# B.TECH. DEGREE COURSE

## SYLLABUS



# POLYMER ENGINEERING BRANCH

# THIRD SEMESTER

## ENGINEERING MATHEMATICS – II

**CMELPA 301** **3+1**

**Module 1 Vector Differential Calculus**

Differentiation of vector functions - scalar and vector fields – gradient, divergence and curl of a vector function – their physical meaning – directional derivative – scalar potential, conservative fields – identities – simple problems.

**Module 2 Vector Integral Calculus**

Line, surface and volume Integrals – work done by a force along a path – Application of Green's theorem, Stokes theorem and Gauss divergence theorem.

**Module 3 Function of Complex Variable**

Definition of analytic functions and singular points – derivation of C.R. equations in Cartesian co-ordinates – harmonic and orthogonal properties – construction of analytic function given real or imaginary parts – complex potential – conformal transformation of function like $z^n$, $e^z$, $1/z$, $\sin z$, $z+k^2/z$ – bilinear transformation – cross ratio – invariant property – simple problems.

**Module 4 Finite Differences**

Meaning of $\Delta$, $\nabla$, E, $\mu$, $\delta$ - interpolation using Newton's forward and backward formula – central differences – problems using Stirling's formula, Lagrange's formula and Newton's divided difference formula for unequal intervals.

**Module 5 Difference Calculus**

Numerical differentiation using forward and backward differences – Numerical integration – Newton – Cote's formula – trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – simple problems. Difference equations – Solution of difference equations.

**References**


1. Erwin Kreyszig, Advanced Engg. Mathematics, Wiley Eastern Ltd.
2. Grawal B.S., Higher Engg. Mathematics, Khanna Publishers.
3. M.K.Venkataraman, Numerical Methods in science & Engg., National Publishing Co.
4. S.Balachandra Rao and G.K.Shantha, Numerical Methods, University press.
5. Michael D.Greenberg, Advanced Engg. Mathematics, Prentice-Hall.
6. M.R.Spiegel, Theory and Problems of Vector analysis, McGraw – Hill.

## HUMANITIES

**P302** **3+1**

### Part A: HISTORY OF SCIENCE & TECHNOLOGY

**Module 1**

Early Developments and Middle Period:Contributions of Indian, Chinese, Greek and Roman Civilizations to science and technology. The dark ages of science in Europe. Technology transfer from east to west, the role of Arabs.

**Module 2**

Renaissance and the Early Modern Period:Flowering of Europian Technology, the fall of the Aristotelian universe and the beginning of modern science. Industrial revolution and its impact on Science, the historical development of prime movers, progress in steel making, the birth and growth of different branches of Engineering. The characteristic trends in 20th century science, comparison with the 19-th century approach. Theories of life and universe, science and religion.

**Module 3**

Modern Trends in Technology:Developments in communication, transport and power engineering. Science in agriculture, the computer and space exploration. Integration of Science, technology and society, Science as agent of social change, Resource depletion and pollution. The urban problem and the social cost of progress, Limits to growth. Science and Technology in developing countries, Problems of technology transfer, Role of small scale and village industries, Gandhian approach to technology, Concept of appropriate technology.

### Part B: ECONOMICS

**Module 4**

The basic economic problem, definitions, nature of economics and its laws. Economic Systems, Capitalism, Socialism and Mixed Economy. Theory of demand and supply, marginal utility theory, law of demand, elasticity, factors of production, cost of production, supply curves.

**Module 5**

Theory of value, value and price, determination of market price and output under perfect competition and monopoly. Distribution, marginal productivity, theory of distribution, rent, wages, interest and profit. Money and banking, Classification of money, inflation, types of banks, their functions, credit creation. Public economics, Revenue, Taxation, Expenditure. National income, macro economic approach, GNP, MNP, NI, DI, PI, methods of calculation of national income.

**References**


1. History of Science and Technology : R.V.G.Menon
2. A History of Technology : C.Singar
3. Science in Technology : J.D.Bernal
4. Science and Human Values : J.Brownoskyi
5. Elements of Economics : Paul A.V.
6. A Text Book of Modern Economics : Abuja K.I.H.L.
7. Principles of Economics : Sundaram and Waish

## COMPUTER PROGRAMMING

**P 303** **3+1**

**Module 1**

Computer fundamentals, classification, mainframe, mini and microcomputers, block schematic of personal computers. Concept of software and hardware. Introduction to PC operating systems, DOS and WINDOWS, Programming languages, classification, machine language, assembly language and high level language. Program development. Flow charts and algorithms. Compilers, assemblers.

**Module 2**

C Programming; Introduction to C programming language, compilation of C programs. Structure of a C program, syntax of C language, input, output statements. Fundamental data types, variables, identifiers, keywords, operator precedence and associativity, arithmetic expressions. Simple exercise, Loop statements-for, while, do-while. Decision statements-if, nested if, switch statements, break and continue statements.

**Module 3**

Arrays & Structures, single and multidimensional arrays, character arrays and its initializations. String and its initializations, Functions-concept, function declaration and calling. Arguments and local variables, parameter passing methods in C function, concept of recursive functions. Declaration and initialisation of structure variables. Array of structures and nested structures. Example programs using structures, unions.

**Module 4**

Pointers, concept of pointers in C, declaration of pointer variables, use of pointers in arrays, functions and structures. Example programs using pointers, files-sequential and random files, file type specification, creating a data file, file operators.

**References**


1. Programming in C : E Balaguruswamy
2. Let us C : Y.P.Kannetkar
3. Pointers in C : Y.P.Kannetkar
4. Programming with C : Bryan.S.Gottfried,Tata McGrawHill


## POLYMER SCIENCE - I

**P304** **3+1**

**Module 1**

Importance in everyday life, classification, examples for natural, synthetic, homo polymer, copolymer, inorganic and biopolymers, structure of linear, branched, ladder, crosslinked and network polymers, homochain and hetero-atomic chain polymers, nomenclature, functionality of monomers, Bi-functional systems, poly functional systems, polymerisability

**Module 2**

Number average, weight average, viscosity average, z- average molecular weights, molecular weight distribution, polydispersity index, simple numerical problems to illustrate average molecular weight, basic principles of the following methods: end group analysis, colligative property measurements, osmometry, vapour phase osmometry, light scattering, ultracentrifugation, viscometry and gel permeation chromatography, Staudinger Index

**Module 3**

Addition polymerization, mechanism and kinetics of free radical, cationic & anionic polymerization, free radical initiators, chain length and degree of polymerisation, control of molecular weight, inhibition, autoacceleration, chain transfer, coordination polymerisation, mechanism, kinetics, Ziegler- Natta catalysts, ring opening polymerization, diene polymerization.

**Module 4**

Basics of condensation polymerisation, Carother's equation, gelation, Copolymerization, different types of copolymers, monomer reactivity ratio, copolymer equation. Polymerisation techniques, bulk, solution, suspension, emulsion and interfacial polymerisation

**References**


1. F.W. Billmeyer, Textbook of Polymer Science, Wiley international publishers, 1984.
2. Joel R. Fried, Polymer science and Technology, Prentice Hall, NJ, 1995
3. J.M.G. Cowie, Polymers: Chemistry and Physics of Modern Materials, Blackie, London, 1991.
4. R.J. Young and P.Lovell, Introduction to Polymers, 2nd Ed., Chapman & Hall, 1991.
5. Premamoy Ghosh, Polymer Science and Technology of Plastics and Rubbers, Tata McGraw - Hill, New Delhi, 1990.
6. H.R. Allcock and F.W. Lampe, " Contemporary Polymer Chemistry", Prentice Hall 1981.
7. F.W.Billmeyer, " Text Book of Polymer Science", Wiley Interscience, 1971.
8. F.Rodrigues, " Principles of Polymer systems", Mc Graw Hill, 1970


## ORGANIC CHEMISTRY

**P 305** **3+1**

**Module 1**

Chemical bonding and molecular structure, electronic effects in organic molecules, inductive, mesomeric and hyperconjugation effects, acids and bases, reactive intermediates in organic chemistry- carbocations, carbanions, free radicals, carbenes and nitrenes.

**Module 2**

Organic reaction mechanisms, introduction. Substitution and Elimination reactions: detailed study of $SN_1$, $SN_2$, $SN_i$, $SN_1'$, $SN_2'$ and borderline mechanisms.

Nucleophilicity and basicity, leaving group effects, solvent effects, neighboring group participation. Detailed study of elimination reactions ($E_1$, $E_2$, and E1cb mechanisms), substitution vs. elimination. Rearrangement Reactions: common rearrangements in organic chemistry, rearrangement of carbocations, non-classical carbocations. Catalysis by acid & bases, Lewis acid catalysis, Phase transfer catalysis and applications of crown ethers. Methods of determination of organic reaction mechanisms.

**Module 3**

Isomerism of organic compounds: isomerism, definition and classification, molecular representation, stereo isomerism, conformation, configuration, chirality and optical activity, stereocentre, racemisation and methods of resolution, chiral synthesis, optical purity and enantiomeric excess, configurational nomenclature, D, L, R and S, determination of configuration, geometrical isomerism, E/Z notation, interconversion of geometrical isomers, conformational analysis of acyclic and cyclic molecules, rotation about bonds, concepts of dihedral angle, torsional strain, optical rotatory dispersion and circular dichroism.

**Module 4**

Organic Spectroscopy: principles and applications of UV, IR, NMR, ESR spectroscopic techniques for the structure elucidation of organic compounds, problem solving approach. Recent advances in NMR techniques, 13C–NMR, 2 dimensional NMR spectroscopy.

**References**


1. Morrison & Boyd, Organic Chemistry, Prentice Hall. New Delhi, 6th edition,1992
2. B.S.Bahl and Arun Bhal, Advanced Organic Chemistry, S. Chand & Co. Ltd., New Delhi, 15th edition, 1998
3. I.L.Finar, Textbook of Organic Chemistry, ELBS, 5th edition, 1996,
4. Jerry March, Advanced Organic Chemistry, John Wiley & Sons, New york, 1992




## STRENGTH OF MATERIALS AND STRUCTURAL ENGINEERING

**MP306** **3+1**

**Module 1**

**Stress and strain** - Bars of varying cross - sections – composite sections - temperature stresses. Principal stresses and planes-Mohr's circle representation of plane stress.

