to one plane and inclined to the other plane- straight lines inclined to both the planes- true length and inclination of lines with reference planes- traces of lines.
Projection of plane laminae of geometrical shapes in oblique positions.

MODULE III

Projection of polyhedra and solids of revolution- frustum, projection of solids with axis parallel to one plane and parallel or perpendicular to other plane- projection of solids with axis inclined to both the planes- projection of solids on auxiliary planes.
Section of solids by planes inclined to horizontal or vertical planes- true shape of sections.

MODULE IV

Development of surface of cubes, prisms, cylinders, pyramids and cones
Intersection of surfaces- methods of determining lines of intersection - intersection of prism in prism and cylinder in cylinder.

MODULE V

Introduction to isometric projection- isometric scales, isometric views- isometric projections of prisms, pyramids, cylinders, cones and spheres.
Introduction to perspective projections : visual ray method and vanishing point method- perspective of circles- perspective views of prisms and pyramids.

TEXT BOOKS & REFERENCES:

1. Engineering Graphics — P.I.Varghese & K.C. John, JET Publishers
2. Elementary engineering drawing — N.D.Bhat, Charotar publishing house
3. Geometric drawing, — P.S.Gill , B.D Kataria &sons Ludhiana
4. Engineering Graphics — P I Varghese, VIP Publishers.

CE/CS/EB/EC/EE/EI/IT/ME/SE 106 BASIC CIVIL AND MECHANICAL ENGINEERING

(A) CIVIL ENGINEERING

MODULE I

Materials: *Cement* - varieties and grade of cement and its uses. *Steel*- types of steel for reinforcement bars, steel structural sections. *Brick*- varieties and strength , tests on bricks.
Aggregates- types & requirements of good aggregates. *Concrete*- grades of concrete as per IS code, water cement ratio, workability, mixing, batching, placing, compaction and curing.
Construction : *Foundation*- types of foundations- isolated footing, combined footing, raft, pile & well foundations,

MODULE II

Super structure : Brick masonry, English bond and Flemish bond , Stone masonry, Random rubble masonry. *Roofing*- Steel trusses, roofing for industrial buildings
Surveying: Principles, instruments, ranging and chaining of survey lines, errors in chaining, field work, field book, selection of survey stations, reconnaissance ,,
Levelling : Levelling instruments, different types, temporary adjustments, mean sea level, reduced level of point, booking of field notes, reduction of levels by height of collimation method.

Text Books & References :

1. Engineering materials : Rangawala
2. Building construction : Punmia
3. A Text book of building construction : N.K.R. Murthy
4. Fundamentals of Civil Engineering- : Roy M Thomas-Educational Publishers.
5. A Text book of building construction : Jha & Sinha
6. Surveying & Levelling : T P Kanetkar
7. Surveying & Levelling : Hussain

(B) MECHANICAL ENGINEERING

MODULE III

Thermodynamics: thermodynamic systems - open, closed and isolated systems, equilibrium state. of a system, property' and state, process, cycle, work, Zeroth law of thermodynamics-concept of temperature, temperature scales. First law - internal energy, enthalpy. Second law - Kelvin-Plank and Claussius statements, Carnot Cycle.
Refrigeration and Air conditioning: Vapour compression and vapour absorption refrigeration systems, summer and winter Air conditioning, Comfort and industrial Air conditioning.
Elementary ideas of simple reaction and impulse turbines, compounding of turbines.

MODULE IV

Internal Combustion Engines: working of two stroke and four stroke Petrol and Diesel engines, simple Carburettor, ignition system, fuel pump, fuel injector, cooling system, lubricating system.
Transmission of Power: Belt drives (open and closed), chain drives.
Metal fabrication: Welding - Arc, gas, resistance welding, Welding defects, Soldering, Brazing

Text Books & References:

1. Engineering Thermodynamics P.K.Nag
2. Engineering Thermodynamics D.B. Spalding & E.H.Cole
3. Engineering Thermodynamics Van Wylon
5. Thermodynamics J.P.Holman
6. Elements of Internal Combustion Engines Rogowsky, Tata McGraw Hill
7. Fundamentals of Internal Combustion Engines Gill, Smith & Ziurys, Oxford & IBH
8. Refrigeration and Air Conditioning, Stoecker Tata McGraw Hill

CE/CS/EB/EC/EE/ EI/IT/ME/SE 107 BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(A) ELECTRICAL ENGINEERING

Module I

Basic principles of Electric circuits: Review of Ohms law - Definition of resistance, current, voltage and power - Series and parallel circuits- constant voltage source and constant current source.

Network Theorems: Kirchoff's laws- Network analysis by Maxwell's circulation currents - Thevenin's theorem - Superposition theorem -Norton's theorem - Simple illustrative problems on network theorems.

Review of electrostatics - Coulomb's Law- Electric field strength and Electric flux density-capacitance.

Module II

Review of electromagnetic induction -Faraday's Law- Lenz's Law - mutually induced emf. Magnetic circuits - magnetic field of a coil - Ampere turns calculation - magnetic flux - flux density - field strength.

Measuring instruments: Working principle of galvanometer, Ammeter, Voltmeter, watt meter & energy meter.

AC fundamentals: Generation of alternating voltage and current - equations of sinusoidal voltage and current - wave form, cycle frequency, time period, amplitude, phase difference, rms value, average value, power factor & form factor. Vector diagram - addition and subtraction of vectors- sine waves in phase and out of phase. AC circuits: RC, RL, RLC circuits-series and parallel - current, voltage and power relationships. Poly phase circuits: vector representation - phase sequence - star and delta connections.

(B) ELECTRONICS ENGINEERING

Module III

Passive components: Resistor – Capacitor - Inductor - Color coding. Transformer- different types, construction.

Semiconductors: Energy band diagram – intrinsic & extrinsic semi conductors, doping - PN junction – Diodes, Zener diodes- Characteristics - Application of diodes. Rectifiers- Half wave, full wave and Bridge rectifiers – Ripple factor and regulation.

Transistors: - PNP and NPN transistors - theory of operation - Transistor configurations - characteristics - comparison.

Special semiconductor devices - FET - SCR - LED - LCD – V-I characteristics, applications.

Module IV

Fundamentals of Instrumentation: Transducers - Definition - Classification – Active & passive - Transducer for position, pressure, velocity, vibration and temperature measurements.

CRO – principle of operation - measurement of amplitude, frequency and phase.

Fundamentals of Communication: Analog communication - concept of modulation, demodulation. Types: AM - FM -PM- Block diagram of general communication system -Basic concepts of digital communication - Block diagram.

Text Book:

1. Basic Electronics – Solid State – B. L. Theraja, S. Chand & Co.
2. Fundamentals of Electrical Engineering – Leonard S. Bobrow, Oxford University Press.

Further References:

1. Electrical Technology : Edward Hughes, Addison Wesley Publication
2. Electronic Devices & Circuits : G.K. Mithal & Ravi Mittal, Khanna Publishers

CE/CS/EB/EC/EE/E1/IT/ME/SE 108 COMPUTER PROGRAMMING

Module I

Introductionn to programming in C: Fundamental data types- integer, floating point, and enumerated data types, Expressions – arithmetic, relational and logic operators, Type conversion – simple and compound statement, Access to standard library, standard I/O-getchar, putchar, Formatted **I/O**, scanf, printf, error handling, line input and out put, control structures, selection statement, **IF, SWITCH, WHILE, DO WHILE, FOR, BREAK, COINTINUE, GOTO, RETURN** statements.

Module II

Functions: Declarations and functions, parameter passing mechanism, storage classes-scope, visibility, and life time of variables, AUTO, EXTERN, STATIC and REGISTER modifiers, Recursion.

Module III

Arrays : Single and multi dimensional arrays, sorting, selection sort, search-linear search and binary search, Structures and union.

Module IV

Pointers: Pointers and addresses, pointer arrays,,,,,, function returning pointers, pointers to function, pointer arithmetic,. pointers to structures, array of structures, preprocessor directive, command line arguments, typedef.

Text Book & References:

1. Computer Fundamentals & Programming in C : Pradip Dey & Manas Ghosh (OXFORD)
2. Computer Fundamentals : Dr. Varghese Paul (EPD)
3. Programming in C : B.S. Gotfried (Schaum series, TMH)

CE/CS/EB/EC/EE/EI/ME/IT/SE 109 TECHNICAL COMMUNICATION AND SOCIAL SCIENCES

(**Module IV Environmental Studies : 1 hour per week**

Other modules : 2 hours per week)

PART - A TECHNICAL COMMUNICATION

Module I **(25 hours)**

Oral Communication: starting and ending a conversation; telling and asking people to do things; expressing opinions and ideas, decisions and intentions, offers and invitations, feelings, right and wrong, numbers and money.
Purpose and audience; dealing with customers and clients; face-to-face discussions; meetings and attending meetings; checking understanding; raising questions; giving and receiving feedback; using body language; leading and directing discussions; concluding discussions; using graphics in oral presentations

Reading Comprehension and reference skills: skimming and scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; comprehending graphics in technical writing.
Reading strategies; reading speed; reading between the lines for hidden meaning; interpreting graphics; using a dictionary; using an index; using a contents list to find information; choosing the right reference source.

Module II **(20 hours)**

Written Communication: note making and note taking; summarising; notes and memos; developing notes into text; organisation of ideas: cohesion and coherence; paragraph writing: ordering information in space and time; short essays: description and argument; comparison and contrast; illustration; using graphics in writing: tables and charts; diagrams and flow-charts; maps, plans and graphs.
Spelling rules and tips; writing a rough draft; editing and proof reading; writing the final draft; styling text; filling in complex forms; standard letters; CV; writing a report; writing leaflets and brochures; writing references; essay writing: expository writing; description of processes and products; classification; the instructional process; arguments and presentation of arguments; narrating events chronologically.

PART - B SOCIAL SCIENCES

Module III **(15 hours)**

Science, Technology and Ethics

Impact of science and technology on the development of modern civilization . The philosophy of modern science – scientific determinism – uncertainity principle. Relevance of scientific temper. Science and religion. Science and technology in developing nations. Technological advances of modern India. Intermediate and appropriate technology. Development of technical education in India.

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professional ideals and virtues - Attributes of an ethical personality – Theories about right action – Self interest.

Responsibilities and Rights of engineers – Collegiality and Loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Professional rights.

Module IV

Environmental Studies : **(30 hours)**

Natural resources – issues related to the use and over exploitation of forest resources , water resources, mineral resources, food resources and energy resources – role of an individual in conservation of natural resources – equitable use of resources for sustainable life styles.

Concept of an ecosystem – structure and function – energy flow in the ecosystem – ecological succession - food chains, food webs and ecological pyramids – structure and functions of a forest ecosystem and an aquatic eco system.

Definition of biodiversity – genetic, species and ecosystem diversity – biogeographical classification of India – Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.

Causes, effects and control measures of air pollution, water pollution, soil pollution , noise pollution, marine pollution, thermal pollution and nuclear hazards – Causes, effects and control measures of urban and industrial solid wastes –Role of an individual in prevention of pollution - An overview of the various environmental legislations in India – Issues involved in enforcement of environmental legislation.

The concept of sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people ; its problems and concerns - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust – Population growth and problems of population explosion – Environmental ethics : issues and possible solutions..

Text Books:

Meenakshi Raman and Sangeetha Sharma *Technical Communication : Principles and Practice,* *Oxford University Press, 2004*

Rajagopalan. R *Environmental Studies : From Crisis to Cure*, Oxford University Press, 2005

Jayashree Suresh and B.S. Raghavan *Professional Ethics*, S. Chand & Company Ltd, 2005.

WC Dampier *History of Science*, Cambridge University Press.

References:

Adrian Doff & **Christopher Jones,** *Language in Use* . Upper intermediate, self-study workbook & classroom book, Cambridge University Press,2000.

Krishna Mohan & **Meenakshi Raman**, *Effective English Communication* ,Tata Mc-Graw Hill,2000.

Edmund D. Seebaur & Robert L. Barry *Fundamentals of Ethics for Scientists and Engineers,* Oxford University Press, 2001

Krishna Mohan & **Meera Banerji**, *Developing Communication Skills* Mac Millan India Ltd,2000.

Rajendra Pal & JS Korlahalli *Essentials of business communication*, S. Chand & Company Ltd

Sarah Freeman, *Study Strategies*, Orient Longman, 1978.

Meenambal T , Uma R M and K Murali *Principles of Environmental Science and Engineering*, S. Chand & Company Ltd, 2005

University Examination pattern

The question paper will have two parts. Part A (Technical Communication) will cover Modules I, II and will have a weightage of 50 marks. Part B (Social Sciences) will cover Module III and Module IV (Environmental Studies) and will have a weightage of 50 marks. Part A and Part B will have to be answered in separate answer books.

Part A

University examination pattern

Q I - 4 short type questions of 5 marks, 2 each from module I and II
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one

Part B

University examination pattern

Q I - 5 short type questions of 4 marks, 2 from module III and 3 from module IV
Q II - 2 questions A and B of 10 marks from module III with choice to answer any one
Q III - 2 questions A and B of 20 marks from module IV with choice to answer any one

CE/CS/EB/EC/EE/EI/ME/IT/SE 110

COMPUTER PROGRAMMING LABORATORY

1. Study of OS commands. General introduction to application packages.
2. Programming using C control structures & pointers.
3. Searching & sorting
4. Creation and use of databases in a suitable database package
5. Programming exercises in C.

CE/CS/EB/EC/EE/EI/ME/IT/SE 111

ELECTRICAL AND MECHANICALWORKSHOPS

ELECTRICAL WORKSHOP

1. One lamp controlled by one switch
2. Series and parallel connections of lamps.
3. Stair case wiring.
4. Hospital Wiring.
5. Godown wiring.
6. Fluroscent lamp.
7. Connection of plug socket.
8. Different kinds of joints.
9. Transformer winding.
10. Soldering practice.
11. Familiarisation of CRO.

MECHANICAL WORK SHOP

1) Fitting Shop.
2) Sheet Metal Shop
3) Foundry Shop
4) Welding Shop
5) Carpentry Shop

(Preliminary exercises for beginners in all shops. Specific models may be designed by the teachers.)

Introduction to the use of concrete mix.