**Module 2**

Shear force and bending moments -Cantilever-simply supported and overhanging beams-concentrated and U. D. loadings analytical method. Relation between load. SF and BM. Theory of simple bending- bending and shear stress distribution rectangular, circular and I-sections.

**Module 3**

Slope and deflection of simply supported beams and cantilevers- Double integration- Macaulay's Method-moment area method- conjugate beam method.

**Module 4**

Torsion of circular shafts-solid and hollow shafts- power transmitted by shafts. Close-coiled and open coiled spring- leaf spring. Thin cyliders and jhick cylinders subjected to internal and external pressures- compound pipes -wire wound pipes-strain energy-axial loads, gradually and suddenly applied load-impact loads.

**Module 5**

Columns and sturts- short and long columns-Euler's theory-Ran kine's theory - Eccentrically Loaded columns-column with initial curvature. General description only of simple and compound steel, beams, columns and column foundation-principle of reinforced concrete. Reinforcements detailing in R. C. Slabs, beams, columns & footings (No problem expected)

**References**


1. Timoshenko.S.P, Strength of Materials, Part 1,D.Van Nostrand company, Inc.Newyork.
2. Popov E.P., Engineering Mechanics of solids, Prentice Hall of India, New Deihi.
3. Punmia B.C, Strength of Materials and Mechanics of structures, Vol 1,Lakshmi Publications, New Delhi.
4. Vazirani V.N., Ratwani N. M, Analysis of Structures, Vol 1, Khanna Publishers, New Delhi.
5. Kazimi S.M.A., Solid Mechanics, Tata Mc Graw Hill.
6. William A Nash, Strength of Materials, Mc Graw Hill.
7. Ryder G.H., Strength of Materials, ELBS.
8. Arthur Morley, Strength of Materials, ELBS, Longman's Green& Company.




## CHEMISTRY LAB

**P 307** **0+3**

**A. Organic synthesis**

1. Synthesis of ethyl n- butyl acetoacetate by the acetoacetatic ester condensation
2. Synthesis of 3-nitrobenzoic acid from benzoic acid
3. Nitration of aromatic hydrocarbons.
4. Side chain oxidation of aromatic hydrocarbons.
5. Benzoylation of phenols.
6. Preparation of solid esters.
7. Bromination of amines.

**B. Purification and characterization of organic compounds**

1. Purification (fractional crystallization, fractional distillation, chromatography) and separation of the components of a binary organic mixture (liquid-liquid, liquid-solid and solid-solid) using chemical analysis and IIR and NMR spectral data.
2. Identify the components of the given binary mixture.
3. Checking the purity of the separated components on TLC plates.

## COMPUTER LAB

**P 308** **0+3**

1. Familiarisation of DOS commands and WINDOWS.
2. Simple C programs with control statements and loops.
3. Programs handling one-dimensional array.
4. Programs handling multidimensional array
5. Programs using a simple function.
6. Functions having arguments.
7. Recursive functions.
8. Programs handling structures.
9. Programs using pointers.
10. Programs involving files.
11. A simple graphic program.

# FOURTH SEMESTER

## ENGINEERING MATHEMATICS – III

**CMELRPTA 401**

**3+1**

**Module 1**

**Ordinary Differential Equations:** Linear Differential equations with constant coefficents - Finding P.I. by the method of variation of parameters – Cauchys equations - Linear Simultaneous eqns- simple applications in engineering problems.

**Module 2**

**Partial Differential Equations:** Formation by eliminating arbitrary constants and arbitrary Functions - solution of Lagrange Linear Equations – Charpits Method – solution of homogeneous linear partial differential equation with constant coefficients – solution of one dimensional wave equation and heat equation using method of separation of variables – Fourier solution of one dimensional wave equation.

**Module 3**

**Fourier Transforms:** Statement of Fourier Integral Theorems – Fourier Transforms – Fourier Sine & Cosine transforms - inverse transforms - transforms of derivatives – Convolution Theorem (no proof) – Parsevals Identity - simple problems.

**Module 4**

**Probability and statistics:** Binomial law of probability - The binomial distribution, its mean and variance - Poisson distribution as a limiting case of binomial distribution - its mean and variance - fitting of binomial & Poisson distributions - normal distribution - properties of normal curve - standard normal curve - simple problems in binomial, Poisson and normal distributions.

**Module 5**

**Population & Samples:** Sampling distribution of mean ($\sigma$ known) –Sampling distribution of variance, F and Chi square test – Level of significance - Type 1 and Type 2 errors – Test of hypothesis – Test of significance for large samples – Test of significance for single proportion, differences of proportions, single mean and difference of mean (proof of theorems not expected).

**References**


1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. M.K. Venkataraman, Engineering Mathematics Vol. II -3rd year Part A & B, National Publishing Company.
3. Ian N.Sneddon, Elements of Partial Differential Equations,Mc Graw Hill International Edn.
4. Richard A Johnson, Miller and Fread's Probability and statistics for engineers, Pearson Education Asia / PHI.
5. Bali and Iyengar, A text book of Engineering Mathematics (Volume II), Laxmi Publications Ltd.
6. Erwin Kreyszig, Advanced Engg. Mathematics, Wiley Eastern Ltd.
7. Hogg and Tanis, Probability and statistical inferences, Pearson Education Asia.

## OBJECT ORIENTED PROGRAMMING

**P 402** **3+1**

**Module 1**

Introduction, concepts of classes and objects, encapsulation and inheritance, building classes, declaring objects, member functions, constructors and destructors, member access control-private, public, protected. Inheritance and access control, extending classes, multiple inheritance

**Module 2**

Polymorphism, virtual methods, definition, usage of virtual methods, abstract classes, simulation using abstract classes, overloading methods, operator overloading, selecting friend or member functions for operator overloading

**Module 3**

Dynamic objects, dynamic object allocation, using references with dynamic memory allocations, in-line functions outside class definitions. Case study-$C^{++}$.

**Module 4**

Concepts of Windows programming, GUI, visual programming concepts, active X concepts, fundamentals of MFC, concepts of DLL, DAO and ODBC.

**References**


1. Data abstraction and OOP in $C^{++}$ - Gordenkeeth Wiley Eastern
2. Object Oriented Programming with $C^{++}$ - E. Balaguruswamy, Tata Mc. Graw Hill
3. $C^{++}$ - Strostroup
4. Object Oriented Programming with $C^{++}$ - Nabajyothy Bjarne
5. Programming Windows 95 - Charles Petzold, Microsoft Press
6. Visual $C^{++}$ Programming - Yashwanth Kaneethkar, BPB
7. Visual Basic from the group UP - Cary Cornessl, Tata Mc. Graw Hill


## ELECTRICAL TECHNOLOGY

**LP 403** **3+1**

**Module 1**

Basic Principles of Electric Machines- concept of motoring and generating action, DC generator, characteristics, working, load test, DC motor, characteristics,, load test, speed control, field control, armature control, basic principles, applications.

**Module 2**

Transformers: Transformer action, EMF equation, step up and step down transformer, load test, calculation of efficiency, design of typical step down transformers like 280/6-0-6V, 230/9-0-9 V, 280/12-0-12 V for inverters and rectifiers. Auto and three phase transformers, basic principles of current transformers (no analysis) basic principles of servo stabilizer.

**Module 3**

A C Machines; Basic principles of operation of synchronous and induction motor characteristics (no analysis), starting of induction motors, starters, single phase induction motor, constructional features, types, working and characteristics only (no analysis).

**Module 4**

Special Machines AC&DC servo motors, synchros constructional features, working of tacho generators, stepper motor, construction working, applications& specifications of stepper motors, universal motors, constructional features, typical applications, criteria for selection of motors, electromagnetic relays, AC&DC contactors.

**Module 5**

Batteries: Dry cells, secondary cells, lead acid cells, charging and discharging characteristics, Ampere hour rating of batteries, construction of button cells, lithium batteries, specifications chargeable batteries, battery charging circuits, Maintenance of batteries, characteristics of nickel cadmium, nickel metal hydride, and lithium ion batteries, used for pagers and cellular phones, concept of UPS, block schematic of UPS, fields of applications.

**References**


1. Electrical Technology - B.L.Thereja
2. Electrical Machines - R.K. Rajput
3. Electrical Design Estimating And Costing - K.B. Raina & Bhattacharya
4. Electrical machines and Power systems - Vincent Del Toro
5. Electric Engineers Hand Book - Donald G. Fink




## CHEMICAL ENGINEERING - I

**P 404** **3+1**

**Module 1**

Fluids-nature of fluids, ideal fluid, real fluid, physical properties of fluids, density, specific weight, compressibility, surface tension, viscosity, capillarity, pressure, Pascal's law, measurement of fluid pressure, piezometer, bourden pressure gauge, simple manometer, differential manometer.

**Module 2**

Fluid flow phenomena-classification of flow, steady and unsteady state flow, uniform and non uniform flow, laminar and turbulent flow, isothermal and adiabatic flow, rotational and irrotational flow, critical velocity, Reynolds number, Bernoulli's theorem, measurement of fluid flow, pitot tube, orificemeter, venturimeter, rotameter.

**Module 3**

Centrifugal pumps-types of casings, piping system, work done, efficiency, discharge, velocity diagrams, characteristic curves, NPSH, cavitation, priming. Reciprocating pumps, discharge, slip, power required, indicator diagram.

**Module 4**

Thermodynamics- fundamental concepts and definitions, types of thermodynamic systems and properties, closed, open and isolated systems, intensive and extensive properties, path functions and state functions, zeroth law of thermodynamics, first law applied to non flow process, formulation of first law, enthalpy, heat capacity, specific heat, second law of thermodynamics, Kelvin-Plank statement, Clausius statement, third law of thermodynamics, entropy changes and irreversibility, Gibb's free energy, work function, Maxwell's equations, Clapyeron equation, Gibbs-Duhem equation, fugacity and activity of pure fluids.

**References**


1. Engineering Thermodynamics, Nag
2. Introduction to chemical engineering thermodynamics, J.M Smith, Tata McGraw-Hill publishing company, New Delhi
3. Fluid Mechanics, Jagadish Lal
4. Hydraulics and Fluid mechanics, P.N Modi
5. Fluid Mechanics, S.K Modi


## POLYMER PHYSICS

**P405** **3+1**

**Module 1**

Stress, engineering stress, true stress, strain, engineering strain, true strain, Poisson's ratio, elastic solid, Hooke's Law, viscous fluid, Newton's law, viscoelastic materials, difference in the response of elastic solid, viscous fluid and viscoelastic materials under static and dynamic conditions, modulus, Young's modulus, compression modulus, bulk modulus, compliance, factors affecting viseoelasticity, short- term and long- term properties, stress- strain curves, hysteresis, tangent modulus, secant modulus, proportionality limit

**Module 2**

Mechanical models, spring, dashpot, Maxwell, Voigt, Maxwell-Weichert, Burger, generalised equations for these models, equations for creep and stress relaxation, Deborah number, time- temperature equivalence principle, Boltzmann superposition principle, simple numerical problems based on these principles, dynamic mechanical properties, storage modulus, loss modulus, tan $\delta$, damping.

**Module 3**

Rubber elasticity, molecular requirements of rubber-like elasticity, energy driven and entropy driven elasticity, thermoelastic experiment, Gough-Joule effect, thermodynamic treatment of rubbers, statistical mechanical theory.

**Module 4**

Newtonian fluids and non-Newtonian fluids, Power law, shear rate dependent fluids, psuedoplasticity, dilatancy, time dependent fluids, thixotropy, rheopexy, rheological measurements, plasticity, plasticity retention index, curing characteristics, scorch time, induction time, cure time, oscillating disc rheometers. capillary rheometer, entrance and exit effects, Rabinowitsch correction, cone and

plate viscometer, Mooney viscometer, melt flow index, elastic effects in polymer melt flow, die swell, elastic turbulence, melt fracture, shark skin, draw down.

**References**


1. David J. Williams, Polymer Science and Engineering, Maclaren and Sons, Newyork1978
2. H.F. Haufman and J.J. Falcetta, Introduction to Polymer science and Technology, S P E Text Book, John Wiley & Sons NewYork 1997
3. J. D. Ferry, Viscoelastic Properties of Polymers, John Wiley & Sons NewYork 1971
4. A.V. Tobolsky, Properties & structure of polymers, John Wiley & Sons NewYork 1960.
5. R.J.Samuels, Structured Polymer Properties, John Wiley & Sons, New York, 1974.
6. J. A. Brydson, Flow Properties of Polymer Melts


## POLYMER SCIENCE - II

**P 406** **3+1**

**Module 1**

Amorphous state, molecular motion, first order and second order transitions, $T_g$, $T_m$, factors affecting $T_g$, secondary transitions, free volume, kinetic, and thermodynamic views of glass transition, factors influencing glass transition temperature, crystalline state, crystal systems, unit cells, primitive cell, Bravais lattices, polymorphism, polymer single crystals, lamellae, spherulites, supermolecular structures, fringed micelle model, degree of crystallinity, factors affecting crystallinity, X-ray diffraction, copolymers, linear and cyclic arrangement.

**Module 2**

Polymer solutions, terms and definitions, types of solutions, Hildebrand approach, Flory Huggins theory, thermodynamic view of miscibility, upper critical solution temperature (UCST), lower critical solution temperature (LCST), concentration regimes in polymer solutions, theta conditions.

**Module 3**

Chemical reactivity of linear and crosslinked polymers, hydrolysis, acidolysis, aminolysis, hydrogenation, addition and substitution reactions, cross linking reactions, reactivity of functional groups, polymer analogous reactions, polymer bound reagents, chain end and random degradation, degradation by oxygen, ozone, heat, UV light, micro-organism, crazing, weathering, stabilisation to prevent degradation.

**Module 4**

Effect of polymer structure on dielectric constant, capacitance, dielectric loss, power factor, dissipation factor and loss factor, prediction of molar polarization and effective dipole moment, effect of additives on electrical properties of polymers, effect of polymer structure on optical properties, clarity, transparency,

haze, transmittance, reflectance, gloss, prediction of refractive indices of polymers by group contributions.

**References**


1. Paul C. Painter and Michael M. Coleman, Fundamentals of Polymer Science, Technomic Publishing Co. Inc., Lancaster, USA, 1994.
2. Ulf W. Gedde, Polymer Physics, Chapman & Hall, 1995.
3. D.W. Van Krevelen And P.J. Hoftyzen, "Properties Of Polymer, 3rd Edition Elsevier Scientific Publishing Company Amsterdam – Oxford – Newyork. 1990.
4. J.E. Mark Ed.AIP, Physical Properties Of Polymers Hand Book, Williston, Vt, 1996.
5. D.A.Seanor, ed., Electrical properties of polymers, Acadamic press, Newyork, 1982.
6. Jozef.Bicerano, Prediction Of Polymer Properties, Second Edition, Marcel Dekker Inc. Newyork, 1995.
7. I.M.Ward & D.W.Hadley, An Introduction to the Mechanical Properties of Solid Polymers, John Wiley & Sons, Chichester, England, 1993.


## POLYMER PREPARATION AND CHARACTERISATION LAB

**P407** **0+3**

1. Synthesis of the following Polymers: Polymethyl methacrylate, Polyacrylamide, Regenerated Cellulose, Phenol-Formaldehyde Resin (Novolak and Resol), Polystyrene, Polyurethanes and glyptal Resins, Urea-Formaldehyde and Melamine-Formaldehyde.
2. Quantitative estimation of the following monomers: Aniline, Phenol, Acetone, Ethyl Acetate, Formaldehyde, Acrylonitrile, Urea, Glycol, Methyl methacrylate
3. Determination of molecular weight by viscosity method.



## ELECTRICAL MACHINES LAB

**P 408** **0+3**

A total of 8 experiments (4 from Group A and 4 from Group B) out of 16 suggested below may be done in the laboratory.

### GROUP A

1. O.C.C and Load test on DC generator.
2. Load test on DC shunt motor.
3. Load test on Single phase induction motor.
4. Load test on 3-phase cage induction motor.
5. Load test on 3-phase slip ring induction motor.
6. Load test on single phase transformer.
7. Load test on 3-phase alternator – regulation at different power factor –
8. Demonstration of terminal voltage control.

## GROUP B

1. Characteristics of diode and Zener diode.
2. Half-wave and full-wave rectifier – study of wave forms and regulations.
3. Transistor biasing – assemble CE amplifier – study input and output
4. Waveforms.
5. Assemble RC phase shift oscillator – study waveforms.
6. Study of SCR – assemble single phase controlled rectifier – study phase control.
7. Operational amplifier circuit – adder, integrator.
8. Study of logic gates – AND, OR, INVERTER, NAND, NOR, Half adder and full adder using NAND gates.

# FIFTH SEMESTER

## ENGINEERING MATHEMATICS – IV

**CMELPA 501** **3+1**

**Module 1**

Complex Integration: Line Integral –Cauchy's integral theorem- Cauchy's integral formula-Taylor's series-Laurent's series- zeros and singularities-Residues- residue theorem-Evaluation of real integrals using contour integration involving unit circle and semicircle.

**Module 2**

Numerical solution of algebraic and transcendental equations: Successive bisection method-Regula falsi method - Newton –Raphson method – solution of system of linear equations by Jacobi's iteration method and Gauss-Siedel method.

**Module 3**

Numerical solution of ordinary differential equation: Taylor's series method-Euler's method –Modified Euleros method - Runge – Kutta method (IV order)-Milne's predictor corrector method.

**Module 4**

Z – Transforms: Definition of Z transform- properties –Z transform of polynomial functions – trigonometric functions, shifting property, convolution property-inverse transform – solution of $1^{st}$ & $2^{nd}$ order difference equations with constant coefficients using Z transforms.

**Module 5**

Linear programming: graphical solution – solution using simplex method (non – degenerate case only) – Big-M method, two phase method - Duality in L.P.P.-Balanced T.P. – Vogels approximation method – Modi method.



**References**


1. Ervin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern limited.
2. Dr. B.S.Grewal, Numerical methods in Engineering & Science, Kanna Publishers.
3. Dr. B.S.Grewal, Higher Engineering Mathematics, Kanna Publishers.
4. Dr. M.K.Venkitaraman, Numerical methods in Science & Engineering, National Publishing Company.
5. P.C.Tulsian & Vishal Pandey, Quantitative techniques Theory & Problems, Pearson Education Asia.
6. Churchill and Brown, Complex variables and applications, McGraw-Hill.
7. Panneer Selvam, Operations research, PHI.
8. S Arumugam, A.T.Isaac & A Somasundaram, Engineering Mathematics Vol. III, Scitech publications
9. T.K.M.Pillai, G.Ramanaigh & S.Narayanan, Advanced Mathematics for Engg. Students Vol. III- S.Vishwananthan printers & publishers.

## CHEMICAL ENGINEERING - II

**P502** **3+1**

**Module 1**

Modes of heat transfer-conduction and Fourier law, thermal conductivity, steady state conduction through single resistance and compound resistances in series, heat flow through a cylinder, unsteady state heat conduction, equation for one dimensional conduction.

**Module 2**

Convection-natural and forced convection, individual and overall heat transfer coefficients, factors influencing heat transfer coefficients, evaluation of heat transfer coefficients, calculation of overall coefficients from individual coefficients, resistance form of overall coefficients, co-current and counter current flows, logarithmic mean temperature difference, evaluation of heat transfer coefficients, fouling factors, analogy between heat and momentum transfer, significance of Prandtl number, Reynolds's and Colburn analogies. Regimes of heat transfer in fluids, Graetz number, Peclet number, Nusselt number, Sieder Tate equation, Coulburn equation.

**Module 3**

Heat exchange equipments-double pipe heat exchangers, shell and tube heat exchangers, parallel and counter flow heat exchanger, single pass 1-1 exchanger, 1-2 exchanger, 2-4 exchanger, enthalpy balances in heat exchangers, temperature pattern in multipass exchangers, heat transfer coefficients in shell and tube heat exchangers, correction of LMTD for crossflow, plate type exchangers, condensers, shell and tube condensers, kettle type boilers, extended surface equipment.

**Module 4**

Evaporation-Types of evaporators, single effect evaporators, performance of evaporators, capacity, economy, boiling point elevation, Diirhring's rule, enthalpy balances for single effect evaporators, calculation of heat transfer area, multiple effect evaporators, methods of feeding.