EB/EC/EE/EI/CE/CS/IT/ME/SE 301 ENGINEERING MATHEMATICS II

Module I

Matrices and Vector spaces: Rank of matrix, Echelon and normal form, Solutions of linear systems of algebraic equations, Eigen values and Eigen vectors, Cayley- Hamilton theorem (no proof). Vector Spaces- Subspaces,-Linear Independence of vectors-Linear span-Dimension and Basis. Linear transformations.

Module II

Fourier series and Fourier integrals: Fourier series of Periodic functions-Euler formulae for Fourier coefficients- functions having period 2π , arbitrary period- even and odd functions-half range expansions, Fourier integral, Fourier cosine and sine transformations, linearity property, transform of derivatives, convolution theorem (no proof)

Module III

Laplace transforms: Linearity property, transforms of elementary functions, Laplace transforms of derivatives and integrals, differentiation and integration of transforms, convolution theorm (no proof), use of Laplace transforms in the solution of initial value problems, unit step function, impulse function - transform of step functions, transforms of periodic functions.

Module IV

Vector calculus : Scalar and Vector point functions-Gradient and directional derivative of a scalar point fuuctions.- Divergence and Curl of a vector point functions- their physical meanings.
Evaluation of line integral, surface integral and volume integrals, Gauss's divergence theorem,. Stoke's theorem (No Proof of these theorem), conservative force fields, scalar potential.

Text books:

1. R.K. Jain, S.R.K Iyengar: *Advanced Engineering Mathematics*, Narosa publishers.1991
2. C.R. Wilie & L.C. Barrett: *Advanced Engineering Mathematics*, MGH Co.

References

1. Larry C Andrews, Ronald C Philips: *Mathematical Techniques for Engineers & Scientists*, PHI
2. M.C. Potter, J.L. Goldberg: *Advanced Engineering Mathematics*, Oxford university press
3. B. S. Grewal: *Higher Engineering Mathematics*, Khanna publishers, 1986

EB/EC/EI/ IT/ME 302 ELECTRICAL TECHNOLOGY

Module I

Transformers: Working principle and elementary theory of an ideal transformer, Constructional features of single phase transformer, emf equation, turns ratio, vector diagram, equivalent circuit, impedance transformation, transformer losses, flux leakage, efficiency, open circuit and short circuit test, load test. Auto transformer - working principle and saving copper, basic idea of current transformer and potential transformer, distribution and power transformer, applications , standard rating, IS specifications.

Module II

Basic principles of electrical machines: Concepts of motoring and generating action.

DC machines: Main constructional features, principles of operation, types of generators, emf equation, characteristics, applications, armature reaction and commutation, types of motors, torque, speed, and power, characteristics, applications, starting losses, and efficiency, speed control, testing, load test of dc machines.

Module III

AC Machines: Alternator- rotating field, speed and frequency, effect of distribution of winding, coil span, characteristics, emf equation, losses and efficiency, regulation (emf method only) ,applications, Synchronous motor- principle of operation, over excited and under excited, starting, applications, synchronous capacitor.

Induction Motor: Three phase induction motor - principles of operation, constructional features of squirrel cage and slip ring motors, torque-slip characteristics, starting, speed control, losses and efficiency. Single phase induction motor - Principle of operation, types of single phase induction motors

Module IV

Generation, transmission & distribution of electrical energy: Different methods of power generation- thermal, hydro-electric, nuclear, diesel, gas turbine stations(general idea only), electrical equipments in power stations, concept of bus bar, load dispatching, methods of transmission, transmission lines, overhead lines and insulators, corona and skin effect of DC & AC distribution, substation (elementary idea only)

Text Books:

1. F. S. Bimbra, *Electrical Machines*, 7th ed., Khanna publications.

References:

1. B.L. Theraja. *Textbook of electrical technology in S.I. system of units : volume 2: AC and DC machines* : S. Chand and Company Ltd., 1997.
2. H.Cotton, *Advanced Electrical Technology*, Wheeler publications. 1984
3. Nagarath & Kothari *Electrical Machines*, Tata Mc Graw Hill.1999

EB 303 PRINCIPLES OF ANATOMY AND PHYSIOLOGY

Module I

Functional organization of human body - cells - cell structure and function, types, homeostasis – tissues, types - organs -systems. *Skin* – structure and functions.

Muscular system – structure & mechanism of contraction of skeletal muscles, smooth muscles and cardiac muscles, principal groups of muscles in human body.

Skeletal system – Bones – composition & structure, - classification of bones & joints in human body.

Teeth – Functional parts.

General awareness of common diseases associated with the each system (detailed study not required).

Module II

Nervous system – Organization – Structure of neuron, nerve centres – cerebrum, cerebellum, thalamus, hypothalamus, brainstem and spinal cord, nerves - cranial and spinal. Autonomic nervous system. Central nervous system – receptors, ascending tracts and descending tracts, sensory perception with special reference to touch, heat, pain, muscle tone, regulation of posture and equilibrium.

Special senses – organs of vision, hearing, taste & smell - mechanisms of each.

Endocrine system – Functions of major endocrine glands and their hormones - Pituitary, thyroid and parathyroid, adrenocortical, insulin, glucagon, hormones of the male and female reproductive systems.

General awareness of common diseases associated with the each system (detailed study not required).

Module III

Digestive system – structure of digestive tract, organs and associated glands – saliva, gastric & intestinal digestion & motility of gastrointestinal tract - Enzymes – mode of action -Basic principles of metabolism – carbohydrate, fat and protein metabolism – Liver – Basal Metabolic Rate – Body Temperature - Regulation.

Urinary system – Structure and function of organs– Kidneys - nephron – Renal function – process involved in urine formation, micturition, composition of urine, Body fluids - Water and electrolytes, acid - base balance & regulation.

Reproductive system – Structure and function of reproductive organs in male and female, monthly ovarian cycle, spermatogenesis.

General awareness of common diseases associated with the each system (detailed study not required).

Module IV

Respiratory system – concepts of organs concerned with the respiration and their structure and organization – Mechanics of respiration, physical principles of gaseous exchange, transport of gases and control of respiration, lung volumes & capacities.

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

General awareness of common diseases associated with the each system (detailed study not required).

Text book:

1. Arthur C. Guyton, *Textbook of Medical Physiology, 11th ed*, Prism Books (Pvt) Ltd & W.B. Saunders Company. 2006
2. Samson Wright, Cyril A. Keele (editor), Eric Neil (editor): *Applied Physiology*, Oxford University Press. 1990

References:

1. J.B.West.: *Best and Taylor's Physiological Basis of Medical Practice*, Williams and Wilkins, Baltimore. 1992
2. W.F.Ganong: *Review of Medical Physiology*, Prentice-Hall, Connecticut. 1990
3. Kathleen J.W. Wilson, Ross and Wilson ,*Anatomy And Physiology In Health And Illness*, ELBS/Churchill Livingstone.1995

EB/EC/EI 304 DIGITAL ELECTRONICS

Module I

Number system and codes : Binary , Octal, and Hexa-decimal number systems - Binary arithmetic, Binary coded Decimal , Excess - 3 code, GrayCode, Error detection and correction - Boolean algebra - Minimization of Boolean function using Karnaugh Map and Quine - McClusky methods – Formation of switching functions from word statements , realisation using NAND, NOR. Combinational circuits- multiplexer demultiplexer, decoder, encoder

Module II

Sequential circuits : Flip-flops - RS , JK & T & D flip- flops , shift registers - counters -Asynchronous and synchronous counters , Up-Down counter, Modulo counter, Ring counter, Johnson counter - sequence generators - state tables and diagrams

Module III

Arithmetic circuits : Half adder, Full adder , Subtractor, Serial and parallel addition - Carry look ahead adder - Binary multiplication and division - Multivibrators - Monostable and astable multivibrators using discrete gates . Memories –ROM, RAM, EPROM

Module IV

Logic families: DCTL, RTL, DTL, TTL, ECL, CMOS - Tri-state logic - specification and transfer characteristics of basic TTL - Standard logic levels - Current and voltage parameters - fan in and fan out - Propagation delay, noise consideration- interfacing of CMOS to TTL and interfacing of TTL to CMOS

Text Book:

1. A. Anand Kumar, *Fundamentals of Digital Circuits*, Prentice-Hall India Ltd, 3rd ed.

References :

1. J.M.Yarbrough, *Digital Logic, Applications & Design*,Thomson Learning, 1997
2. Flyod & Jain, *Digital Fundamentals*, Pearson Education, 8th Ed.
3. R P Jain, *Modern Digital Electronics*, Tata Mc Graw Hill, 3rd ed.
4. R. K. Gaur, *Digital Electronics and Microcomputers* , Dhanpat Rai and Sons ,3rd Ed.
5. Taub & Schilling, *Digital Integrated Electronics*, Mc Graw Hill, 1985
6. Malvino and Leach, *Digital Principles and Applications*, Mc Graw Hill, 5th ed.
7. Charles H.Roth , *Fundamentals of Logic Design*, Thomson Learning, 5th ed.
8. John M. Yarbrough, *Digital Logic- Applications and Design*, Thomson Learning, 2006

EB 305 MEDICAL PHYSICS

Module I

Radioactivity - Units - radio emission - law of radioactive decay, half life period - production of radio isotopes for medical use, Production of x rays – discharge tube and Coolidge tube method, x-ray spectra – continuous and line spectra, factors determining the x-ray emission, Efficiency of x ray production, distribution of x-rays in space. Radiation units - detection and measurements of x-rays.

Module II

Interaction of radiation with matter - exponential attenuation - half value thickness – Photon scattering – elastic and Compton scattering, Photon disappearance - photo electric, pair production process and photonuclear reactions and their significance in radiology. Transmission and absorption. Effects of x-rays. Radiation protection – units & Limits, Instrumentation, Radiation Protection in Diagnostic radiology, radiotherapy & nuclear medicine, radiation accidents.

Module III

Introduction to electrical simulation – impedance & current distribution – dielectric properties of biological materials – skin impedance – total body impedance – impedances at high frequencies – high voltage & transient properties. Patient safety – electrical shocks and hazards – micro and macro shocks – effects of electrical current on human body – ventricular fibrillation - leakage currents – types & measurements. Precautions and devices to protect against electric shock hazards – Patient isolation – methods. Equipment safety - regulations - Inspection and preventive maintenance of equipments. Regulation to keep the hospital environment safe - BIS standards - ISO Protection against shock, burn & explosion hazards.

Module IV

Basic principles of magnetic resonance – magnetic moment, FID, excitation and emission, Useful and harmful effects of magnetic fields. Basic physics of ultrasound – characteristic impedance, wavelength, frequency and velocity of propagation, Absorption, beam width, resolution, generation and detection. Applications in medicine. Radio waves, micro waves , ultra violet radiation and infrared radiation on human beings - Applications. Effect of hypothermia and hyperthermia. Production of ultra low and low temperature for medical use.

Text books:

1. W.J. Meredith & J.B. Massey, *Fundamental Physics of radiology*, Varghese Publishing House, Bombay, 1992.
2. Geddes & Baker, *Principles of Applied Biomedical Instrumentation*, John Wiley 3rd edition 1989.
3. Webb, S. (ed) *The Physics of Medical Imaging*, Institute of Physics Publishing, Bristol, 1992.

References:

1. John G. Webster (ed.), *Medical Instrumentation - Application and Design*, Houghton Mifflin Co., Boston, 1992.
2. Khandpur R S, *Handbook of Medical Instrumentation*, Tata Mc Graw Hill, New Delhi, 2005.
3. B. H. Brown & R H Smallwood, *Medical Physics & Physiological Measurements*, Blackwell Scientific Publications, 1981.
4. John R Cameron, J.G. Skofronick, *Medical Physics*, John Wiley & sons 1997

EB/EE/CS 306 ELECTRONIC DEVICES & CIRCUITS

Module I

DC power supplies - power transformers - rectification - half wave , full wave, bridge - expression for ripple factor, efficiency, comparison, diode ratings. filters - capacitor - inductor LC filters- use of bleeder resistor - voltage multipliers - dual power supplies - zener and avalanche diodes - simple and series voltage regulator. *Special semiconductor devices:* Principles and operation of photodiodes, PIN diodes, phototransistors, LED, UJT. MOSFET- basic principles & characteristics.

Module II

Small Signal amplifiers: Bipolar junction transistor – configurations, characteristics - current amplification factors - relations between alpha & beta – comparison. *BJT amplifiers*: Biasing techniques of BJT- stabilization of operating point - h-parameters - CE RC coupled amplifier - concept of load lines- frequency response of RC coupled amplifier - frequency analysis of R C coupled amplifier - lower cut-off frequency - upper cut-off frequency - 3 db bandwidth.
FET Amplifiers: Principle of operation, characteristics, Common source amplifier- design, frequency response-applications

Module III

Power amplifier - classification - class A, B, AB and C power amplifiers-tuned amplifier- push-pull and complementary symmetry power amplifier –Harmonic distortion – Heat sinks.
Feed-back amplifiers: concept of Negative and positive feedback – Bark Hausen criteria -low frequency sinusoidal oscillators
High frequency oscillators – types- LC, Crystal oscillators –circuit diagram-description-applications

Module IV

*Pulse Circuits***:-**Different types Pulse circuits - pulse characteristics - Pulse shaping using RC circuits - Differentiating and integrating circuits –applications. Clipping and clamping circuits using diodes - *Transistor as a switch*– simple sweep circuits-bootstrap sweep.
Multivibrators-astable, monostable and bistable ciruits using BJTs-applications

Text book:

1. Boylestead & Neshelsky, *Electronic Devices & Circuit Theory*, Prentice Hall of India.2003
2. Millman & Halkias, *Electronic Devices & Circuits*, Tata McGraw Hill, New Delhi.1996
3. Taub &Schilling, *Pulse,digital and Switching ciruits*,Tata Mc Graw Hill 2002

References:

1. Bapat Y N, *Electronic Devices & Circuits*, Tata McGraw Hill, New Delhi.1995
2. Allan Mottorshed, *Electronic Devices & Circuits*, Prentice Hall of India, New Delhi.2003
3. Schilling & Belove, *Electronic Circuits, Discrete & Integrated*, Tata McGraw Hill, New Delhi 1989
4. Theodore F.Bogart, *Electronic Devices & Circuits* Universal Book Stall, New Delhi 1992

EB/EC/EI 307 BASIC ELECTRONICS LABORATORY

1. Study of - Multimeter, Signal generators, CRO etc. and measurement of electrical quantities (Voltage, Current, FREQUENCY & PHASE)

2. Testing of Passive and Active components - Resistors, Capacitors, Inductors, Transformers, Diodes, Transistors, etc.

3. Characteristics of Active devices
   i) Forward and reverse characteristics of a diode - measurement of forward resistance

   ii) Common base characteristics of a transistor - measurement of current gain, input resistance and output resistance, maximum ratings of the transistor.

   iii) Common emitter characteristics of a transistor - measurement of current gain, input resistance and output resistance, relation between and study of the effect of leakage current, maximum ratings of the transistor.

   iv) Common source characteristics of a JFET - measurement of transconductance g_m and drain to source resistance r_{ds}, use of FET as VVR.