**References**


1. Introduction to chemical engineering, Tata McGraw-Hill publishing company, New Delhi, Badger
2. Unit operations in chemical engineering, Tata McGraw - Hill publishing company, New Delhi, Mc Cabe & Smith
3. Heat transmission, Mc Dams, Tata McGraw- Hill publishing company, New Delhi,

## PLASTICS - SCIENCE & TECHNOLOGY

**P 503** **3+1**

**Module 1**

Advantages and disadvantages of plastics, monomer preparation, polymerisation, properties and application of LDPE, HDPE, cross linked and chlorinated PE, PP and PS

**Module 2**

Monomer preparation, polymerisation, properties and application of PVC, polyvinilidine chloride, PVA, polyvinylacetate, PMMA and PAN

**Module 3**

Monomer preparation, polymerisation, properties and application of PU, PTFE, PVF, ABS, PC, polyacetal, polyester, SAN, epoxies, PF, novolac, resol, MF and UF

**Module 4**

Monomer preparation, polymerisation, properties and application of nylon-5, 6, 66, 612 and polyacrylamide

**References**


1. K.J. Saunders, "Organic Polymer Chemistry, Chapman and Hall ", London.1973.
2. J.A. Brydson, " Plastic materials", Newnes Butterworths.
3. Encyclopaedia of Polymer Science and Technology.




## RUBBERS - SCIENCE & TECHNOLOGY

**P 504** **3+1**

**Module 1**

Natural rubber, source, chemical formula, molecular weight distribution, crystallisation, structure property relationship, chemical reactivity, electrical and oxidation properties, anti degradants, strength of rubbers. Various forms of natural rubber, crumb, sheet, crepe, SP rubber, DPNR, LNR, liquid rubber, classes of liquid elastomers, telechilic polymers, powdered rubber.

**Module 2**

Vulcanisation, chemical and physical aspects, curing characteristics such as scorch time, induction time, cure time, mechanism of crosslinking by different crosslinking agents, sulphur, sulphur monochloride, nitrosourethane, diazo esters, phenolic resins, metal oxide, diamines, peroxides, oximes, batch and continuous vulcanisation. Different curing systems, EV, semi EV, conventional and sulphur less cure, assessment of state of cure, vulcanisation techniques, press cure, autoclave, hot air, cold and hot water, fluidised bed, molten salt bath, drum curing, radiation, microwave curing.

**Module 3**

IR, BR, IIR, SBR, NBR-synthesis of monomers, polymerisation, structure, chemical properties, crosslinking by different methods, oxidation and ageing, different types of CR, halogenation of IIR, characterisation, crosslinking, compare the oxidation properties of saturated and unsaturated rubbers, antioxidants, antiozonant.

**Module 4**

Monomers, preparation, synthesis of polymers, structure, properties and application of the following rubbers. Ethylene based rubbers, chlorosulphonated polymers, fluorine containing rubbers, nitrosofluoro elastomers, phosphonitrillic elastomers, poly(thiocarbonyl fluoride) and related elastomers. Acrylic rubbers, oil resistant rubbers, polyvinylether elastomers, polysulphide rubber, silicone rubbers, polyalkenamers, polynorbornene, polyurethane, thermoplastic rubbers, polycarbonate rubbers.

**References**


1. J.A. Brydson, Rubber Chemistry, allied Science publishers, London, 1978.
2. M.Morton, Rubber Technology, Van Nostrand Reinhold, 1987.
3. J.A. Brydson, Rubber Materials and Their Compounds Elsevier, 1988.
4. A.Whelan and K.S. Lee, Developments in Rubber Technology (Vol. I-IV) Applied Science Publishers.


## LATEX TECHNOLOGY

**P 505** **3+1**

**Module 1**

Natural latex, preservation, synthetic lattices and their blends, principles of latex compounding, deammoniation of latex, vulcanising agents, accelerators, antioxidants, fillers, dispersing and emulsifying agents, stabilisers, thickening agents, and other miscellaneous additives, special ingredients, preparation of dispersions and emulsions, latex compounding.

**Module 2**

Fundamental latex characteristics, particle size and distribution, stability and destabilisation, coacervation, viscosity-concentration relationship, surface free energy and wetting behaviour, zeta potential, electrical properties of colloidal system, thermal movement of molecules, Brownian motion. Latex concentration methods, concentrated latex, significance of specification limits, test methods, total solids, dry rubber content, total alkalinity, coagulum content, sludge content, pH, KOH number, mechanical stability time, VFA number, surface tension, redox potential changes, degradation leading to acid formation, zinc oxide stability, stability tests, volatile fatty acids.

**Module 3**

Manufacture of rubber goods from lattices and from solid elastomers, a comparison, impregnation, spreading, fabric proofing and coating. Rubber textile composite products, latex bonded fibrous structures, coir foam, latex treated rugs and carpet backing, latex application to paper. Dipping Methods, straight dipping,

dipping with porous formers, coagulant dipping, heated formers, drying, surface treatments, extraction of surface soluble materials, vulcanisation, compounding of latex, manufacture of dipped goods like rubber band, surgeons gloves, household gloves, dipped fabric gloves, balloon, nipples, prophylactics.

**Module 4**

Latex foam processing methods, ammonia content of latex, compounding, mechanical frothing by beating, vulcanisation, washing, and drying, gelling, gelling systems, merits and demerits of gelling systems. Continuous foam production, typical latex compounds for foam production. Latex casting, principles, production of hollow articles, solid articles, use of porous moulds in casting, manufacture of rubber thread, latex cement and adhesives, latex paints, protective coatings, chewing gum, use of latex in roads rubberisation.

**References**


1. D. C. Blackley, High Polymer Latices, Vol I&II, Maclaren & Sons, London
2. Madge, Latex Foam Rubber, Maclaren & Sons Ltd; 1982
3. Mausser, Vanderblit Latex Handbook, 3rd edition, Pub.R.T.Vanderbilt Co. Inc., U.S.A. 1987
4. Dipped goods, J. of Rubber Developments, V 25, pp.12-14-1972


## POLYMER PROCESSING - I

**P 506** **3+1**

**Module 1**

Compounding ingredients, plasticisers, extenders, factice, stabilizers, fillers, antioxidants, antiozonants, UV absorbers, flame retardants, mould release agents, colorants, and other special additives, vulcanizing agents, activators, accelerators, peptiser, retarders, tackifying agents, blowing agents, bonding agents, fragrances, antistatic agents.

**Module 2**

Compound development, factors to be considered for compound development, formulation of a mix, compounding for specific applications, ozone resistance, heat resistance, weather, resistance, oil resistance, radiation resistance, ermeability, medical, liquid resistance, low temperature resistance, electrical applications and opticalapplications.

**Module 3**

Compounding, different methods, principles of mixing, dispersive and distributive mixing, mastication, two-roll mill mixing, internal mixers, comparison between open mill and internal mixer, Banbury mixing, Brabender plasticorder, continuous mixing, master batching.

**Module 4**

Plastics processing techniques, compression moulding, types-flash, positive and semipositive, compression moulding cycle, troubleshooting, equipment for moulding of thermoplastics, moulding of thermosets and rubber, automatic

compression moulding. Transfer moulding, transfer moulding cycle, advantages, limitations, theoretical and design consideration, general mould design consideration, troubleshooting.

**References**


1. D.V. Rosato Kluwer, Injection moulding hand book. - Academic Publishers Boston 2nd edtion 1995.
2. Richard C. Progelhof James. L. Throne, Polymer Engg. Principles, Hanser Publisher Munich 1993
3. N.P. Charemisinoff & P.N. Chere, Hand book of applied Polymer Processing Tech, Marcel Dekker, inc, NY 1996.
4. Herbert Recs, Understanding of Injection moulding Tech., Hanser Pub., Munich 1994.


## SPECIFICATION TESTS LAB

**P 507** **0+3**

1. Specification tests for field latex
   Viscosity, density, pH
2. Specification tests for preserved latex
   Ammonia content, Magnesium content, Copper and manganese content, Dry rubber content, Total solid content, KOH number, Volatile fatty acid number, Sludge content, Coagulum content, Mechanical stability time, Heat stability time, ZnO stability.
3. Specification tests for dry rubber
   Volatile matter, Ash content, Dirt content, nitrogen content, Estimation of Cu, Estimation of Fe, Estimation of Mn, $P_0$, PRI.



## POLYMER ANALYSIS LAB

**P 508** **0+3**

1. Identification of Rubbers: NR, SBR, BR, IR, IIR, EPDM, CR, NBR, Hypalon, Thiokol, Silicone.
2. Identification of Plastics: PE, PP, PS, PVC, PVA, PF, UF, MF, Polyester.
3. Identification of Thermoplastic Elastomers: SIS, SBS, SEBS, Hytrel.
4. Estimation of Polymers: Acrylonitrile content of NBR, Chlorine content of CR, Rubber hydrocarbon content of NR.
5. Analysis of Polymer Compounds: Iodine value of rubber compounds, Carbon black content, Free sulphur content, Total inorganic content, Silica content.

# SIXTH SEMESTER

## PRINCIPLES OF MANAGEMENT

**P 601** **3+1**

**Module 1**

Evolution of scientific management, functions of management, planning, organising, staffing, directing, motivating, communicating, controlling and coordinating. Organisational structure line, staff and functional relationship, organisational structure of various departments, authority and responsibility, span of control delegation. Formation of companies, proprietary, partnership, joint stock, private limited and public limited companies, private sector, public sector and co-operative sector, raising of capital shares, types of shares and debentures.

**Module 2**

Personnel management and Industrial relations, objectives and functions of personnel management, recruitment, selection and training of workers, psychological attitude to work and working conditions, fatigue, methods of eliminating fatigue cause, effect of industrial disputes, methods of settlement, collective bargaining, trade unions, workers participation in management, labour welfare and social security, industrial psychology, scope and objective. Job evaluation and merit rating, objectives and principles of job evaluation, systems of job evaluation, merit rating plans. Wages and incentives, primary wage systems, time rate and piece rate systems of wage payment, incentive plans, profit sharing, co-partnership, non-money incentives.

**Module 3**

Production Management, product, planning and control, batch and mass production, determination of economic lot size in batch production, function of production control, routing, scheduling, despatching and follow up, production control in mass production.

**Module 4**

Marketing Management, importance, marketing Vs selling, marketing planning, competitive marketing strategy, product life cycle strategy, new product development cycle strategy, marketing channels inventory controls, determination of economic order quantity and recorder level, locating store, store room layout, store techniques, store room registers and records. Application of patents, sale of patent rights, trade mark and copy rights.