4. Rectifying circuits
   i) HW rectifier
   ii) FW rectifier
   iii) FW Bridge rectifier
   iv) Filter circuits - Capacitor filter, inductor filter and Pi section filter
   (Measurement of ripple factor, maximum ratings of the devices)

5. Biasing of Active devices
   i) Voltage biasing, current biasing and feedback biasing of BJT
   ii) Biasing of JFET

6. Regulators

7. Design of Power supplies

8. Series Voltage Regulator using transistors.

EB/EC/EI 308 ELECTRICAL MACHINES LABORATORY

Compulsory experiments

1. (a) Preliminary study of AC and DC Power supplies in the laboratory.
   (b) Study of instruments and their mode of use
2. Open circuit characteristics of
   (a) Self excited generator
   (b) Separately excited generator.
3. Load characteristic of compound generator
4. Load characteristic of shunt generator
5. Study of face plate starter and starting of DC motors
6. Load characteristics of DC series motor.
7. Swinburn's test
8. Polarity and transformation ratio test on single phase transfer.
9. O.C & SC test on single phase transformer - equivalent circuit
10. Load rest on single phase transformer.
11. Study of starting methods of squirrel cage and slip ring induction motor.
12. Load test on slip ring induction motor and study of characteristics.

Optional Experiments

1. Study of single-phase motors.
2. Load test of DC shunt motor.
3. Poly phase connection of single phase transformer.
4. Load test on squirrel cage induction motor
5. Study of alternators.

EB/EC/EE/EI/CE/CS/IT/ME/SE 401 ENGINEERING MATHEMATICS III

Module I

Complex Analytic functions and conformal mapping: curves and regions in the complex plane, complex functions, limit, derivative, analytic function, Cauchy - Riemann equations, Elementary complex functions such as powers, exponential function, logarithmic, trigonometric and hyperbolic functions. *Conformal mapping*: Linear fractional transformations, mapping by elementary functions like Z^2, e^z, sin z, cos z, sin hz, and Cos hz, Z+1/Z.

Module II

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, residue theorem, evaluation of real integrals using integration around unit circle, around the semi circle, integrating contours having poles, on the real axis.

Module III

*Partial differential equations:*Formation of partial differential equations. Solutions of equations of the form F(p, q) = 0, F(x,p,q)=0, F(y,p,q)=0, F(z,p,q)=0, F1(x,p) = F2 (y,q), Lagrange's form Pp+Qq = R. Linear homogeneous partial differential equations with constant co-effients.

Module IV

Vibrating string : one dimensional wave equation, D'Alembert's solution, solution by the method of separation of variables. *One dimensional heat equation,* solution of the equation by the method of separation of variables, *Solutions of Laplace's equation* over a rectangular region and a circular region by the method of separation of variables.

Text Books:

1. R.K.Jain, S.R.K.Iyengar, *Advanced Engineering Mathematics*, Narosa Publishers, 2nd ed.
2. C.R.Wilie & L.C.Barrett ,*Advanced Engineering Mathematics*, Mc Graw Hill,6th ed.

References:

1. Ervin Kreyszig, *Advanced Engineering Mathematics*, Wiley Eastern,9th ed.
2. Churchill R.V, *Complex Variables & Applications*, Mc Graw Hill Publishers,5th ed.
3. M.C.Potter, J. L. Goldberg, *Advanced Engineering Mathematics*, Oxford University Press,3rd ed.

EB/EC/EI 402 MICROPROCESSORS

Module I

Introduction to 8 bit microprocessor: Microcomputers and microprocessors, 8/ 16/ 32/ 64-bit microprocessor families;

Internal architecture of Intel 8085 microprocessor: Block diagram, Registers, Internal Bus Organization, Functional details of pins, Control signals, External Address / Data bus multiplexing, Demultiplexing, I/ O mapped I/ O, and memory mapped I/ O techniques.

Interrupts, Serial communication and DMA features

Module II

Assembly Language Programming: 8085 instruction set: Instructions, Classifications, Addressing modes, Stack and Subroutines, Delay routines, Counters etc. Programming examples.

ModuleIII

Instruction Timing and Interrupts: Timing Diagrams (of various instructions): T- state, Machine cycle (Opcode fetch, Read / Write, Interrupt Acknowledge, Bus Idle, etc), Interrupts: -types (h/ w and s/ w), Maskable / Non maskable, their organization.

ModuleIV

Interfacing concepts and devices:

Memory interface: Concept of memory chip/ chips interface to 8085 with appropriate examples

Programmable interfacing devices: - Programmable peripheral interface (Intel 8255), Programmable timer interface (Intel 8253/ 54), Programmable display / Keyboard interface (Intel 8279), Programmable serial communication interface (Intel 8251)-(their architecture, register organization, initialization, hard ware and software inter face to 8085.

Text Books:

1. Ghosh and Sridhar, *0000 to 8085 Microprocessors for Engineers and Scientists,* PHI, 2nd ed.
2. Gaonkar , *Microprocesors, Architecture, Programming and Applications*, Wiley Eastern, 4th ed.

References:

1. A. Nagoor Kani, *Microprocessors,architecture and programming,*RBA Publications,2004
2. Douglas V. Hall , *Microprocessors, Interfacing and Peripherals,* Tata McGraw Hill,2nd ed.

EB 403 INTEGRATED CIRCUITS & SYSTEMS

Module I :*Brief overview of microelectronic fabrication technology*- Epitaxial Growth, Diffusion,Ion Implantation Processes-Description –Difference between discrete and integrated BJTs-cross-section of a MOSFET(enhancement and depletion type)-NMOS-PMOS-CMOS

Introduction to operational amplifiers – Basic differential amplifier - dual input balanced output and unbalanced output - Internal block schematic of op amp - Power supply requirements - Op-amp parameters - ideal op amp Open loop gain – input and output impedence – frequency response, frequency compensation. Slew rate, Input bias current – offset - drift - compensating networks CMRR, SVRR, finite gain bandwidth and its effect in op amp circuit performance . *Open loop and closed loop op amp configurations*: Feed back configurations - Voltage series feedback and voltage shunt feedback - concept of virtual ground - voltage follower - V/I & I/V converters and its applications.

Module II :Difference amplifiers with one op amp and 3 op amps - Use of offset minimizing resistor (R_{OM}) and its design. Instrumentation amplifier IC and its application. Op amp applications - Summing - Difference – Log and Antilog amplifiers - Integrator and differentiator. Comparators: zero crossing – with reference voltage - regenerative (Schmitt trigger) comparators, window detector.
Peak detector circuit. Precision rectifiers.
Sample and hold circuit- *ADC*- successive approximation , flash, integrating.
DAC —weighted, R-2R ; ADC-DAC-performance specifications

Module III

Active Filters : Transfer functions – LPF, HPF, BPF, BRF Approximation methods –Butter worth – Chebyshev -Active Filters - I order and II order filters, Quality factor –Design- Gyrator- Negative Impendence Converter-Universal Active Filters –All Pass filters. Switched Capacitive Filters.
Multivibrators- Astable and monostable - Design,working.
Wave generators- Triangular and saw tooth - RC phase shift and Wien bridge oscillators -

Module IV

Specialized ICs and applications: IC regulators - 723 (block diagram, typical low voltage regulator circuit), 78XX, 79XX, 317 - applications. Timers - 555 – Functional block diagram- Astable and monostable multivibrators using 555 - applications. Voltage Controlled Oscillators – 566. Phase locked loop(PLL) - Block diagram and derivation of capture range, lock range and pull in time capture and lock range - 565 – applications.

Text books:

1. Coughlin & Driscoll: *Op amps and Linear Integrated circuits* - Pearson Education Asia.2000
2. Sergio Franco, *Design with operational Amplifiers & Analog ICs*, Tata McGraw Hill.1998
3. Millman & Grabel: *Microelectronics*, McGraw Hill International, 2nd edition.1988

References:

1. Ramakant A. Gayakwad, *Op-Amp and Linear Integrated Circuits*", Pearson Education Asia. 4th ed.
2. K R Botkar: *Integrated circuits*, Khanna Publishers, Delhi. 1991
3. Gray: *Analog Integrated Circuits*, John Wiely.
4. Horstian: *Micro Electronics*, Prentice Hall of India.
5. Sedra & Smith: *Microelectronic circuits*, Oxford University Press. 5th ed.
6. D A Bel, *Opamps and Linear integrated Circuits*, Prentice Hall of India.
7. Clayton: *Operational Amplifiers*, Butterworth & Co. (Publishers) Ltd.

EB 404 BIOELECTRIC PHENOMENA

Module I

Cell membrane: Structure, Excitable cells, Nernst potential, Resting membrane potential, Polarised state, Goldman Hodgkin Katz equation, Action potential – Features, ionic basis, depolarization, re-polarization and hyper polarization- Propagation of nerve impulses – length constant, time constant, passive decay, Refractory period – absolute, relative, mono-phasic and bi-phasic recordings - Hodgkin Huxley model of squid gait axon membranes, Modes of transport of substances across the cell membranes.

Module II

*Electrical activity of the heart: C*ardiac muscle, Action potentials in cardiac muscle, SA node, Origin and propagation of rhythmical excitation & contraction, refractoriness, regular and ectopic pace makers, electrocardiogram – lead systems - waveforms and their significance – ECG in diagnosis – Arrhythmias, abnormal rhythms, heart blocks, premature contractions, flutter, fibrillation, vulnerable period.

Module III

Electrical activity of brain – Sleep stages, Brain waves, waveforms & measurements, 10-20 electrode system – montage - Evoked potentials – visual, auditory and somatosensory EPs, *Magnetoencephalogram*, *Electrogastrogram*, *Electroretinogram*, *Electroocculogram.*

Module IV

Electrical activity of muscles – neuromuscular junction, synaptic potentials, motor unit, motor unit action potentials, Electromyogram

Electrodes for measurement of biopotentials– Types, Recording and stimulating electrodes, electrode-tissue interfaces – electrode-electrolyte and electrolyte-skin interfaces, Polarizable and non polarizable electrodes - Silver-silver chloride electrodes, skin contact impedance.

Electroneurogram – nerve conduction studies.

Text books:

1. Arthur C. Guyton : *Textbook of Medical Physiology*, Prism Books (Pvt) Ltd & W.B. Saunders Company.1991
2. D.J. Aidley: *The Physiology of Excitable cells*, 3rd Ed., Cambridge University Press. 1998

References:

1. John G. Webster: *Medical Instrumentation - Application and Design*; Houghton Mifflin Co., Boston.1992
2. Richard Aston: *Principles of Biomedical Instrumentation and Measurement*, Merril Publishing Co., Columbus 1990.
3. Khandpur R S*: Handbook of Medical Instrumentation*, Tata Mc Graw Hill, New Delhi.2005
4. B. Katz : *Nerve, Muscle, and Synapse*, Mc-Graw Hill, New York. 1990

EB 405 COMMUNICATION TECHNIQUES

Module I

Introduction to communication systems – Definition of communication- Information – transmitter – receiver - - Analog and digital communication systems – comparison. Channel – noise – external and internal – noise calculations – noise figure, calculation – equivalent noise resistance. *Modulation*: Need for modulation different types amplitude modulation, frequency modulation and phase modulation – bandwidth requirements – frequency spectra.

Module II

Amplitude modulation: Frequency spectrum – representation of AM – modulation index - power relations in AM wave - AM Generation – modulated transistor amplifier (one example). Evolution and description of SSB – Balanced modulator - suppression of unwanted sideband – extension of SSB - ISB,VSB – system evaluation and comparison - AM Transmitter and receiver (Block level).

Module III

Frequency modulation: Mathematical representation of FM – Frequency - FM generation – Direct and indirect methods – FM Transmitters (Block level) – FM demodulation techniques - FM Receivers (Block diagram). *Phase modulation* – FM and PM comparison

Pulse modulation – Need for pulse modulation – different types – Pulse Width Modulation, Pulse Position Modulation and Pulse Code Modulation – principles of operations.

Module IV

Introduction to digital communication: Emergence of data communication systems – characteristics – digital codes – error detection and correction – constant ratio codes, redundant codes, parity check codes, rate transmission, forward error correcting codes. Data sets and interconnection requirements – Modems – classification, modes of operation, modem interconnection, modem data transmission speed – modem interfacing.

Text book:

1. George Kennedy & Davis: *Electronic communication Systems*, Tata Mc Graw Hill, 1999.

References:

2. Dennis Roody and John Coolen: *Electronic Communication*, Prentice Hall of India, New Delhi.
3. Taub and Schilling: *Principles of Communication Systems*, Mc Graw Hill.1987
4. Sam shanmugham: *Digital and Analog Communication Systems*, John Wiley & Sons, 1985.
5. William Schweber: *Electronic Communication Systems – A complete course*" 4th edition, Prentice hall of India, 2002.

EB/EC/EE/EI 406 INDUSTRIAL AND POWER ELECTRONICS

Module I.

Power transistors - Design of high power amplifier – switching transistors - Parallel operation of transistor - Power MOSFET - Operating principles - Structure and characteristics. Thyristors- Classification & Constructional Details. SCR - Working principle - turn on, turn off and V - I characteristics - gate characteristics, and rating: Series and parallel operation of SCR - TRIAC - characteristics, modes of operation, Trigger circuits - magnetic & solid state , half- wave and full-wave operation .

Module II.