**References**


1. Koontzand O' Dennel- 'Essentials of Management' (TMH)
2. F.Lufthans 'Organisational Behavior' (TMH)
3. P.Hersey and Ken Blanchard 'Management of Organisational Behavior' (PHI)
4. E.S.Buffa 'Modern Production Management'
5. E.S.Buffa 'Operations Management'
6. O.B.Choudhary 'Marketing Management'
7. A.K.Sinha & R.Sinha 'Project Engg. & Management'

## ENGINEERING STATISTICS & QUALITY CONTROL

**P 602** **3+1**

**Module 1**

Population and sampling, large and small samples, random sampling, estimating the mean value and variance, confidence intervals, choice of sample size for estimation. Testing of hypotheses for large samples, means, proportions, difference between means and standard deviations. Testing of hypothesis for small samples, t-distribution, test of hypothesis for mean, difference between means, test for paired data, F-distribution, f-tests and properties, contingency table, $X_2$ distribution, goodness of fit and independence.

**Module 2**

Concepts of inspection, quality control, quality assurance, quality circles, zero defect, total quality control, quality costs, computer aided inspection, economics of quality, quality vs. cost of production, Organisation of a Q.C. department, Q.C. Education, Training aids. Process control: control charts, 3 control limits, types of control charts for variables and attributes, r-chart, Q-chart, P-chart, NP- chart, U-chart, determination of revised control limits, use and significance of control charts, quality rating system.

**Module 3**

Acceptance sample, types of acceptance, sampling plans, determination of probability of acceptance by these sampling plans, sampling risks, design of sampling for stipulated producers risk and consumers risk. Concepts of AQL, LTPD, AOQL in sampling, QC curves, construction, standard sampling plans, MIL, STD, LOSD, plan, dodge roming plans, continuous and sequential sampling plans.

**Module 4**

Definition of reliability, maintainability, failure rate, mean time between failures, factors contributing to reliability of products, failure cycle of products, bathtub curve, reliability tests, operating characteristics, curves for acceptance.

**References**


1. I.W.Burr, Engineering Statics and Quality Control, Mc-Graw Hill, 1975
2. A.J.Duncon, Quality Control and Industrial Statistics, Richard. Irwin, Inc., 1975
3. R.C.Gupta, Engineering Manufacture and Statical Quality Control, Khanna Publishers, Delhi, 1982
4. Granth L. Engene, Statistical quality Control, Mc Graw Hill, Inc, New York, 1952
5. Sigmund Halpern, An Introduction to Quality Control and Reliability,
6. Quality Control Handbook (TMH)
7. E.L. Grant," Statistical Quality Control"
8. Gupta And Kapoor, Fundamentals of Mathematical Statistics.
9. Gupta and Kapoor, Applied statistics

## CHEMICAL ENGINEERING - III

**P 603** **3+1**

**Module 1**

Distillation, vapour liquid equilibrium, Dalton's law, Raoult's law and Henry's law, relative volatility, boiling-point diagrams, equilibrium diagrams, rectification, construction of fractionating column, calculation of the number of theoretical plates by Mc-Cabe Thiele method, feed quality and feed line, feed plate location, total reflux, minimum reflux, optimum reflux, plate efficiency.

**Module 2**

Molecular diffusion, molecular diffusion in gases and liquids, Fick's law, mass transfer coefficient, steady state diffusion of A through stagnant B and equimolar counter diffusion in binary gases and liquids, diffusivity of liquids and gases. Applications of molecular diffusion, mass, heat and momentum transfer analogies.

**Module 3**

Drying, principles of drying, heat transfer in drying, mass transfer in drying, equilibrium moisture content, bound, unbound and free water, critical moisture content, batch drying, rate of batch drying, constant drying rate period, factors affecting the constant drying rate period, falling rate period, time of drying, rate of drying curve, material and enthalpy balances in drying, equipments for drying, batch dryers, rotary dryers, tunnel dryers.

**Module 4**

Gas absorption, absorption equipment, tray towers, continuous contact equipment, packed columns, properties of tower packing, types of tower packing, tower construction, solubility of gas in liquid, two component systems, multicomponent systems, ideal liquid solutions, non ideal liquid solutions, choice of solvent, material balance in absorption, counter current flow, minimum liquid-gas ratio, absorption factor, number of plates by graphical construction.

**References**


1. Unit operations in chemical engineering, Tata Mc Graw-Hill Company limited, New Delhi, Mc Cabe & Smith.
2. Introduction to Chemical Engineering, Tata Mc Graw-Hill Company limited, New Delhi, Badger
3. Mass transfer Operations, Tata Mc Graw-Hill Company limited, New Delhi, Treyball

## BIO MEDICAL & BIO POLYMERS

**P 604** **3+1**

**Module 1**

Biomaterials, biocompatibility, stabilisation, inflammation and wound healing, blood clotting system, kinn system, biological responses to implants, implant design and applications, silicone polymer implants.

**Module 2**

Biomedical applications of polymers, permanent implants for function, orthopaedics, cardio vascular, respiratory patches and tubes, digestive system, genitourinary system, nervous system, orbital (corneal and lens prosthesis) permanent implant for cosmoses, other applications of engineered material in clinical practices, silicone implants, polymer membranes, polymer skin, polymeric blood, poly (vinyl pyrollidone)

**Module 3**

Contact lenses, hard lenses, gas permeable lenses, flexible lenses, soft lenses, hydrogels, equilibrium swelling, absorption and desorption, oxygen permeability, types of soft lenses, manufacture, cleaning and disinfection, dental applications, denture base, denture reliners, crown and bridge resins, plastic teeth, mouth protectors, maxillofacial prosthetic materials, restorative materials, polyelectrolyte based restorative sealants, adhesives, dental impression and duplicating materials, agar, algmater elastomers.

**Module 4**

Chemistry of peptides, polypeptides and proteins, synthetic approach to polypeptides and proteins, structural organisation in proteins, nucleic acids, RNA, DNA, structure, chemistry of polysaccharides, starch and cellulose, chemical modifications of cellulose, regenerated cellulose, viscose rayon and cuprammonium rayon

**References**


1. R.H. Yocum and E.B. Nyquist, Eds., Functional Monomers, Volume 1,Marcel Dekker Inc.,NewYork,1973,Chapter 3,PP 299-487
2. M.A.Galin and M.Ruben, Ed, Soft contact lenses:Clinical and Applied Technology,John Wiley and sons,Inc.,NewYork,1978.
3. Lehninger, "Principles of Biochemistry, Shulz and Bhirmer ,"Principles of protein structure ",Academic Press.
4. H.F. Mark (Ed), Encyclopedia of polymer science and engineering, John Wiley and Sons New York, 1989.
5. Galin and M. Ruben Ed., Soft compact Lenses clinical and applied Technology.
6. John Wiley and Sons, Inc. New York, 1978. Comprehensive Polymer Science Vol.7
7. (Ed) David Byrom, "Bio-Material" Macmillan Publishers Ltd. and ICI Biological products Business, 1991.
8. Wilfred Lynch, Hand book of Silicone rubber fabrication, Van Nostrand Reinhold Company, 450 west 33 rd Street, New York 1000.

## POLYMER BLENDS & COMPOSITES

**P605** **3+1**

**Module 1**

Introduction, preparation of polymer blends, thermodynamic criteria for polymer miscibility, specific interactions, copolymer effect, phase separation, spinoidal decomposition, nucleation and growth, phase diagram, morphology, blend characterisation techniques.

**Module 2**

Structure-property relationship, rubber plastic blends, phase morphology, properties of blends prepared by dynamic vulcanization, technological application, thermoplastic styrene block copolymers, polyester thermoplastic elastomers, thermoplastic polyurethane elastomers, basic structure, manufacture, morphology, commercial grades, applications, thermoplasic 1,2-polybutadiene, trans 1,4-polyisoprene, ionic thermoplastic elastomers, silicone based thermoplastic elastomers, polyamide 1,2-elastomers.

**Module 3**

Introduction, particulate and fibre filled composites, matrices and fibres, polymer-fibre interface, pull-out strength, critical fibre length, short fibre and continuous fibre composites, effect of coupling and bonding agents, characterization of interfacial bond strength, applications, polymer concrete, polymer impregnated concretes, polymeric binders for rocket propellants, analysis of long fibre composites, analysis of short fibre composites, factors influencing the performance of composites, rule of mixtures, physical and functional properties.

**Module 4**

Introduction, resins (polyester, epoxies, phenolics), reinforcements (glass, carbon, aramid, polyester, nylon, cellulosics), moulding process, contact moulding, vacuum bag moulding, pressure bag moulding, hand lay up, filament winding, spray up, compression moulding, injection moulding, co-injection moulding, resin transfer moulding, pultrusion, RRIM, matched die moulding.

**References**


1. Hand book of Elastomers, New Developments and Technology (Eds), A.K. Bhowmic, and H.C. Stephense, Markel Dekker, Inc., New york.
2. O.Olabisi, I.W. Robeson, and M.T. Shaw, Polymer-polymer Miscibility Academic Press, New York, 1979
3. Paul S. Newman (Ed) 'Polymer Blends'" Academic Press, New York, 1978
4. G.Alliger, etal, Rubber world, 164930,51(1971)
5. Goettler inc, the role of the polymeric matrix in the processing and structural prpperties of copmposite materials (J C Sferis and L.Nicolars, (Edn) Plenum, New York 1983.

## POLYMER PROCESSING - II

**P 606** **3+1**

**Module 1**

Injection moulding, terminology, process description, moulding cycle, classification of moulds, 2-plate and 3-plate moulds, different types of gates, cavity lay-out, setting up of mould, types of injection unit, elements of plasticating process, classification of screw, screw design, process control, clamping unit, classification of machine hydraulics, ancillary equipment, computer operation, trouble shooting of injection moulding, reaction injection moulding

**Module 2**

Extrusion, principle, types of extruders, single screw and twin-screw extruders, metering, screw design, process control variables, types of dies, die design, elastic properties and die swell, manufacturing of pipes, cables, wire coating, extrusion profiles, blown films, flat film, sheets, filaments, lamination, extrusion of elastomers

**Module 3**

Blow moulding, terminology, basis, process variables, injection & stretch blow moulding, single and multi layer, extrusion blow moulding, extrusion heads, process controls for blow moulding machine, process and product controls. Thermoforming, definition, methods of forming, thermoforming machinery, heating of sheet, heating cycle, stretching, concept, hot strength, blistering, sags, cooling and trimming the parts, heat balance, shrinkage, trimming operations.