Single phase controlled rectifiers - half-wave, full-wave, half-controlled and fully controlled - typical waveforms with R, RL, RL with diode and RL with voltage source - voltage and current equation for half-wave controlled rectifier. Three phase half-wave and full-wave controlled rectifier with R load, waveforms. DC motor speed control - various schemes - multiquardrant operation - simple circuits for speed control of series, PM and separately excited motors.

Module III.

Commutation schemes -(different classes) waveforms - single-phase invertors - series, parallel and bridge -PWM invertor - square wave and sin wave output. Chopper circuits using SCR transistor (detailed analysis not required) - Jones Chopper. A.C Motor speed control - various schemes - electronic control of speed of induction motors and synchronous motors.

Module IV.

Static switches: dc & ac switches-1φ and 3φ switches-design of static switches-Solid state relays. Switching regulators - Basic concepts, analysis and design of Buck, Boost, Buck-Boost and derived converters . UPS - Characteristics - Configuration – Application. Batteries: Characteristics and selection-charging circuits.

Thyristor protection - over current, over voltage, di/dt, dv/dt, gate protection. Industrial applications: Timer circuits - Flasher circuits-Electronic ballast, dielectric heating, induction heating.

Text Book:

1. Muhammed H. Rashid, *Power Electronics – Circuits, Devices and Applications*, PHI Ltd, 3rd ed.

References:-

2. *Power Electronics*, IMPACT Learning Material Series, Indian Society for Technical Education.
3. J. Michael Jacob, *Power Electronics: Principles & Applications*, Thomson Learning, New Delhi, 2006
4. B. K. Bose, *Modern Power Electronics And AC Drives*, Pearson Education/ Prentice-Hall India Ltd, 2003
5. Biswanath Paul, *Industrial Electronics and Control,* Prentice Hall of India, New Delhi, 2002
6. D W Hart, *Introduction to Power Electronics*, Pearson Education,1997
7. P C Sen, *Power Electronics*, Tata Mc Graw Hill, 2007
8. Singh & Khanchandani , *Power Electronics*, Tata Mc Graw Hill, 2nd ed.
9. Asghar M syed , *Power Electronics*, Prentice Hall of India, 2003
10. Hays , *The art of Electronics*, Cambridge University Press,1989

EB/EC/EE/EI/CS 407 DIGITAL ELECTRONICS LABORATORY

1. Transfer characteristics and specifications of TTL and MOS gate
2. Design of half adder and full adder using NAND gates.
3. Set up R-S & JK flip flops using NAND Gates
4. Code conveters - Binary to Gray and gray to Binary using mode control.
5. Asynchronous UP / DOWN counter using JK Flip flops
6. Design and realisation of sequence generators.
7. Study of shift registers and design of Johnson and Ring counter using it.
8. Binary addition and subtraction (a) 1's complement (b) 2's complement
9. Study of IC counters 7490, 7492, 7493 and 74192.
10. Astable and monostable multi-vibrators using TTL gates
11. Interfacing –CMOS , TTL
12. Study of MUX & DeMUX Circuits and ICs

EB 408 ANALOG CIRCUITS LABORATORY

1. Clipping and clamping circuits using diodes / transistors
2. Study of RC and RLC circuits - Frequency responses, pulse response, Filter characteristics
3. Differentiating circuit and integrating circuits.
3. RC coupled amplifiers using BJT with and without feedback
4. FET amplifiers – frequency response, Common source amplifier
5. Low frequency oscillators - RC phase shift. Wein Bridge
6. Multivibrators - Astable , Bistable, Monostable.
7. Sweep circuits - Simple transistor sweep, bootstrap sweep.
8. Series Voltage Regulator using transistors.
9. Power amplifiers.

EB/EC/EE/EI/CE/CS/IT/ME/SE 501 ENGINEERING MATHEMATICS IV (Common)

Module I

Probability distributions: random variables (discrete & continuous), probability density, mathematical expectation, mean and variance of a probability distribution, binomial distribution, Poisson approximation to the binomial distribution, uniform distribution , normal distribution. *Curve fitting*: method of least squares, correlation and regression, lines of regression.

Module II

Sampling distributions: population and samples, the sampling distribution of the mean unknown),σ known), the sampling distribution of the mean (σ (the sampling distribution of the variance, point estimation, interval estimation, tests of hypotheses, null hypotheses and significance tests, hypothesis concerning one mean, type I and type II errors, hypotheses concerning two means. The estimation of variances : Hypotheses concerning one variance - Hypotheses oncerning two variances.

Module III

Finite difference Operators: ∇, Δ, E, δ, μ , $x^{(n)}$ .Newton's Forward and Backward differences interpolation polynomials, central differences, Stirlings central differences interpolation polynomial. Lagrange interpolation polynomial, divided differences, Newton's devided differences interpolation polynomial. *Numerical differentiation:* Formulae for derivatives in the case of equally spaced points. *Numerical integration:* Trapezoidal and Simpson's rules, compounded rules, errors of interpolation and integration formulae. Gauss quadrature formulae (No derivation for 2 point and 3 point formulae)

Module IV

Numerical solution of ordinary differential equations: Taylor series method, Euler's method, modified Euler's method, Runge-Kutta formulae 4th order formula. *Numerical solution of boundary value problems:* Methods of finite differences, finite differences methods for solving Laplace's equation in a rectangular region, finite differences methods for solving the wave equation and heat equation.

Text Books:

1. Irvrin Miller & Freind , *Probability And Statistics For Engineers*, Prentice-Hall India Ltd, 6th ed.
2. S.S.Sastry, *Numerical Methods*, Prentice-Hall India Ltd, 4th ed.

References:

1. P.Kandaswamy K.Thilagavathy, K.Gunavathy , *Numerical Mehtods*, S.Chand & Co., 2005
2. A.Papoulis, *Probability,RandomVariables And Stochastic Processes*,,Mc Graw Hill, 4th ed.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

EB 502 BIOMATERIALS

Module I

Definition and classification of biomaterials: Applications of polymers, metals, ceramics and composite as biomaterials for implantation. Surface properties of materials, mechanical properties. Metallic implant materials: Stainless steel, Co-based alloys, Ti and Ti-based alloys .Ceramic implant materials: Aluminium oxides, Glass ceramics, Carbons, Bioactivity, bioactive glasses and applications.

Module II

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

Module III

Hard tissue replacement implant: Orthopedic implants, Dental implants. Soft tissue replacement implants: Percutaneous and skin implants, Vascular implants, Heart valve implants- Strength and strengthening mechanisms of metals, ceramics and polymers. Tailor made composites, Bio-composites and nano bio-composites.

Module IV

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

Text books:

1. Joon B. Park & Roderic S. Lakes: *Biomaterials : an Introduction*, Plenum Press, New York, 1992
2. Jonathan Black, *Biological Performance of materials*, Marcel Decker, 1981

Reference books :

1. Piskin and A S Hoffmann, *Polymeric Biomaterials(Eds)*, Martinus Nijhoff Publishers, Dordrecht, 1986.
2. Eugene D. Goldbera & Akio Nakajima: *Biomedical Ploymers*, Academic Press, 1980
3. A . Rembaum & M. Shen, *Biomedical Polymers* , Mercel Dekker Inc., New York, 1971.
4. L. Stark & G. Agarwal, *Biomaterials*, Plenum Press, New York, 1969.
5. Donald L. Wise...[et al.] eds. :*Encyclopedic handbook of biomaterials and bioengineering* (4 vols.), Marcel Dekker, New York,1995
6. Fredrick H.Silver: *Biomaterials, Medical Devices & Tissue Engineering: An integrated approach.* Chapman & Hall, 1994.
7. Julien F V Vincent: *Structural Biomaterials*, Macmillan Press, 1982.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

EB 503 HOSPITAL ENGINEERING

Module I

Definition of Bio-Engineering , Biomedical Engineering, Clinical engineering & Hospital engineering - functions, responsibilities and training requirements of hospital engineers and clinical engineers. Modern Hospital Architecture – Space distribution in a hospital building. Preparation of estimates, specifications , inviting tenders etc. Ordering, testing, acceptance & maintenance protocols for medical equipments. Computerized preventive maintenance planning. Importance of ISO Certification.

Module II

Electrical power systems in hospitals - Design of sub stations, wiring in hospitals, protective systems – over voltage and over current protectors, circuit breakers , Surge protectors, EMI filters, Stabilised and uninterrupted power supply systems - Basics of air conditioning and refrigeration systems- De-odourisation and disinfections and dehumidification

Module III

Sterilization systems in hospitals: Principles and techniques of sterilization - - Steam , formaldehyde & EO sterilization, Autoclaves, Incinerators. Design of operation theatres – theatre lighting, OT tables, power supply systems - Cryogenic systems for hospitals.

Module IV

Hospital gas supply systems - Centralized supply of air, nitrous oxide, vacuum & oxygen – principle of production of liquid oxygen, - Principle of production of liquid oxygen. Working of dry, oil free air compressor - small and big vacuum engines. Wheel chairs & stretches.

Text books:

1. C A Caceres ,*Clinical Engineering*, Acadmic Press, New York,1977
2. C S Ward ,*Aneasthetic Equipments*, W. B. Saunders, London, 1985.
3. Kutz Myer, *Standard Handbook of Biomedical Engineering, & Design*,McGraw Hill,2002

References :

1. B. N. Feinberg, *CRC Handbook of Clinical Engineering*, CRC Press, 1980.
2. Richard L. Miller,Earl S. Swensson “Hospital and Healthcare Facility Design” W. W. Norton & Company; 2nd edition 2002
3. John Douglas McDonald “Electric Power Substations Engineering”– 2003 CRC Press
4. Alexander Kusko, *Emergency and Standby Power Systems* 1989 - McGraw-Hill
5. Anantha Narayanan , *Basic Refrigeration and Air Conditioning* , 2nd edition, Tata Mcgraw-hill 1996

For EB 503 Hospital Engineering, assignment shall be a one week in plant training in a hospital where the students get familiarized with the hospital management and the topics included in the syllabus. The students shall fix up the hospital for training and prepare a document based on this training and present it.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

EB 504 BIO SIGNAL PROCESSING – I

Module 1

Introduction to biomedical signals –nature- examples ECG, EMG, EEG, PCG, VAG, carotid pulse, speech signal, concurrent signals .Sampling theorem - Discrete time signals and systems - Properties of discrete systems - LTI system convolution correlation - difference equation representation of discrete systems - The Z transform - properties of Z transform - the inverse Z transform - Transfer function.

Module 2

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

Module 3

FIR filter design using Fourier series - use of window functions like rectangular, raised Cosine, Kaiser, Triangular - frequency sampling design - Notch filter - FIR Digital Filters Realizations - direct - cascade - lattice forms - Finite word length effects in FIR filters.

Software implementation of filters (only for experimental study)

Module 4

Analog filter approximations- Butterworth and chebychev approximations- IIR Digital Filters Realizations - Direct - Cascade - Parallel forms - Frequency transformation techniques - The method of mapping of impulse transformation - transformation -Matched transform technique-

Finite word length effects in IIR filters

software implementation of digital filters (only for experimental study)

Text Books

1. Rangaraj M Rangayyan: *Biomedical Signal Analysis*, John Wiley, 2002.
2. John G Proakis & Dimitris G Manolakis: *Digital Signal Processing – Principles, Algorithms and Applications*, Prentice Hall of India, 2005.

References:

1. Andreas Antonion: *Digital Filters Analysis & Design*, Prentice Hall of India, 2002.
2. P. Ramesh Babu: *Digital Signal Processing*, Scitech Publications,India 2004.
3. R Rabiner & B. Gold: *Theory & Application of Digital Signal processing*, Prentice Hall of India, 2000.
4. Alan V. Oppenheim & Ronald W Schafer: *Digital Signal Processing*, Prentice Hall of India, 2004.
5. Andreas Antoniou: *Digital Signal Processing*, Prentice Hall of India. 2nd ed.
6. John L.Semmlow: *Biosignal and Biomedical Image Processing – Matlab Based Applications*" Marcel Dekker Inc., New York.2004
7. Steven W. Smith, *Digital Signal Processsing – A Practical Guide for Engineers and Scientists*, Elsevier India Pvt Ltd., 2006
8. Avtar Singh & Srinivas, *Digital Signal Processing*, Thomson Learning, 2004
9. Sanjit K.Mithra ,*Digital Signal Processing*, Tata Mc Graw Hill, 3rd ed.
10. Charles S.Williams, *Designing digital filters*, Prentice-Hall India Ltd, 1986
11. Vinay K. Ingle, John G. Proakis, *Digital Signal Processing using MATLAB*, Thomson Learning, 2007

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

EB 505 BIOINSTRUMENTATION – I

Module I

General measurement system: Static characteristics - accuracy, precision, linearity, hysteresis, threshold, dynamic range, calibration, standards. Errors – measurement of errors, error reduction. Dynamic characteristics -Transfer function - first and second order instruments - first and second order response, dynamic errors and dynamic compensation - Loading effect.

Basic principles of test and measuring instruments: Multimeters - analog and digital multimeters

Frequency and time measurement - analog CRO and digital storage oscilloscope.

Module II

Analytical equipments used in clinical environment - Beer-Lambert's Law - UV, visible and infra-red spectrophotometers- monochromators, detection systems and amplifiers - basic applications in biochemical analysis. Flame photometers, colorimeters, pHmeter, Hb meter - principles and applications. Blood cell counters- methods- Coulter Counters- automatic recognition and differential counting.

Module III

Analytical aids – Electrophoresis – principles and applications, Densitometers – principle and applications, Chromatography - gas and liquid chromatographs - principle and applications, Flow cytometry. Fundamentals of NMR spectroscopy, X-ray spectrometers, Mass spectrometers, Raman & Moss Beer spectroscopy. Principles of scanning and transmission electron microscopy. Principles of simple, compound and phase contrast microscopes.

ModuleIV

Recording systems – signal conditioning & preamplification – instrumentation amplifiers – patient isolation – sources of noise and signal processing – main amplifier and driver stage – Writing systems – direct writing recorders – inkjet recorders – potentiometric recorders – digital recorders – thermal array recorders – video printers – electrostatic recorders – instrumentation tape recorders, strip chart and x-y recorders. Medical display systems- – single and multicahnnel displays- nonfade displays.

References:

1. W.D. Cooper , Alber D Helfrick, *Modern Electronic Instrumentation and Measurement Techniques* PHI,1989.
2. D. Patranabis, *Principles of Industrial Instrumentation*, Tata McGraw Hill.1999.
3. Hobart H. Willard, Lynne H Merritt, *Instrumental Methods of Analysis*, Wadsworth Publishing Co., 1998.
4. Khandpur R S, *Handbook of Analytical Instruments*, Tata McGraw Hill,1989
5. Larry Jones, A. Foster Chin, *Electronic Instruments and measurements*, John Wiley and sons, 1983.
6. Joseph J Carr, *Elements of Electronic Instrumentation and measurement*, Pearson Education.3rd edition.

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

CS/EB 506 MICROPROCESSOR BASED SYSTEM DESIGN

Module I

Architecture of 16 bit microprocessors: Intel 8086 Architecture — Segment registers and memory segmentation – memory address space and data organization, addressing modes, instruction set, instruction template examples, instruction execution timing. Assembly Language programming, programming examples;

Modular programming-Assembler instruction format, assembler directives and operators, assembly process, linking and relocation, debugging, stacks, procedures, interrupt routines, macros

Module II

8086 hardware design:minimum mode and maximum mode configurations, pin configuration of 8086, comparison with 8088; Bus structure, bus buffering, latching, system bus timing with diagram,

Peripherals and their interfacing:Dynamic RAM interfacing, interfacing I/O ports,, interfacing with programmable interrupt controller 8259,programmable DMA interface 8237, DMA transfer and operations

Multiprocessor Systems:Interconnection topologies-interfacing with 8087- architecture of 8087 and configuration-Design of a PC based multimicroprocessor system

Module III

Architecture of 32 bit Microprocessors: Intel 80386 Architecture, Block Diagram, Addressing modes,Data Types 80386,Real address mode of 80386 protected mode of 80386, segmentation,paging and Virtual modes

Recent advances in microprocessor architectures-Pentium families-salient features of Pentium II Pentium III and Pentium IV- a few relevant concepts of computer architecure-pipelining,CISC and RISC Architecture-Introduction to dual-Core Architecture.

Module IV

Introduction to micro controllers - comparison with microprocessors Study of micro controller (MCS 51 family-8051) - Architecture, instruction set, addressing modes and programming - Comparison of various families of 8bit micro controllers. Interfacing with sensors and actuators

Text books

1. Ajoy Kumar Ray,Kishor Mbhurchandi, *Advanced Microprocessors and Peripherals*,TMH, New Delhi,2000,
2. Kenneth J.Ayala, *8086 Microprocessor:Programming and Interfacing the PC*, Thompson Publishing, 1995 (1st Indian reprint 2007)
3. Mazidi, *The 8051 Microcontrollers & Embedded Systems*, Pearson Education 2nd edition

References:

1. Kenneth J.Ayala, *The 8051 Microcontroller, Architecture, Programming and Applications*, Penram International Publishing (India), 1996
2. Douglas V Hall, *Microprocessors & Interfacing-Programming and Hardware*, TMH 2002
3. Avtar Singh , *The 8088 and 8086 Microprocessors -programming, Interfacing, Software, Hardware and Application*s, PHI 2000

4. Barry B. Brey, *The INTEL Microprocessors - 8086/8088, 80186/80188, 80286, 80386, 80486 Pentium and Pentium pro processor, Pentium II, Pentium III, Pentium 4 - Architecture, Programming and interfacing*, Prentice Hall of India , 6 Ed, 2003.
5. A.K.Ray&K.M.Bhurchandi , *Advanced Microprocessors and peripherals*, 1st edition-TMH
6. YU-Cheng Liu & Glenn A Gibson, *Microprocessor System , Architecture Programming & Design" PHI 2nd edition*
7. Kenneth Hintz & Daniel Tabak, *Microcontroller architecture implementation and programming*, Mc Graw Hill.2000
8. *Intel Users manual for 8086, 80386 & 80486, Pentium & Pentium pro*
9. *Microprocessor Systems, Learning Material Series, ISTE, NewDelhi,1997*
10. John B. Peatman, *Design with microcontrollers*, McGraw Hill, Singapore.1998

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

CS/EB/EC/EI 507 MICROPROCESSOR LABORATORY

PART I – 3 Lab sessions

Part I A (*Compulsory*)

1. Study of a typical microprocessor trainer kit and its operation
2. Interfacing and programming of 8255.(eg: traffic light control, burglar alarm, stop watch)
3. Interfacing and programming of 8253/ 8254.
4. Interfacing and programming of 8279.

Part I B*

1. A/D and D/A converter interface
2. Stepper motor interface
3. Display interface
4. Programming of different types of EPROM 2716, 2732 etc

(* *At least two topics from part B to be covered*.)

PART II – 7 Lab sessions

(*Compulsory*)

1. Introduction to IBM/PC and its DEBUG program commands
   - Examining and modifying the contents of the memory
   - Assembling 8086 instructions with the ASSEMBLER commands
   - Executing 8086 instructions and programmes with the Trace and GO Command.
   - Debugging a program
2. Assembly language program development using IBM/PC Macro assembler
   - Creating an Assembler source file
   - Assembling source program with MASM
   - The link program - creating a RUN module
   - Typical programming examples.
3. Interfacing Experiments with micro controllers

(* At least two topics from part B has to be covered.)

Note: 50% Marks is earmarked for continuous evaluation and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50% marks separately for the two components to be eligible for a pass in that subject.

EB 508 MEDICAL ELECTRONICS LABORATORY - I

1) Study of op amps and basic circuits using op amp
   (arithmetic circuits, simple amplifier circuits, comparator circuits)
2) Phase detector
3) Study of LDR & its characteristics
4) Study of IC 4051 and its applications
5) ECG filters
6) Design of pacemaker circuits & Characterization
   i. Fixed type
   ii. Demand type
7) Bioamplifier
8) Digital to analog converter
9) Notch filter
10) Thermistor & strain Gauge characteristics
11) Skin contact impedance
12) Study of medical equipments
   i. ECG
   ii. Sphygmomanometer
   iii. Analytical equipments such as colorimeter, pH meter, HB meter

Note: 50% Marks is earmarked for continuous evaluation and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50% marks separately for the two components to be eligible for a pass in that subject.

EB 601 BIOSENSORS & TRANSDUCERS

Module I

Transducers and sensors: Transducers- sensors- active and passive. Study of biological sensors in human body and their basic mechanism of action - organization of nervous system- neuronal mechanism and circuit processing - Study of various corpuscles like Pacinian - Chemoreceptors, hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste.

Module II

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

Module III

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

Module IV

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

Text books:

1. Geddes & Becker: *Principles of Applied Biomedical Instrumentation,* John Wiley, 1989.
2. R S C Cobbold, *Transducers for Bio medcial Instruments*, John Wiley & Sons, 1974.

References :

1. Brown & Gann: *Engineering Principles in Physiology Vol. I* Academic Press,1973
2. A V S De Reuck:, *Touch Heat & Pain*, J & A Churchill Ltd. London,1967.
3. Iberall & Guyton , *Regulation & Control in Physiological System*, Instruments Society USA
4. Harry Thomas , *Handbook of Bio medical Instrumentation* , Reston, Virginia 2000
5. R S Khandpur, *Handbook of Bio medical Instrumentation*, Tata McGraw Hill,2004
6. D L Wise , *Applied Bio Sensors*, Butterworth Publishers, London 1989
7. Keith Brindley, *Sensors & Transducers*, Heinemann Newnes, Great Britain, 1988.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

EB 602 BIOMECHANICS

Module I

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

Module II

Biomechanics of joints, Human locomotion – gait analysis - Foot Pressure measurements - Pedobarograph - Force platform.

Module III

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

Module IV

Biomechanics of spine - Scoliosis - Measurement – biomechanical treatment- instrumentation – Muscle mechanics - Exoskeletal system for paraplegics - Powered wheel chairs – crutches & canes. Monitoring Devices: Catheter Mathematical Model, response to a sinusoidal input. Tonometry- different types Respiratory Sound measurement.

Text books:

1. D N Ghista , *Biomechanics of Medical Devices* , Macel Dekker , 1982
2. J B Park, *Biomaterials - Science and Engineering*, Plenum Press , 1984

References :

1. Alexander R Mc Neill , *Biomechanics*, Chapman and Hall, London, 1975
2. A Z Tohen and C T Thomas , *Manual of Mechanical Orthopaedics*" ,1973
3. D N Ghista and Roaf , *Orthopaedic Mechanics*, Academic Press,1978
4. VC Mow and W C Hayes *Basic Orthopedic Biomechanics*, Lippincott – Raven publishers,1997.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

EB 603 BIOINSTRUMENTATION - II

Module 1

Basic medical Instrumentation system – block diagram – design and performance requirements – constraints in design – types of biomedical equipments – analytical, diagnostic, therapeutic, surgical – manual, microprocessor and PC based equipments – regulation of medical devices and testing of biomedical equipments.

Oximeters – types – Pulse oximeter- Audiometers – pure tone and speech audiometers.

Module 2

ECG machine – Block diagram - Detection, amplification and recording of ECG – artifacts in ECG recording – types of ECG machines – Vectorcardiograph – Phonocardiograph – Patient monitoring systems – central station and bedside monitoring – cardioscope – cardiotocograph – methods of monitoring fetal heart rate – arrhythmia monitors – arrhythmia detection methods – Holter monitoring and recording – data recording, replay and analysis – cardiac stress testing – bicycle and treadmill tests – protocols –

Module 3

Electroencephalograph – block diagram – amplifiers, filters – sensitivity control – applications of EEG. Evoked potentials – types and stimulations – Recording - Amplifiers - Analysis and storage of VEP AEP and Somatosensory EP – Applications. Brain mappers - Magneto Encephalogram – principles, measurements and applications. Principles of electromyography – detection, signal processing, amplification and recording – applications – use of myo electric signal for control myoelectric control system.

Module 4

Impedance Techniques : Bipolar and tetrapolar circuits , detection of physiological activities using impedance techniques - cardiac output, respiratory activity, Impedance Plethysmography- resistance and capacitance type. Blood flowmeters - electromagnetic – types – ultrasonic – types – NMR and Laser Doppler blood flowmeters. Pulmonary function measuremenst – respiratory volumes, capacities compliance and related pressures , dynamic respiratory parameters – Spirometry – basic system – types and applications. Cardiac output measurement- different techniques

Text Books:

1. Geddes & Baker , *Principles of Applied Biomedical Instrumentation*, Wiley
2. Khandpur R S, *Handbook of Bio-Medical Instrumentation*, Tata McGraw Hill, 2nd edn 2003

References:

1. Richard Aston, *Principles of Biomedical Instrumentation and Measurements*, Merril Publishing Co., 1990.
2. Myer Kutz, *Standard Handbook of Bimedical Engineering and Design*, McGraw Hill, 1993.
3. Joseph D. Bronzino, *The Biomedical Engineering Handbook*, CRC Press, 1995.
4. John G. Webster, *Encyclopedia of Medical Devices and Instrumentation*, 2nd edn, Wiley Interscience, 2006
5. A M Halliday, *Evoked Potential in Clinical Testing* (2nd ed), Churchill Livingstone, London 1993

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A orB.

EB 604 PRINCIPLES OF OBJECT ORIENTED PROGRAMMING

Module I

Object –Encapsulation – Class- Class Structure- Implementation of a class- Persistance-Object identity-Inheritance-overriding-Polymorphism-abstract class-Multiple Inheritance-Repeated Inheritance-Object Oriented Design Process

Module II

C++ Class - class scope – constructor – creating an object or an instance – destructor- copy constructor – The dot operator - this pointer - pointer to an object- Array- Composite class definition- constructor for composite object-destructor for composite object- access control for component object –Special C++ Features.
Static Member – friends to a class – pointers- Derived Class – copy constructor under
derivation - virtual function

Module III

Operator Function Definition – Arithmetic operator- Logical operator-Relational operator –Operator [ ] – operator ( ) –Assignment operator – Dereferencing operator- Extraction operator–Insertion operator –Conversion operator

Module IV

Class Template Definition –Template Class instantiation – Template Class Specialisation –Function Templates – Template Class Static member – Multiple Template Parameters

TEXT BOOK:

1. Balaguruswamy, *Object oriented programming with C++* , Tata McGraw-Hill, Second edition.

REFERENCES:

1. Lafore.R., *"Object oriented programming in Microsoft C++"*, Galgotia, New Delhi, 1993.
2. Venugopal, Ravishanker and Rajkumar, *Mastering C++*, Tata McGraw-Hill, First edition, 1998.
3. D. Ravichandran, *Programming with C++*, Tata McGraw-Hill, First edition, 1997.
4. Appleby, *Programming Languages*: *Pradigm and Practice*, Tata McGraw-Hill, First edition.
5. N.E.Smith, *Object oriented programming using Turbo C++*, BPB, New Delhi, 1992.
6. Sourav Sahay: *Object Oriented Programming with C++*, Oxford University Press, 2006.
7. Thomas Wu, *An introduction object oriented programming with Java*, Mcgraw-Hill,1999

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

EB/EC/EI/CS 605 CONTROL SYSTEMS ENGINEERING

Module I

Basic idea of control systems and their classification - differential equations of systems - linear approximation - Laplace transform and transfer function of linear system - Model of physical system (Electrical, mechanical and electromechanical)- block diagram - signal flow graph - Mason's gain formula.

Module II

Time domain analysis - Representation of deterministic signals - First order system response - S-plane root location and transient response - impulse and step response of second order systems - performance - characteristics in the time domain - effects of derivative and integral control - steady state response - error constant - generalised definition of error coefficients - concepts of stability - Routh - Hurwitz criterion.

Module III

Frequency domain analysis - frequency response - Bode plot, Polar plot, Nicol's chart - closed loop frequency response and frequency domain performance characteristics. Stability in frequency domain. Nyquist criterion.

Module IV

Root locus method - basic theory and properties of root loci - procedure for the construction of root loci - complete root locus diagram. Design and compensation of feed back control system: approaches to compensation - cascade compensation networks and their design in the frequency domain - simple design in S-plane.