**Module 4**

Rotational moulding, types of machines, moulds, materials, part design, calendering, types of calenders and strainer, embosser, winder, take off-systems, crowning, machinery powder coating, manufacturing methods, application methods, types of powder coating, finishing and machining of plastics, joining, welding and assembling of plastics.

**References**


1. Edited by Michael L. Berlin Plastics Engineering. Handbook. Society of the plastic Industries Chapman & Hall NY 1991.
2. James L. Throne, Technology of Thermoforming. Hanser, Publisher Munmich 1996.
3. M.J. Stevens and J.A. Covas, Extruder principle and operation. Chapman & Hall UK, 2nd edtion 1995.
4. D.V. Rosato & D.V. Rosato, Blow moulding Hand book, Hanser Published 1998.

## LATEX PRODUCTS LAB

**P 607** **0+3**

1. Preparation of dispersion, slurry and emulsions
2. Creaming of NR latex.
3. Manufacture of rubber bands, balloons, finger caps, household gloves, surgeons' gloves, latex thread and articles by casting.
4. Heat sensitized dipping.
5. Latex impregnation in textiles
6. Preparation of SP, CV and LV rubber
7. Preparation of latex based adhesives
8. Work practice in the production of latex foam
9. Work practice in the production of bonded coir

## PRODUCT MANUFACTURING LAB

**P 608** **0+3**

1. Determination of Cure time.
2. Effect of mastication time on plasticity/ viscosity
3. Work practice in mastication, band formation, homogenisation and mixing using a laboratory mill
4. Preparation of micro cellular sheet, V-strap, tea mat, teats, injection bottle cap, play ball, man made hose, solvent based adhesives, solid tyre, sponge, eraser and oil seal.
5. Work Practice in calendaring, injection moulding, rotational moulding and extrusion
6. Compounding of PVC on two roll mill
7. Visit to factories manufacturing tyres and non tyre products.
8. Preparation and characterisation of thermoplastic elastomers from rubber-plastic blends.
   a) Miscible binary system (solution and melt mixing)
   b) Immiscible binary system (solution and melt mixing)
   c) Compatibilised binary system (solution and melt mixing)
9. Preparation of miscible polymer blends, phase separation, LCST measurements.
10. Blending of NR with SBR, BR and EPDM.
11. Preparation of fibre filled composites.
12. Hand Lay up technique and Compression Moulding.

# SEVENTH SEMESTER

## PAINT TECHNOLOGY (ELECTIVE - I)

**P 701 - 1** **2+1**

**Module 1**

Reflection, refraction, diffraction, colour science, additive colour mixing, gloss, specular gloss, bloom gloss, surface uniformity, hiding power, chromaticity diagrams for colour measurements, components of paints, paint preparation, formulation, factors affecting pigment dispersion, preparation of pigment dispersion, manufacture, pigments, pigment properties, different types, selection, dispersion and colour matching of pigments, extenders, solvents, different types, solvent properties, oil, driers, resins, dilutents, additives affecting viscosity, interfacial tension, chemical reactions, living micro organisms.

**Module 2**

Classification based on polymeric resin, emulsion, oil and alkyd paints, acrylic paints, epoxy coatings, polyurethanes, silicones, formaldehyde based resins, chlorinated rubbers, acrylics, hydrocarbon resins. Classification based on application. Fluoropolymers, vinyl resins, appliance finishes, automotive finishes, coil coatings, can coatings, marine coatings, aircraft finishes.

**Module 3**

Mechanism of film formation, physical drying, oxidative drying, chemical drying, factors affecting coating properties, film thickness, film density, internal stresses, pigment volume concentration (PVC), different methods used for film preparation, barrier properties. Mechanical properties and optical properties of coatings, ageing properties, effect of rheological behaviour on paint performance.

**Module 4**

Adhesion properties of coatings, factors affecting adhesive bond, thermodynamics of adhesion, destructive methods, nondestructive methods, properties such as floating, silking, cratering, foaming, skinning, flame retardance, slip resistance and storage stability, surface cleaning methods, chemical conversion treatments, paint application, brushing, dip coating, flow coating, roller coating, spray painting, electro deposition, chemiphoretic deposition.

**References**


1. Swaraj Paul, " Surface coating: Science and Technology" Wiley- Interscience 1985
2. R. Lambourne, " Paint and Surface Coatings-Theory and Practice" Ellis Horwood Chichester 1987

## INFORMATION TECHNOLOGY (ELECTIVE - I)

**P 701 - 2** **2+1**

**Module 1**

Data Structures, introduction, storage structures for arrays, stacks, application of stacks, queues, pointers and linked allocations, linked linear list, operations, circularly and doubly linked list, applications, sorting techniques, selection sort, bubble sort, exchange sort, searching techniques, sequential searching, binary searching.

**Module 2**

Operating systems, generation and history of operating systems, multi programming and time sharing concepts, process states, transition, PCB, interrupt processing, job and process scheduling, disk scheduling, seek optimization, rotational optimization.

**Module 3**

Software engineering, planning and cost estimation, importance of software, defining the problem, developing a solution strategy, planning, development process, organizational structure, software cost estimation, introduction, software cost factors, cost estimation techniques, staffing level estimation.

**Module 4**

Software design concepts, introduction, fundamental design concepts, modules and modularization criteria, design notations and techniques, detailed design consideration, real time and distributed system design, test plans, milestone, walkthroughs and inspections, design guidelines, computer security, fundamental concepts of cryptosystems. Computer networks, introduction, uses of computer networks, network hardware & software, reference models, network topologies, examples of network, internet programming, HTML, DHTML, front page, introduction to dream weaver. E-commerce, introduction, applications in business, E-commerce framework.



**References**


1. Jean-Paul Tremblay& Paul.G.Sorenson, An Introduction to Data Structures with Applications, Mc Graw Hill, II edition, 1984.
2. Harvey.M.Detail, An Introduction to Operating Systems, Addison Wesley Publication Company, 1998.
3. James.L.Peterson, Abraham Silberschatz, Operating System Concepts, Addison Wesley Publication Company, 1985.
4. Richard Fairley, Software Engineering Concepts, Mc Graw Hill, 1985.
5. Pressman R.S., Software Engineering, Mc Graw Hill, II edition, 1987.

## ENGINEERING ECONOMICS AND INDUSTRIAL MANAGEMENT
## (ELECTIVE - I)

**P701 - 3** **2+1**

**Module 1**

Nature and scope of engineering economics, definition and scope of study of the subject, significance of economic analysis in business decisions, demand and supply analysis, determinants of demand, law of demand, Elasticity of demand, Demand forecasting, Law of supply, Elasticity of supply, Market price.

**Module 2**

Cost analysis, fixed cost, variable cost, marginal cost, cost output relationship in the short run and the long run, equilibrium of the firm, pricing decisions, situations demand, pricing decisions, pricing in practice, full cost pricing, marginal cost pricing, bid pricing, pricing for a rate of return, statutory price fixation in India, break even analysis, break even point, basic assumptions, break even chart, managerial uses of break even analysis.

**Module 3**

Capital budgeting, need for capital budgeting, method of appraising project Profitability, rate of return, pay back period, present value comparison, cost benefit analysis, preparing of feasibility report, appraisal process, economic and commercial feasibility, financial feasibility, technical feasibility.

**Module 4**

Work study, production, productivity, factors affecting productivity, role of work study, human factor, methods study, objectives and procedure, SIMO chart, principles of motion economy, work measurement, stop watch time study, rating concept and systems, allowances, work sampling, plant layout, factors governing plant location, objectives of a good plant layout, process layout, product layout and combination layout.

**References**


1. O.P. Khanna- Industrial Engineeering and Management- Dhanpatrai Publications-New Delhi-1998
2. R. L. Varshney & K.L. Maheswari-Managerial Economics-S Chand and Co.
3. Samuelson P. A. & Nordhaus. W. D-Economics-Mc'Grawhill-1992

## TOTAL QUALITY MANAGEMENT & RELIABILITY ENGINEERING
## (ELECTIVE - I)

**P 701 - 4** **2+1**

**Module 1**

Basic concepts, evolution of total quality management, definitions of quality, deming, crosby, juran, taguchi, ishikawa theories, inspection, quality control, TQM system, human component, service and product quality, customer orientation.

**Module 2**

Quality planning & techniques, quality planning, goal setting, designing for quality, manufacturing for quality, process control, CPK, 6σ, process capability, data based approach, statistical tools, 7QC tools, bench marking, QFD, FMEA, 5S, continuous improvement techniques, POKAYOKE, deming wheel.

**Module 3**

Human dimension & system development in TQM, TQM mind set, participation style, team work, team development, quality circle, motivational aspect, change management, documentation, structure, information system, ISO 9000, ISO 14000, QS 9000, certification, clauses, procedure, TQM road map.

**Module 4**

Reliability, definition, probabilistic nature of failures, mean failure rate, meantime to failure, meantime between failures, hazard rate, hazard models, weibull model, system reliability, improvement, redundancy, series, parallel and mixed configurations, reliability in design, case studies of aircraft engines, brake system in automobiles and aircraft, electronic equipollents.

Maintainability, introduction, choice of maintenance strategy, mean time to repair (MTTR), factors contributing to mean down time (MDT), fault diagnosis, routine testing for unrevealed faults, factors contributing to mean maintenance time, (MMT), on-condition maintenance, periodic condition monitoring, continuous condition monitoring, economics of maintenance.

**References**


1. Joel E. Rose, Total Quality Management, 2nd edn., Kogan page Ltd., USA, 1993.
2. Srinath L.S., Reliability Engineering, Affiliated East West Press, New Delhi – 1975.
3. John Bentley, Introduction to Reliability and Quality Engineering, 2nd edn., Addison – Wesley, 1999.
4. Samuel K Ho, TQM – An integrated approach, 2nd edn., Kogan page Ltd., USA, 1996.
5. John Bank, TQM, Prentice Hall of India Pvt. Ly\td., New Delhi, 1993.
6. Patrick P.T. O' Connor, Practical Reliability Engineering 2edn., John Wiley & Sons, 1985.
7. Balagurusamy E., Reliability Engineering, Tata McGrew Hill Pub. Co., New Delhi, 1984.
8. Bazovsky, I., Reliability Theory and Practice, Printice Hall, Inc. Englewood Cliffs, New Jersey, 1961.