Text Book:

1. Ogata K, *Modern Control Engineering*, Prentice-Hall India Ltd /Pearson Education, 4th ed.

References:

1. Dorf , *Modern Control system*, Pearson Education, 8th ed.
2. Franklin, *Feed back Control Systems*, Pearson Education
3. Kuo B. C, *Automatic Control System*, Prentice-Hall India Ltd, 8th ed.
4. Nagoor Kani, *Control Systems*, RB Publishers,1998
5. Ogata, *Discrete Time Control Systems*, 2nd edn., Pearson Education/ Prentice-Hall India Ltd
6. Nagarath & Gopal, *Control System Engineering*, Wiley Eastern, 2nd ed.
7. Ramkayan, *Control Engineering*, Vikas Publications, 2007
8. M N Bandyopadhyaya, *Control Engineering- Theory& Practice* , Prentice-Hall India Ltd, 2003
9. Glad, *Control Theory* , Thomson Learning,2000

Type of Questions for University Exam.
Q 1.Eight short answer questions of each 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

EB 606 BIOSIGNAL PROCESSING – II

Module 1

Spectral analysis, Estimation of power density spectrum, Periodogram-Parametric model based spectral Linear prediction theory, estimation Auto regressive (AR), Moving average (MA) Autoregressive moving average (ARMA) models. Estimation of parameters- spectral error measure EEG analysis.

Module 2

Optimal and adaptive filters: Weiner filters, Adaptive signal processing Steepest descent algorithm LMS adaptive algorithm, Adaptive noise canceller – cancellation of 50 Hz signal in ECG- cancellation of maternal ECG in fetal electrocardiography.

ECG data reduction Techniques: Direct ECG data compression- transformation compression – comparison.

Module 3

Wavelets-Introduction - Continuous wavelet transform, wavelet time-frequency characteristics, Discrete wavelet transform and orthogonal wavelet decomposition, orthonormal wavelets, filter banks-Applications- wavelet de-noising, discontinuity detection, feature detection : wavelet packets ,wavelet compression.

Module 4

Introduction to DSP processors: characteristic features of DSP processors ,special features for arithmetic ,I/O interfaces ,memory architectures ,data formats, some basic DSP chip designs ,brief overview of some major DSP processors .The Architecture of TMS320C54xx Digital Signal Processors. Addressing Modes of the TMS320C54xx Processors. Memory Spaces of TMS320C54xx Processors. Program Control. TMS320C54xx Instructions and Programming. On-Chip Peripherals. Interrupts. Pipeline Operation of the TMS320C54xx Processors.

Text book:

1. D C Reddy: *Biomedical signal Processing*, Tata McGraw-Hill, New Delhi, 2005

References:

1. John L.Semmlow: *Biosignal and Biomedical Image Processing – Matlab Based Applications* , Marcel Dekker Inc. New York, 2004.
2. Raghuveer M Rao et al: *Wavelet Transforms- Introduction To Theory And Applications*, Pearson Education Asia, 2003.
3. Rangaraj M Rangayyan: *Biomedical Signal Analysis*, John Wiley, 2002
4. Avtar Singh, S. Srinivasan *Digital Signal Processing Implementations : Using DSP Microprocessors (with examples from TMS320C54XX), Thomson-Engineering 1st Ed.2004*
5. Kuo,SenM.Gan, Woon-Seng S. *Digital Signal Processors: Architectures, Implementations, and Applications, Prentice Hall - PEARSON 1st Ed.2005*

Type of Questions for University Exam.

Q 1.Eight short answer questions of each 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 607 MEDICAL ELECTRONICS LABORATORY - II

1. First order and second order high pass and low pass filters.
2. Precision rectifiers (Half wave and Full wave).
3. UJT relaxation oscillator
4. Band pass filter
5. High voltage and low voltage regulators
6. DC power control using SCR.
7. ECG simulator.
8. Basic principle of biotelemetry using IC 4046.(Transmitting ECG signals)
9. Patient isolation circuits
10. Study of PLL IC 565.
11. Sample and hold circuit
12. Study of AD 590
13. Voltage to frequency converter
14. Systolic and diastolic pressure measurement.
15. Front end of ECG machine
16. Front end of plethysmograph
17. Study of medical equipments
    i. Fetal monitor
    ii. EEG
    iii. EMG
    iv. Spirometer
    v. Plethysmograph
    vi. Defibrillator

Note: 50% Marks is earmarked for continuous evaluation and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50% marks separately for the two components to be eligible for a pass in that subject.

EB 608 MINI PROJECT

Each batch comprising of 3 to5 students shall design, develop and realize an engineering product which is having application in Biomedical field. Basic elements of product design must be considered. Fully software/simulation projects are not allowed. Each student shall submit a project report at the end of the semester. The project report should contain the design and engineering documentation and test results. Product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations and aesthetics/ergonomic aspects taken care of in the project shall be given due weightage.

Guidelines for evaluation:

i) Attendance and Regularity	10
ii) Work knowledge and Involvement	30
iii) End-Semester presentation & Oral examination	20
iv) Level of completion and demonstration of functionality/specifications	25
v) Project Report	15
Total	100 marks

***Note**: External projects and R&D projects need not be encouraged at this level. Points (i)&(ii) to be evaluated by the project guide & co-ordinator and the rest by the final evaluation team comprising of 3 teachers including the project guide*

EB/EC/CS/EE/EI/IT 701 INDUSTRIAL ORGANIZATION AND MANAGEMENT

Module I

Organisation :- Introduction, definition of organization, system approach applied to organization, necessity of organization, elements of organization, process of organization, principles of organization, formal and informal organization, organization structure, types of organization structure .

Forms of business organization: - concept of ownership organization, types of ownership. Individual ownership, partnership, joint stock Company, private and public limited company, co-operative organizations, state ownership, public corporation

Module II

Basic concept of management: - introduction, definitions of management, characteristics of management, levels of management, management skills

Management theory: - Scientific management, contribution of Gilbreth. Gantt, Neo-classical theory, modern management theories

Functions of management: - planning, forecasting, organizing, staffing, directing, motivating, controlling, co-coordinating, communicating, decision making.

Module III

Personnel management: - Introduction, definition, objectives, characteristics, functions, principles and organization of personnel management

Markets and marketing: - Introduction, the market, marketing information, market segmentation, consumer and indusial markets, pricing, sales, physical distribution, consumer behaviour and advertisement.

Financial management:- the basics , financial accounts, inflation, profitability, budgets and controls, cost accounting, valuation of stock, allocation of overheads, standard costing ,marginal costing

Module IV

Productivity and production, measurement of productivity, productivity index productivity improvement procedure

Materials management and purchasing: - objectives, functions, importance of materials management. Stores and storekeeping

Inventory control: - classification, functions, inventory models, inventory costs, EOQ, Materials requirement planning

Reference:

1 Fraidoon Mazda, *Engineering Management*-, Addison –Wesley 1997

2 Koontz and O'Donnell, *Essentials of Management*, Mc Graw Hill 1974

3 Kotlar P, Marketing Management,: Analysis, Planning, Implementation, and Control 1991 Prentice Hall India

4 Chandra P , *Finance Management:* Theory and Practice 1984 - Tata McGraw-Hill

5 Monks J.G Operations Management theory and problems 1985 - McGraw-Hill

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 702 THERAPEUTIC EQUIPMENTS

Module I

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

Module II

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

Module III

Surgical diathermy – principles, burn and shock hazards - electro surgical analyzers - Principles of short wave and microwave diathermy. Lithotripsy – principles of percutaneous, ultrasonic & extracorporeal shock wave lithotripters.

Module IV

Principle of endoscopy-Types of endoscopes , cystoscopes , laproscopes - Fiber optic endoscopes and endoscopes with integral TV cameras - Infusion pumps, peristaltic pumps – Dialysis equipments - Pulmonary function analysers – spirometers

Heart lung machines.

References :

1. Mushin, *Automatic Ventilation of Lung*, Black Well,1980
2. R S Khandpur, *Handbook of Bio medical Instrumentation*, Tata McGraw Hill,2004
3. Massey & Meredith , *Fundamental Physics of Radiology*, Wright, Bristol,1992
4. Geddes & Baker , *Principles of Applied Biomedical Instrumentation* Wiley,1989

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 703 PRINCIPLES OF RADIO DIAGNOSIS AND RADIOTHERAPY

Module I

Various components of radiographic systems – Electrical circuit for X-ray unit – Filament circuit and mA control- HT circuit & KV control – Safety devices - X-ray tubes for various medical applications – fixed anode, rotating anode, x-ray tubes for specialised applications - Rating charts of X-ray tubes.

Module II

Exposure switching and control of exposure time – Types of timer circuits - Automatic exposure control – Photo electric and ionisation timers –-limitations - performance - Guard timers. Scattered radiation – effects & control in radiography – collimators – grids – types and characteristics, bucky grids – Absorbed dose and Rad - Basics of tables & arms.

Module III

X-ray films and its processing, properties of X-ray films, intensifying & fluorescent screens -properties Fluoroscopy systems – Direct and indirect fluoroscopy, Image intensifier & TV chain for fluoroscopy, Automatic brightness control – Camera tubes for x-ray TV chains. Serial film chargers – types - radiographic considerations - film exposure time - Basics of digital radiography & digital subtraction angiography.

Module IV

Physical principles of radiotherapy - Dosage data for clinical applications - kV & MV radiations – output and percentage depth dose values Measurement of output and use of ISODOSE charts - Radiation therapy planning- Collimators and beam direction devices –Tele-therapy sources - Principles of linear accelerators for radiation therapy.

Text books:

1. Sybil M Stockley, *A Manual of Radiographic Equipments*, Churchill Livingstone, New York.,1986
2. Meredith & Massey, *Fundamental Physics of Radiology*, Varghese Publishing House, Bombay.1972

References :

1. Thomas T. Thompson, *A Practical Approach to Modern Imaging Equipment* Little Brown & Co., 2nd edition,1978
2. T S Curry, J E Dowdey & R C Murrey: *Christensen's Introduction to Physics of Diagnostic Radiology*, Lea & Febiger, Philadelphia,1984
3. D N & M O Chesney, *Radiographic Imaging*, CBS Publishers,1990
4. D N & M O Chesney, *X-ray equipment for student Radiographers*, CBS Publishers,1975.

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 704 MEDICAL IMAGING TECHNIQUES

Module I

Ultra Sound In Medicine - principles of image formation, capture and display - principles of A-mode - B-mode and M-mode display - Doppler Ultrasound and Colour flow mapping - Applications of diagnostic ultra sound. Introduction to 3D and 4D ultrasound systems and its applications

Module II

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

Module III

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

Module IV

Radio isotope imaging - Rectilinear scanners, Linear scanners - SPECT - PET –Gamma Camera – Radio-nuclides for imaging, Emission Computed Tomography. Infra red Imaging - Physics of thermography imaging systems - Pyroelectric vidicon camera – clinical thermography

Textbooks

1. S Webb , *The Physics of Medical Imaging*, IOP Publishing Ltd., 1988.
2. Peter Fish, *The Physics of Diagnostic Ultrasound*, John Wiley & sons, England, 1990.

References :

1. A C Kak, *Principle of Computed Tomography* ,IEEE Press New York
2. Douglas A Christensen: *Ultrasonic Bioinstrumentation*, John Wiley, New York, 1988.
3. M N Rehani: *Physics of Medical Imaging*, Macmillian India Ltd., 1991.
4. D L Hykes, W R Hedrick & D E Starchman: *Ultrasound Physics & Instrumentation*, Churchill Livingstone, Melbourne, 1985.
5. Atam Dhavan, *Medical Image Analysis* ,Wiley IEEE Press, 2003.
6. HH Schild *MRI made easy* 2003 - Schering AG

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB /EE 705 (A) COMPUTER COMMUNICATIONS

Module 1

Introduction to computer networks – Types of Networks - Layered architecture- OSI reference model, TCP/IP reference model –Internet Protocol Stack – Network Entities in Layers- Connection oriented and Connection less services. Transmission media - description and characteristics - base band and broad band transmission - synchronous and asynchronous transmission - full duplex and half-duplex links. MODEMS serial communication standards - X-21 digital interface.X.25 Networks.

Module 2

Need for data link layer - Error detection and correction Techniques- Elementary data link layer protocols-sliding window protocols - Multiple Access protocols -Random Access protocols: ALOHA-CSMA and CSMA/CD. Terminal handling - polling, multiplexing and concentration. Local area Network: LAN addresses- Address Resolution Protocol-Reverse Address Resolution Protocol. Ethernet: Ethernet Technologies-IEEE standards- Hubs-Bridges and Switches.

Module 3

Network Layer: Virtual circuits and data grams -Datagram and Virtual circuit service- Routing - different types of congestion control – IP protocol – Subnets – Multicasting - Network layer in ATM.
Transport layer – Transport layer services - design issues – Elements of transport Layer – Internet Transport Protocols (TCP and UDP).

Module 4

Session layer - design issue - data exchange – dialogue management - synchronisation -
remote procedure call - client server model.
Application layer - network security and privacy - cryptography – Domain Name System (DNS)- SMTP – SNMP - virtual terminal and file transfer protocols - electronic mail - WWW and HTTP.

References:

1. Andrew S Tannenbaum, *Computer Networks*, Prentice hall of India Pvt. Ltd, 2003.
2. Uyless Balack, *Computer Networks, Protocols Standards & Interfaces*, Prentice hall of India Pvt. Ltd, 2000.
3. Zheng, S Akhtar, *Networks for computer scientists and Engineers*, Oxford Press, 2004
4. S. Keshav, *An Engineering Approach to Computer Networkin*g, Pearson education, 2002
5. Uyless Black, *Computer Networks - Protocols, Standards and Interface*s, PHI Ltd., 1994
6. Stalling , *Local and Metropolitan Area Networks* Prentice Hall; 6th edition (April 15, 2000)
7. Jean Walrand *Communication networks*, Richard D Irwin (May 1991) *2nd Edition*

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 705 (B) BIOSTATISTICS & DESIGN OF EXPERIMENTS

Module I

Basic concepts: Measures of central tendency – measure of dispersion – properties. Random variables – discrete and continuous – probability density function – binomial, Poisson and normal distributions – Joint probability density function – marginal and conditional distributions.

Module II

Statistical inference: Interval estimation – mean and variance – testing of hypothesis – single population mean – difference between two population means. Hypothesis testing for categorical data – Fisher exact test – chi square distribution – Goodness of fit. Non parametric tests – sign test – Wilcoxon sign rank test – Wilcoxon rank sum test.

Module III

Multisample inference –Introduction to analysis of variance – one way analysis of variance (fixed effects model) – hypothesis testing in one way anova (fixed effects model) – comparison of specific groups in one way anova. Regression and correlation: Fitting of regression line (least squares method) – linear regression – statistical inference on parameters from regression line – correlation coefficient – statistical inference on correlation coefficient – multiple regression – partial and multiple correlation – rank correlation coefficient.

Module IV

Scope of statistics in biomedical data analysis - Statistical design of experiments for clinical and laboratory data – Study design - Measure of effect for categorical data – confounding and standardization – methods of inference for stratified categorical data – power and sample size estimation for categorical data – multiple logistic regression – meta analysis – equivalence studies - Crossover designs – clustered binary data – measurement-error method – missing data.

Text books:

1. Wayne Daniel: *Biostatistics: Foundation for Analysis in the Health Sciences, 5th ed*., John Wiley & Sons, New York.
2. Bernard Rosener: *Foundations of Biostatistics, 6th edition*,Thomas Brooks, USA.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB/CS/IT 705 (C) ARTIFICIAL NEURAL NETWORKS

Module I

Introduction to neural networks. Artificial neural networks. Biological neural networks- Comparison , Basic building blocks of ANN. Activation functions. McCulloch-Pitts Neuron Model, Hebb net. Learning Rules-Hebbian Learning Rules, Perceptron, Delta, Competitive, Boltzmann. Perceptron networks- single layer, multilayer – algorithm.

Module II

Feedback Networks, Discrete Hopfield nets, Continuous Hopfield nets. Feed Forward Networks: Back Propagation Networks, Learning Rule, Architecture, training algorithm. Counter Propagation Network: Full CPN, Forward only CPN, architecture, training phases.

Module III

Adaptive Resonance Theory, architecture, learning in ART, Self Organizing feature maps: Kohonen SOM, Learning Vector Quantization, Max net, Mexican Hat, Hamming net. Associative memory networks Algorithms for pattern association Hetero associative networks, Auto associative memory networks Bidirectional associative memory networks Energy Function.

Module IV

Special networks: Probabilistic neural networks, Cognitron, Simulated Annealing, Boltzmann machine, Cauchy machine, Support Vector Machine Classifiers. Application of Neural networks In Image Processing and classification. Introduction to Fuzzy systems, Neuro fuzzy sytems.

Text books:

1. Laurene Fausett: *Fundamentals of neural networks*, Prentice Hall, New Jersey,1994.
2. James A. Freeman, David M. Skapure: *Neural Networks Algorithms, Applications and Programming Techniques*, Addison-Wesley, 1990.

References:

1. S N Sivanandan: *Introduction to neural networks using "MATLAB"*, TataMcGrawHill New Delhi.,2004
2. Kevin Gruney: *An Introduction to neural networks*, CRC Press,1997.
3. D. L.Hudson & M. E. Cohen: *Neural Networks and Artificial Intelligence in Biomedical Engg.*, Prentice Hall Of India, New Delhi.,1999
4. James A. Anderson, *An Introduction to Neural Networks, Prentice Hall of India,1995.*
5. Simon Haykin: *Neural Networks*, Pearson Education1998
6. Yegnanarayana: *Artificial Neural Networks*, Prentice Hall of India2004.
7. Jack M. Zureda, *Introduction to Artificial Neural Systems* West Publishing Company, *1992*

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB/EC/EI 705D MECHATRONICS

Module I

Introduction to Mechatronics- Elements of Mechatronic Systems.
Sensory System: Sensors & Transducers- Performance measure, static and dynamic characteristics- Sensing displacement, position, proximity, velocity and motion, force, pressure, flow, level, range, temperature and Light.
Signal Conditioning and Date Acquisition: Signal Conditioning Elements- amplification, attenuation, impedance matching, linearization, digitization, level shifting, filtering, error compensation, etc. Data acquisition and presentation in mechatronic systems- signal measurement and calibration- Design Considerations

Module II

Actuation System: *Pneumatic & Hydraulic Systems*: Hydraulic Pumps, Process Control Valves, Directional and Pressure Control valves, Linear and Rotary actuators.
Mechanical Actuation Systems: Translational and Rotational motions, Kinematic Chains, Cams, Gear Trains, Ratchet and Pawl, Belt and Chain drives, Bearings.
Electrical Actuation Systems: Mechanical and Solid State Relays, Solenoids, DC & AC motors, Servo & Stepper motors- Specifications and Selection considerations.
Power sources for mechatronic Systems

Module III

Mathematical modeling of Engineering Systems: System Building blocks for Mechanical, Electrical, Fluid and Thermal systems.
General Engineering System Modeling: Rotational_Translational, Electromechanical, Hydraulic_Mechanical systems- System Transfer Function- Dynamic response of systems for standard test signals (Detailed mathematical analysis not required).
MEMS: Internal Structure, advantages, manufacturing, applications- Fibre Optic Devices in Mechatronics
(For this module assignments on Simulation studies using computer software such as MATLAB with SIMULINK is recommended)

Module IV
Mechatronic System Controllers: ON/OFF, P, I, D, PI and PID Controllers, Digital controllers, Intelligent Controllers in Mechatronics.
Programmable Logic Controllers: Structure, I/O processing, Programming, applications – Selection Criteria.
Typical Mechatronic Systems: Robotic Systems, CNC machines, FMC, FMS, AGV etc.

Text Books

1. Bulton. N, *Mechatronics- Electronic Control systems in Mechanical and Electrical Engineering*, Pearson Education, 2006
2. Devadas Shetty, *Richard A. Kolk, Mechatronics System Design*, Thomson, New Delhi, 2007
3. S. R. Deb, *Robotics Technology and Flexible Automation*, Tata Mc Graw Hill, New Delhi, 2004

References:

1. Godfrey C. Onwubolu, *Mechatronics Principles and Applications*, Elsevier India Pvt Ltd., Delhi, 2006.
2. M.D. Singh, J.G. Joshi, *Mechatronics*, Prentice Hall India, New Delhi, 2006
3. Dradly. D.A, Dawson.D, Burd N.C and Loader A.J, *Mechatronics – Electronics in Products & Processes*, Chapmen & Hail, 1993.
4. *Mechatronics*, HMT Limited, Tata McGraw Hill, 1998.
5. James Harter, *Electromechanics- Principles concept and Devices*, Prentice-Hall India Ltd, 2nd ed.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 705 (E) EMBEDDED SYSTEMS AND APPLICATIONS

Module I

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

Module II

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

Module III

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

Module IV

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

TEXT :

1. Dreamtech Software Team , *Programming for Embedded Systems*-, Wiley Dreamtech 2002
2. Rajkamal, *Microcontrollers- Architecture, programming, Interfacing and system Design*, Pearson Education, 2005
3. John B Peatman *Design with PIC micro-controllers*:, Pearson Education

References

1. Daniel W Lewis *Fundamentals of Embedded Software where C and Assembly Meet* PHI Ltd, 2003.
2. DS101374: *National Semiconductor reference manual*.
3. SoftwareTeam, Wiley Dreamtech, *Embedded / RealTime systems: Concepts, Design and programming, Dreamtech* 1993
4. *1187D: Atmel semiconductor reference manual.*
5. *Atmel semiconductor web site* – www.atmel.com
6. *Microchip semiconductor web site* – www.microchip.com

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 706 BIO ENGINEERING LABORATORY

1) Flash ADC
2) Automatic gain compensator
3) Power amplifier of stylus movement
4) X-ray timer circuit
5) ESU waveform generator
6) Chart drive circuit.
7) QRS detector circuit.
8) Study of IC 7107
9) ECG monitor circuit.
10) Study of
    i. ECG monitor and recorder
    ii. Defibrillator
    iii. ESU
    iv. X-Ray Machine
    v. Tread Mill
    vi. Holter Recorder

Note: 50% Marks is earmarked for continuous evaluation and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50% marks separately for the two components to be eligible for a pass in that subject.

EB 707 BIO SIGNAL PROCESSING LABORATORY

1. MATLAB familiarisation
2. Acquisition of biosignals to the system
3. Implementation of filters.
4. Processing of ECG signals for acquiring parameters like heart rate, QRS complex, P wave etc
5. Arrhythmia analysis.
6. Analysis of Plethysmographic signal.
7. Automated detection of systolic and diastolic pressure from cuff pressure and peripheral pulse.
8. Signal Classification using neural networks.
9. 50 Hz interference rejection in ECG signals.
10. Event detection in EEG signals
11. Spectral analysis of EEG, EMG signals.

Note: 50% Marks is earmarked for continuous evaluation and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50% marks separately for the two components to be eligible for a pass in that subject.

EB 708 SEMINAR

Students shall individually prepare and submit a seminar report on a topic of current relevance related to the field of Electronics & Biomedical Engineering. The reference shall include standard journals, conference proceedings, reputed magazines and textbooks, technical reports and URLs. The references shall be incorporated in the report following IEEE standards reflecting the state-of-the-art in the topic selected. Each student shall present a seminar for about 30 minutes duration on the selected topic. The report and presentation shall be evaluated by a team of internal experts comprising of 3 teachers based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

EB 709 MAIN PROJECT – FIRST PHASE (PROJECT DESIGN)

Each batch comprising of 3 to 5 students shall identify a project related to the curriculum of study. At the end of the semester, each student shall submit a project synopsis comprising of the following.

- Application and feasibility of the project
- Complete and detailed design specifications.
- Block level design documentation
- Detailed design documentation including circuit diagrams and algorithms / circuits
- Project implementation action plan using standard presentation tools

Guidelines for evaluation:

i)	Attendance and Regularity	10
ii)	Quality and adequacy of design documentation	10
iii)	Concepts and completeness of design	10
iv)	Theoretical knowledge and individual involvement	10
v)	Quality and contents of project synopsis	10
	Total	50 Marks

Note: *Points (i)-(iii) to be evaluated by the respective project guides and project coordinator based on continuous evaluation. (iv)-(v) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.*

The first phase of the main project including the literature survey, schematic block or algorithms and the design of the initial phase of the project shall be completed. A report on the work done in this phase shall be submitted by each student by the end of the VIII semester. There will be an internal examination of the project that includes oral presentation regarding the overall project and demonstration, if any, of the completed work. The evaluation panel shall consist of at least three faculty members including the project guide .

EB 801 MEDICAL IMAGE PROCESSING

Module I

Image perception -MTF of the visual system - monochrome vision models - color vision model Image sampling and quantization - Two dimensional sampling theory - Practical limits in sampling reconstruction. Image quantization - visual quatization. Image transforms - Two dimensional orthogonal and unitary transforms - properties of unitary transforms - onedimensional DFT-2D DFT - cosine,sine Hadamard ,Haar transforms, KLT ,slant transforms.

Module II

Image enhancement - Point operations - contrast stretching - clipping and thresholding - digital negative intensity level slicing - bit extraction. Histogram modelling - histogram eqalization - modification. Spatial operations - smoothing techniques. Magnification and interpolation. Transform operations.Applications in medical imaging.

Module III

Image filtering and restoration.Inverse and weiner filters –filtering using image transforms. Splines and interpolation. Maximum entropy restoration. Bayesian methods Image analysis- spatial feature extraction - transform features. Edge detection – boundary extraction, shape features image segmentation.

Module IV

Image reconstruction from projections CT reconstruction Radon transform-inverse radon transform back projection operator-convolution back projection- parallel beam geometry-Fan beam geometry. MRI Fourier reconstruction.

Text Book

1. Jain Anil K: *Fundamentals of Digital Image Processing-* , Prentice Hall of India. 1989
2. Rosenfield Azriel, Kak Avinash C: *Digital Picture Processing*, Academic Press Inc.1991

References:

1. Gonzalez Rafel C, Wintz Paul: *Digital Image Processing*, Addison Wesley.1993
2. Pratt William K: *Digital Image Processing*, John Wiley and Sons. 2001

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 802 TELEMEDICINE

Module 1

Definitions of telemedicine telehealth and telecare**.** History of telemedicine: Main phases of telemedicine Pre electronic telemedicine Electronic telemedicine Technical Requirements , Type of information and standards, audio, data, Fax, Video Types of communications and networking- networking architecture, POTS, ISDN, ATM Other Fixed networks, Air/aireless communications.- RF,Microwaves, Satellite, GSM, CDPD (Cellular Digital Packet Data) Acquisition/ displays: Acquisition systems Cameras, Scanners, Other medical specialized acquisition system

Display systems: Analogue devices, LCD, Laser displays, Holographic representations, Virtual screen devices Computation / storage systems: Magnetic, Mixed, Optical (laser) devices (only brief description required)

Module 1I

Telemedicine applications: Teleradiology : Basic parts of a teleradiography system, Image acquisition and management, display, communication, interpretation Telepathology: Applications, requirements, security and confidentiality tools, telequantitation at distance. Telecytology: Applications, Telecardiology: requirements, portable solutions Telehome-Care Home based applications, Teleoncology : Applications, Telesurgery, telepsychiatry, Teledermatology : Techniques.

Module III

Internet in telemedicine 1) The internet 2) Basic concepts 3) Security – secure socket layer – Firewalls – proxies. Personal Communication , Medical data sharing needs for telemedicine- -Internet problems Distant training, teleworking and telecasting.

Module IV

Ethical and legal aspects of telemedicine-confidentiality, patient rights and consent-ehtical and legal aspects of internet-telemedical malpractice

Constraints for the wide spread use of telemedicine- constraints linked to economy, social acceptance Strategic planning for telemedicine implementation. Analysis of the present situation and the demand Objectives and strategies- Plan of implementation Forces affecting technology transfer scenarios for telemedicine

Text Books:

1. Olga (EDT), Ferrer – Roca, M. Sosa (EDT), Marcelo C, *Handbook of telemedicine*,IOS Press 1998
2. Ling Guan, *Multimedia image and video processing*, CRC Press 2000
3. Thorsten M Buzug, Heinz Handels, Dietrich Holz, *Telemedicine: Medicine and Communication*", Springer Verlag 2001
4. Douglas V.Goldstein, " *E Healthcare: Harness the power of Internet, e-commerce and e-care"*, Jones and Barlett Publishers
5. A. C. Norris *Essentials of Telemedicine and Telecare*, John Wiley & Sons 2002

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 803 BIOPHOTONICS

Module I

Principles of operation and characteristics & properties of common continuous and pulsed lasers used in medicine – He-Ne, Nd-YAG, Argon, CO_2, free electron and semiconductor lasers.