## INDUSTRIAL ENGINEERING

**P 702** **2+1**

**Module 1**

Introduction, evolution of modern concepts, functions of an industrial engineer, field of application, entrepreneurship, concept of project, types of investment, capital budgeting, investment proposals, project development cycle, preinvestment analysis, project environments, government regulations, import-export status, foreign exchange regulations, technical collaborations, means of raising capital, availability of resources, marketing survey and strategies.

**Module 2**

Product development and research, design function, objectives of design, manufacture Vs purchase, development of design, experimentation, prototype production, testing, simplification, standardization, product development, selection of materials and processes, human factors in design, value engineering, selection of factory site, building design, construction, plant layout and material handling, product and process, layout, comparison of flowchart, use of time study data, physical facilities, constructional details, environmental control like lighting, temperature, humidity, ventilation, noise, dust, industrial waste disposal-principles of material handling, types of material handling equipment, selection and application.

**Module 3**

Maintenance and replacement, preventive and breakdown maintenance, economic aspect, replacement of equipment, methods of providing for depreciation, determination of economic life, criteria for selection of equipment.

**Module 4**

Methods Engineering, analysis of work methods using different types of process charts and flow diagrams, critical examination, micro motion study and Therblings, SIMO chart, principles of motion economy, determination of standard time and allowances, accounting and costing, element of double entry book keeping, trial balance, trading profit and loss account, balance sheet, principles of costing, methods of allocation of overhead costs, finance and capital requirements, price fixation, cash flow statements, return of investment, source of finance.

**References**


1. Production System - J.L.Riggs
2. Production Control - Hiegel
3. Human Factors in Engg. Design - Mc Cornic, E.J.
4. Time and Motion Study - Barnes R.M.
5. Operations Management - Buffa E.S.
6. Value Engineering - Miles L.D.
7. Methods Engineering - Krick
8. System Analysis and Project Management - Cleand &king.

## PRODUCTION ENGINEERING

**P 703** **3+1**

**Module 1**

Lathe, types of lathe specification, parts of center lathe, operations, single point tool nomenclature accessories and attachment, capstan and turret lathe, parts, difference, automatic lathe, single spindle and multispindle types.

**Module 2**

Shaping, types, operations, parts of standard shaper, specifications, planning, types, parts of double housing, planning machine, operations table drive mechanism only, specifications, milling, types, specifications, operations only, drilling, types, specification, operations, twist drill nomenclature, boring, types, specification, grinding, types, abrasives, girt, grade and structure of grinding wheel, bonding process, fine finishing, honing, super finishing, buffing, metal spraying, electro plating.

**Module 3**

Special machining, electrical discharge machining, electro chemical machining, electron beam machining, ultrasonic laser machining, plasma arc machining, abrasive jet machining, chemical machining.

**Module 4**

Transfer machines, types, components, N.C. machines, open and closed loop control system, analogy and digital control system, absolute and incremental position control, part programming, manual part programming technique and computer aided part programming technique, measurement principles, classification of measuring instruments, gauges, height gauge, slip gauges, sine bars, autocollimator, go, no gauges, classification, surface roughness, terms, symbols, measurement.



**References**

1. S.K. Hajra Choudry, Elements of Workshop Technology Vol. I & II Media promoters and Publishers, 1999, 9th Edition.
2. Workshop Technology, W.A.J. Chapman, Vol. I, II & III.3
3. Manufacturing Technology, M. Hastle Hurst.

## CHEMICAL ENGINEERING - IV

**P 704** **3+1**

**Module 1**

Process control-controllers, types, proportional derivative control, proportional integral controller, proportional integral derivative controller, basic principles and transfer functions, pneumatic and electronic controllers, open and closed loop systems, first order systems, mercury thermometer, liquid level and mixing process

**Module 2**

Temperature measurement-different methods like electrical, contact and non-contact methods- thermometers- liquid filled, bimetallic and resistance thermometers, thermocouple, optical pyrometer. Pressure measurement, manometers, U-tube, well type and inclined types, barometer, bourden tube, bellows, diaphragms.

**Module 3**

Chemical reaction engineering-classification of chemical reactions and reactors, variables affecting the rate of reaction, reaction rate, molecularity and order of a reaction, Arrhenius law, collision theory and transition state theory. integral and differential method of data analysis, ideal batch reactor, semi batch reactor, mixed reactor

**Module 4**

Process calculations-methods of expressing composition of mixture of solids, liquids and gases. concept of limiting and excess reactants. ideal gas law, Dalton's law, Amagat's law, material balance problems involving mixing, leaching, evaporation, distillation and absorption.

**References**


1. Stochiometry, Tata McGraw Hill Company limited, New Delhi, Bhatt & Vora
2. Chemical reaction engineering, Levenspiel, Tata McGraw Hill Company limited, New Delhi
3. Process control, Patranabis, Tata McGraw Hill Company limited, New Delhi
4. Process instrumentation, Patranabis, Tata McGraw Hill Company limited, New Delhi
5. Process system analysis and control, Coughnour & Koppel, Tata McGraw Hill Company limited, New Delhi
6. Chemical engineer's Handbook, Perry, Tata McGraw Hill Company limited, New Delhi.
7. Introduction to chemical engineering, Anderson & Wenzel, Tata McGraw Hill Company limited, New Delhi

## TYRE TECHNOLOGY

**P705** **3+1**

**Module 1**

History on the design and development of tyres, current status of tyre industry in India and its future prospects, tyre sizing, different components of a tyre, its geometry, basic functions, functions of a pneumatic tyre, load carrying, vibration and noise reduction, the tyre function as a spring, contribution to road adhesion, tyre friction contribution to driving control, steering control and self aligning torque. Solid tyres, concave tyres, winter tyres, OTR tyre, bicycle tyre, different types of tyres, bias, bias belted, radial, relative merits and demerits, their components, tube and tubeless tyres-basic features.

**Module 2**

Cord-rubber composites, failure mechanism of cord reinforced rubber, mechanics of tyre pavement interaction, tyre forces on dry and wet road surface, traction forces on dry, wet, ice, snow and irregular pavements, breaking and traction of tyres, tyre wear, rubber friction, sliding mechanism, various factors affecting friction and sliding, tyre stresses and deformation, tyre noise, mechanism of noise generation, effect of tread pattern, noise level, flatspotting, fatigue resistance, patographing, pneumatic resilience effect.

**Module 3**

Manufacturing techniques of various tyres - two wheeler, car tyres, truck tyres, cycle tyres, cycle tubes, OTR tyres, aircraft tyres, automotive tubes, manufacture of tyre treads, beads, sidewalls, compounding techniques, principles of designing formulations for various rubber components, tyre reinforcement materials (textile, steel, glass, aramid), criteria of selection, different styles and construction, textile treatment (RFL dip), tyre mould design, green tyre design principles, methods of building green tyres for bias, bias belted, radial and tubeless tyres, green tyre treatments, tyre curing methods, curing bags, bladders, diaphragms, autoclave, airbag, bagomatic, autoform, post cure inflation, different types of tyre building machines, bead winding machine, bias cutters, curing presses.

**Module 4**

Measurement of tyre properties, dimension and size-static and loaded, tyre construction analysis, endurance test, wheel and plunger tests, traction, noise measurements, force and moment characteristics, cornering coefficient aligning torque coefficient, load sensitivity and load transfer sensitivity, rolling resistance, non-uniformity dimensional variations, force variations, radial force variation, lateral force variation concentricity and ply steer, type balance, mileage, evaluations, tyre flaws and separations, X-ray holography, foot print pressure distribution, BIS standards for tyres, tubes and flaps, quality control tests.

**References**


1. Samuel K. Clark, Mechanics of pneumatic Tires, National Bureau of standards, Monograph, US Govt. printing office, 1971.
2. Tom French, Tyre Technology, Adam Hilger, New York, 1989.
3. F.J. Kovac, Tire Technology, 4th edition, Good year Tire and Rubber Company, Akron, 1978.
4. E. Robecchi, L. Amiki, Mechanics of Tire, 2 Vols, Pirelli, Milano, 197

## POLYMER TESTING

**P706** **3+1**

**Module 1**

Standards organizations, BIS, ASTM, BS, DIN, FDA, preparation and conditioning of test pieces, short term testing, stress-strain behaviour in tension, compression and shear, tensile strength, compressive strength, tear strength, flexural strength, impact, Izod, Charpy, long term testing, creep, stress relaxation, hardness, abrasion resistance, resilience, heat build- up, ageing.

**Module 2**

Chemical analysis of polymers, functional group analysis, tacticity analysis, use of mass spectrometry, gas chromatography, IR, $C^{13}$, $H^{1}$, ESR, NMR spectroscopy, optical microscopy, SEM, TEM, X-ray diffraction, electron diffraction, neutron diffraction in polymer characterization.

**Module 3**

Principle and use of DTA, TGA, DSC, DMA and TMA, determination of $T_g$, $T_m$, heat of fusion, thermal conductivity, flammability, vicat softening point, heat deflection temperature.

**Module 4**

Analysis of dielectric strength, dielectric constant, volume resistivity, surface resistivity, arc resistance, corona resistance, power factor, dissipation factor, loss factor, transparency, refractive index, haze, gloss.

**References**


1. R.P.Brown, Physical testing of Rubber, Academic Press, New York 1984
2. Vishu Shah, Testing of Plastics
3. ASTM Manual 35,36,37
4. BIS and TST Manual

## POLYMER TESTING LAB

**P707** **0+3**

**Testing of mechanical properties of plastics and rubbers**

1. Tensile strength
2. Compression strength
3. Flexural strength
4. Tear strength
5. Izod and Charpy impact strength
6. Falling dart impact strength
7. Shore Hardness
8. Abrasion resistance
9. Rebound resilience
10. Flex resistance

## CHEMICAL ENGINEERING LABORATORY

**P 708** **0+3**

1. Fluid flow measurement using orificemeter
2. Fluid flow measurement using venturimeter
3. Verification of Bernoulli's theorem
4. Single tank system
5. Simple distillation
6. Reynolds's experiment
7. Dynamics of thermometer
8. Characteristic curves of a centrifugal pump
9. Characteristic curves of a reciprocating pump
10. Kinetics of hydrolysis of ethyl acetate.