Module II

Optical properties of tissues: Introduction – fundamental optical properties – refraction, scattering, absorption – light transport in tissue – preliminaries to radiation transport – time resolved propagation of light pulses – tissue properties – refractive indices, scattering and absorption properties. Light tissue interactions – light interactions with a strongly scattering tissue – continuous wave light, polarized light, short light pulses, diffused photon density waves.

Optothermal interaction – temperature rise and tissue damage – optothermal and optoacoustic effects.

Module III

Biophotonic diagnostics: Near IR spectroscopy for biological glucose analysis, flow cytometry – basic operation, optical response,– applications - optical biosensors – principles, biorecognition, optical transduction – Bioimaging – cellular, tissue imaging and in vivo imaging. Introduction to Optical Coherence tomography.

Module IV

Biophotonic Therapy: Photodynamic therapy- basic principle, photosensitizers, mechanism of photodynamic action, applications – Laser tissue welding, lasers in dermatology, neurosurgery, ophthalmology, urology.

Text books:

1. William T Silfwast: *Laser fundamentals*, Cambridge University Press, 1998.
2. Ed.. Tuan Vo-Dinh: *Biomedical Photonics Handbook*, CRC Press, 2003.
3. Paras N Prasad: *Introduction to Biomedical Photonics*, John Wiley.2003

References:

1. Leon Goldman, *The Biomedical laser Technology and Clinical Applications* Springer-Verlar.
2. Leon Goldman, *Lasers in Medicine*, Springer-Verlag.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 804 (A) MODELLING OF PHYSIOLOGICAL SYSTEMS

Module 1

Feed back control system - homeostasis - Regulatory system - Servo mechanism – biological control system - similarities and differences - components of living control system, Model and Analog, system properties, resistance, storage, distributed and lumped systems. Mathematical approach, electrical analogues, etc. Introduction to various process controls like cardiac rate, blood pressure, respiratory rate. Blood - Glucose regulation. Pharmacokinetic modeling-compartmental models, blood-tissue models.

Module II

Modeling of human thermal regulatory system: Parameters involved, control system model etc. Biochemistry of digestion, Loss of heat to the environment, Heat transfer within the body, Models describing heat transfer between core and skin, heat distribution in extremities .

Module III

Modeling of Respiratory system : Human Lungs: Anatomy and physiology of the respiratory system, mass balance in lungs, oxygen and carbon dioxide transport in blood
Modeling oxygen uptake by RBC and pulmonary capillaries .

Module IV

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

Text boks:

1. David Cooney, *Advanced in Bio medical Engineering*, Marcel Decker Publications, 1980
2. David Cooney, *Biomedical Engineering Principles*, Marcel Decker Publications, 1976.
3. Arthur C Guyton, *Text Book of Medical physiology*, PRISM Books India, 2000

References:

1. Rushmer, *Medical Engineering*, Academic Press
2. Yukihito Nose: *The Artificial Kidney*, The C V Mosby Co., 1969.
3. Kennedy & Blackie, *Electromedcial Engineering*
4. Webstar, *Electronic Devices for Rehabilitation*
5. Myers, *Engineering in Heart and Blood Vessels*, Wiley International
6. Ibrall & Guytion , *Regulations and Control in Physiological Systems* , Instruments Society USA
7. Brown & Gann, *Engineering in Physiology Vol 1 & Vol 2*
8. Michael C.K. Khoo, *Physiological Control System*, PHI, New Delhi, 2001

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

CS/EB/EC/IT 804 B BIOINFORMATICS

Module I

Basic Concepts of Molecular Biology: Cells - Chromosomes, DNA, RNA, Proteins, Central dogma of molecular biology, Genomes and Genes - Genetic code, Transcription, Translation and Protein synthesis. Web based genomic and proteomic data bases: NCBI, Gen Bank

Module II

Sequence alignments – Dot plot-Pair-wise sequence alignments - local and global -Sequence similarity and distance measures - Smith-Waterman algorithm, Needleman-Wunch algorithm, Multiple sequence alignment –Sum-of-Pairs measure - Star and tree alignments – PAM and BLOSUM, Phylogenetic analysis

Module III

Informational view of Genomic data, Genomic Signal Processing, DNA Spectrograms, Identification of protein coding regions, Gene expression, Microarrays, Microarray image analysis

Module IV

Gene structure in Prokaryotes and Eukaryotes: Molecular Structure Prediction: Basic concepts and terminologies related to molecular structures, Basic molecular Visualization, RNA secondary structure prediction, Protein folding problem, Protein Threading, Protein Visualization, Introduction to Drug Discovery.

Case Study

Software Tools: Use of Tools for basic and specialized sequence processing such as: BLAST, FASTA, RasMol, Phylip, ClustalW

Text Books:

1. Setubal & Meidanis, *Introduction to Computational Molecular Biology*, Thomson: Brooks/Cole,
2. International Student Edition, 2003
3. Claverie & Notredame, *Bioinformatics - A Beginners Guide*, Wiley- Dreamtech India Pvt Ltd, 2003.

References:

1. Lesk, *Introduction to Bioinformatics*, Oxford University Press, Indian Edition, 2003
2. Higgins and Taylor, *Bioinformatics: Sequence, structure and databanks*, Oxford University Press, Indian Edition, 2003
3. Bergeron, *Bioinformatics Computing*, Prentice hall of India, 2003
4. Jiang, Xu and Zhang, *Current topics in Computational Molecular Biology*, Ane Books, New Delhi, 2004
5. S.C Rastogi & Namitha Mendiratta, *Bioinformatics method and application Genomics,Protinomics & drug discovery*
6. Dov Stekel, *Microarray Bioinformatics*, Cambridge University Press

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB 804 (C) COMPUTER GRAPHICS AND VOLUME VISUALISATION

Module I

Overview of graphics systems. Video display devices – raster scan systems – random scan systems – input devices. Hardcopy devices – graphic software. Output primitives – points and lines. Line drawing algorithms – circle generating algorithms – polygon filling algorithms.

Module II

Two dimensional transformations, basic transformations – translation – rotation – scaling, matrix representation and homogeneous co-ordinates – composite transformations. Transformation between co-ordinate systems – affine transformations. Two dimensional viewing – viewing pipeline – windows to viewport transformations – clipping operations – point clipping – line clipping – polygon clipping.

Module III

Three dimensional object representations, polygon surfaces – three dimensional transformations, Three dimensional viewing. Visible surface detection. Depth buffer. Scan line algorithms – BSP trees – octrees – Ray casting.

Module IV

Volume visualization – visualization pipeline – reconstruction - 3D voxel image – enhancement – classification – mapping – Viewing and shading. Volumetric shading techniques. Introduction to shading. Illumination models – light sources – basic illumination models. Surface shading. Image space shading. Volume representation. Viewing algorithms, Marching cube algorithm.

References:

1. Allan Watt, Mark Watt, *Introduction to animation and Rendering* Addison Wesley Publishing Co, 1994.
2. Arie Kauffman, *Volume Visualisation* IEEE Computer Society Press Tutorial, Washington, 1990.
3. Donald Hearn, M.Pauline Baker, *Computer Graphics*, Prentice Hall of India Pvt. Ltd.,1993.
4. James D. Foley et.al., *Introduction to computer Graphics*, Addison Wesley Publishing Co., 1994.

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

EB/EE 804 (D) VLSI DESIGN

Module I.

VLSI process integration: - fundamental considerations in IC processing - NMOS and PMOS IC technology - CMOS IC technology - BiCMOS IC technology. - GaAs technology. Ion implantation in IC fabrication. The MOS device - (n - channel & p- channel) - capacitance of MOS structure - accumulation, depletion and inversion, threshold voltage, current equations - characteristics, channel pinch-off. Second order MOS device effects : short-channel effect, narrow width effect, sub-threshold current, device saturation characteristics.

Module II.

Switch logic- pass transistors and transmission gates, Gate logic-The basic inverter using NMOS-circuit - current equations - pull up to pull down ratio- transfer characteristics- Alternate forms of pull up. Basic NAND, NOR circuits. The CMOS inverter, characteristics – NAND, NOR and compound circuits using CMOS. Other forms of CMOS logic : pseudo CMOS, CMOS domino logic, n-p logic. Layout design of static MOS circuits – Layout rules - general principles & steps of lay-out design - use of stick diagrams - design rules - Layout examples of NAND and NOR.

Module III.

Basic circuit concepts: sheet resistance, area capacitance, delay unit, inverter delays – driving large capacitive loads, cascaded inverters, super buffers, BiCMOS drivers . Combinational circuits - clocked sequential circuit - drivers for bus lines. Scaling of MOS circuits: scaling models and scaling factors for device parameters.

Module IV.

Timing issues in VLSI system design: timing classification- synchronous timing basics – skew and jitter- latch based clocking- self timed circuit design - self timed logic, completion signal generation, self timed signaling– synchronizers and arbiters.

Text Books

1. Douglas A Pucknell, Kamran Eshraghian , *Basic VLSI Design*, P HI
2. Jan M. Rabaey, A. Chandrakasan, B. Nikolic *Digital Integrated Circuits- A Design perspective* 2/e, Pearson education

References

1. Thomas E. Dillinger , *VLSI Engineering* , PH International editions.
2. S M Sze, *VLSI Technology,PHI*
3. Weste and Eshraghian, *Principles of CMOS VLSI Design ,A Systems Perspective*,2/e, Pearson Education.
4. Mead & Conway , *Introduction to VLSI System Design*-Addison Wesley
5. Fabricius, *Introduction to VLSI Design*,Pearson
6. Charles H Roth Jr – *Fundamentals of Logic Design 4 Ed*, Jaico Publishers
7. Wayne Wolf:Modeern *VLSI Design Systems on Chip*-Pearson Education,2nd ed.,

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A & B.

B 804 (E)BIOMEMS & NANOTECHNOLOGY

Module I

Introduction to Microsystems, MEMS and BioMEMS - Evolution of Microfabrication - Introduction to Nanotechnology - Comparison of these systems

Silicon microfabrication techniques - photolithography(high resolution), Ion Implantation, oxidation, diffusion, sputtering, epitaxial growth, etching-

Design of flow processes in bulk manufacturing-surface micro machining- the LIGA process – EFAB fabrication- Micro system packaging.

Module II

*MEMS materials:*Polymer materials -common Bio MEMS polymers- micro fluids-micro arrays

Polymerase Chain Reaction (PCR)-elements of PCR-specification of PCR

Microsystem approach to PCR-Batch system-PCR flow system;Lab-on-a-chip and micrototal analytical system Nanostructure synthesis-functional polymersand Dendrimers-Microelectronic Array Devices DNA Diagnostics and nanofabrication applications- Nanotechnology Manufacturing

Module III:

MEMS Devices:Pressure sensors, accelerometers, micromotors, micropumps, microvalves, thermal sensors and actuators, prosthetics made of MEMS

Module IV

Nanosensors and nanodevices for clinical diagnostics – nanostructures for drug delivery, nano arrays, use of nano analytical devices and systems – potential use of DNA and other biomolecules for computing and ultra high density data storage.Application of Nanotechnology to Medical Therapy

References

1. *Ferrari , Mauro* BioMEMS and Biomedical Nanotechnology *Springer 2006*
2. Steven S. Saliterman,*Fundamentals of BioMEMS and Medical Microdevices*,SPIE PressMonograph,2006
3. Tai-Ran Hsu *MEMS&Microsystems*,TMH ,New Delhi

4. S.Senturia, *Microsystem Design* ,Kluwer Academic Press,2000
5. G.Kovacs, *Micromachined Transducers Source book*, McGraw Hill,NY,1998
6. S.A.Camphell, *The Science and Engineering of Microelectronic Fabrication,Oxford University Press*,1996
7. Mark A Ratner, Daniel Ratner *Nanotechnology: A Gentle Introduction to the Next Big Idea* PHI
8. Sergery E. Lyshevski, *MEMS and NEMS: Systems, Devices and Strucures*, CRC Press,2002

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Q 1. Eight short answer questions of 5 marks with two questions from each of the four modules.
Q 2. to Q.5 : Two questions A or B of 15 marks from each modules with option to answer either A or B.

EB 805 MAIN PROJECT

Each batch of students shall develop the project designed during the VII semester. The implementation phase shall proceed as follows:

- For hardware projects, practical verification of the design, PCB design, fabrication, design analysis and testing shall be done.
- For software projects, a proper front end (GUI) if applicable, shall be designed. A detailed algorithm level implementation, test data selection, validation, analysis of outputs and necessary trial run shall be done.
- Integration of hardware and software, if applicable, shall be carried out.
- A detailed project report in the prescribed format shall be submitted at the end of the semester. All test results and relevant design and engineering documentation shall be included in the report.
- The work shall be reviewed and evaluated periodically

The final evaluation of the project shall be done by a team of minimum 3 internal examiners including the project guide and shall include the following.

- Presentation of the work
- Oral examination
- Demonstration of the project against design specifications
- Quality and content of the project report

***Guidelines for evaluation*:**

Regularity and progress of work	30
Work knowledge and Involvement	100
End semester presentation and oral examination	50
Level of completion and demonstration of functionality/specifications	70
Project Report – Presentation style and content	50
Total	300 marks

Note: Points (i) and (ii) to be evaluated by the respective project guide and the project coordinator based on continuous evaluation. (iii)-(v) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.

EB 806 VIVA - VOCE

Each student is required to appear for a viva-voce examination at the end of the complete course work. The students shall produce the seminar report and project reports duly attested by the institutional authorities, before the examiners. The examination panel shall comprise of one internal examiner and one external examiner, both appointed by the University. The examiners shall evaluate the students in terms of their conceptual grasp of the course of study and practical/analysis skills in the field.