# EIGHTH SEMESTER

## ADHESIVE TECHNOLOGY (ELECTIVE - II)

**P801 - 1** **3+1**

**Module 1**

Bond types, immiscible planar substrates, immiscible substrates with interphase formation via chemical reaction, setting, adhesive joint strength, interface, thermodynamics of adhesive, contact angle, work of adhesion, acid base consideration, surface treatment, measure of adhesion, test methods, strength of adhesion, rheology of adhesion

**Module 2**

Low energy surface, high energy surface, solvent, solvent cleaning, mechanical abrasion, chemical treatments, primers, plasma treatments, mechanism of adhesion, introduction, mechanical interlocking, mechanically roughened substrates, chemically roughened substrates, role of localized energy dissipation diffusion theory, welding of plastics, polymer/ metal interface, electronic theory, adsorption theory, secondary force interactions, donor-acceptor interactions, primary force interaction.

**Module 3**

Hardening by solvent or dispersing medium removal, hardening by cooling, hardening by chemical reaction, non-hardening adhesives, adhesives from natural sources, rubber based adhesives, TPE based adhesives, phenolic resins, tannin formaldehyde resin, lignin based resin, polyvinylacetates, polyvinylalcohols, epoxides, di isocyanates, cyanoacrylate, anaerobic, acrylic, hot melt adhesives, pressure sensitive adhesives, structural adhesives in aerospace, adhesives in automobile industry, conductive, adhesives in building construction, adhesives in electrical industry.

**Module 4**

Stresses, types of joints, selection of joint detail, joint design criteria, standard test methods, engineering properties of adhesives, non destructive testing, fracture mechanics of adhesive joints, effect of joint geometry, effect of temperature, dynamic and static fatigue, environmental attack, service life prediction.

**References**


1. Skiests (Ed). Handbook of Adhesives, III edition, Van Nostrand Reinhold, 1990
2. Shields, Handbook of Adhesives, Butterworths 1984
3. Pizzi (Ed) Wood Adhesives, Chemistry and Technology, Marcel Dekker 1983.

## PLASTICS PACKAGING TECHNOLOGY (ELECTIVE - II)

**P 801 - 2** **3+1**

**Module 1**

Introduction to plastics packaging, functions of packaging, advantages of plastic packaging, distribution hazards, special requirements of food and medical packaging, packaging legislation and regulation, packaging as a system, elements, approach, package, design, relation criteria for packaging materials, packaging equipment checklist, case histories, major packaging plastics, introduction, PE, PP, PS, PVC, polyesters, PVDC, vinylacetate, PVA, EVA, PV Alcohol, PA, PC ionomers & fluoro polymers.

**Module 2**

Conversion process, compression & transfer moulding, injection moulding, blow moulding, extrusion, rotary thermoforming, lamination, metallizing, decoration process, shrink wrapping, pallet & stretch wrapping, sealing methods, plasma barrier coatings, energy requirement for conversion.

**Module 3**

Extrusion, film and flexible packaging, extrusion, cast film & sheet, blown film, multi layer film & sheet coatings, laminations & co extrusions, stretch and shrink wrap, pouching, sealing, evaluation of seals in flexible packages, advantages of flexible packaging, flexible packaging products, specialized packaging for food products

**Module 4**

Thermoformed, moulded and rigid packages, thermoforming packages, position & thermoforming & wrap forming, variations in thermoforming and solid phase pressure forming, scrabbles, twin sheet & melt to mould thermoforming, skin packaging, thermoforming moulds, thermoforming fill real, aseptic thermoforming, advantages & disadvantages of moulding foams, other cushioning materials & distribution packaging, polystyrene & other foams systems cushioning, design of molded cushioning systems, plastic pallets, drums & other shipping containers, testing plastic packages, barrier, migration & compatibility, printing, labeling & pigmenting, sterilization systems and health care products, packaging hazards and their controls, environmental considerations.

**References**


1. Susan E.M. Seleke, Understanding plastic packaging Technology, Hanser publications – Munich
2. A.S. Altalye, Plastics in packaging, Tata McGraw – Hill publishing Co. Ltd., New Delhi.

## PROCESS ENGINEERING ECONOMICS AND MANAGEMENT
## (ELECTIVE - II)

**P 801 - 3** **3+1**

**Module 1**

Value of money, equivalence, equation for economic studies and equivalence, amoritation, capital recovery, depreciation, depletion.

**Module 2**

Capital requirements for process plants, cost indices, equipment costs, service facilities, capital requirements for completed plan, balance sheet, cost, earnings, profits and returns, variable costs, fixed costs, income statement, economic production charts, capacity factors.

**Module 3**

Economics of selecting alternates, annual cost methods, present worth method, equivalent alternate, rate of return and payment time, cash flow analysis, economic balance, economic balance in batch operation, cyclic operations and multiple equipment units.

**Module 4**

Micro economics, elasticity of demand and supply, demand forecasting methods, economic analysis, cost analysis, time element, Beep micro economics, Keynesian employment theory, multiplier and accelerator, national income, accounting, business cycle. Concept of management, principles, managerial functions, scientific management, advanced techniques in management, type of organization, merits and demerits, concept of marking, need, reserach, sales forecasting, product cycle, personnel management, concepts recruitment, selection and training and development, maintenance, merit rating, job evaluation, fatigue, accidents, causes and prevention, labor management of relations, concept of industrial relations.



**References**

1. Schwyer H.E., "Process Engineering Economics", Mcgraw Hill Book Co., (N.Y)
2. Jelam, F.F., "Cost And Optimisation Engineering ".
3. Peter And Timmerhaus, "Plant Design And Economics For Chemical Engineers.

## PROCESS CONTROL AND INSTRUMENTATION (ELECTIVE - II)

**P 801 - 4** **3+1**

**Module 1**

Principles of measurement and classification of process control instruments, temperature pressure, fluid flow, liquid level, volumetric and mass flow rate, fluid density and specific gravity, viscosity and consistency, pH and concentration, electrical and thermal conductivity, humidity composition by physical and thermal properties and spectroscopy.

**Module 2**

Transient response of open loop systems, first order systems, examples, response to step, impulse and sinusoidal forcing functions, first order systems in series, interacting and non interacting types, response of first order systems in series, second order system, transfer functions, examples, response of second order systems to step, impulse and sinusoidal inputs transient response of chemical reactor.

**Module 3**

Control system, development of block diagram for feed back control systems, servo and regulator problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transportation lag, feedback characteristics of control systems, block diagram, signal flow graph techniques.

**Module 4**

Introduction to frequency response of closed loop systems, concept of stability ROUTH test for stability, stability criterion, bode stability criterion, Niquist diagram, tuning of controller settings. Process dynamics and applications, dynamics and control of chemical reactors, heat exchangers and distillation columns, digital computer applications, microprocessors and computer control of chemical processes, introduction to PLC programming and DCS.

**References**


1. Coughanowr D.R. and Koppel L.M., Process Systems Analysis and Control McGraw Hill, New York.
2. P. Harriot, Process Control, Tata McGraw Hill, New Delhi 1977.
3. D.P. Eckman, Industrial Instrumentation, Wiley 1978.

## COMPUTER AIDED DESIGN & MANUFACTURE

**P 802** **3+1**

**Module 1**

Introduction, design process, application of computers for design, creating manufacture database, benefits of CAD, input-output devices in CAD, design work station, graphic terminal, operator input devices, plotters and other output devices, secondary storage. Functions of graphic package, constructing the geometry, 2D transformations, 3D transformations, conceteration, data base structure and content, wire-frame modeling, surface modeling, solid modeling finite element modeling, digitizing, layering, groups, patterns, local coordinates, automate dimensioning, on line calculation capabilities.

**Module 2**

Conventional memorial control (NC), basic components of NC system, NC procedure, NC co ordinate system, NC motion control system, applications of NC, economics of NC, NC part programming, punched tape in NC, tape coding and format, manual part programming, computer assisted part programming, the ATP language, the macro statement in ATP, NC programming with interactive graphics, voice NC programming, manual data input, computer controls in NC, introduction, problems with conventional NC, NC controller technology, computer numerical control, direct numerical control, combined DNC/CNC systems, adaptive control machining systems.

**Module 3**

Structural modes of manufacturing process, process control strategies, distributed control versus central control, direct digital control, supervisory computer control, computer aided quality control, technology in Q.C., computer in Q.C., contract inspection methods, non contract inspection methods, optical and non optical, computer aided testing, integration of CAQC with CAD/ CAM manufacturing systems, manufacturing systems, machine tools and related equipment, material handling system, computer integrated manufacturing systems, human labour in the manufacturing system, CIMS benefits.

**Module 4**

Group technology (G.T.), introduction, part families, part classification and coding, G.T. machine cells benefits of G.T., computer aided process planning, planning function, retrieval type process planning system, generative process planning system, benefits of CAPP, machinability data systems, computer generated time standards.

**References**


1. M.P. Groover, E.M. Zimmers, Jr."CAD/CAM"; Computer Aided Design and Manufacturing, Prentice Hall of India, 1987
2. Besent C.B. " Computer aided Design and Manufacturing" Ellis Horwood Ltd England 1980

## FIBRE TECHNOLOGY

**P 803** **3+1**

**Module 1**

Introduction, definition of fibre, fibre dimensions, units of measurements, tex, denier, conversion from one system to another, use of fibres in the rubber and plastic industry, polymer products containing fibres, fibre manufacturing industries in India, present status and future prospects.

**Module 2**

Fibres used in polymer industry- types and sources, chemical composition, properties, concept of order in fibres and polymers, crystallinity and orientation, methods of investigating fibre structure, detailed study of fibre properties such as mechanical properties, electrical properties, moisture absorption, optical properties and fibre friction, relation between fibre properties and structure, uses of vegetable fibres such as cotton, flax, linen, coir, sisal, pineapple, jute, silk, banana, use of animal and mineral fibres.

**Module 3**

Man made fibres, physical structure of fibre forming polymers, production, chemical composition, properties and testing of viscose rayon, cellulose acetate, nylon 66 and nylon 6, polyester, acrylic, poly vinyl alcohol, spandex, carbon fibre, metallic fibres, saran, kevlar, nomex, steel wire, finishing and dyeing.

**Module 4**

Yarn and textile production from fibres, definition of various textile terms, fibre spinning, drawing of fibres, felting, knitting, lacing, bonding and weaving, properties of yarns, yarn numbering system, brief idea about spinning of cotton yarns and blends, yarn properties such as count appearance, evenness, strength, abrasion, fatigue, friction, twist, dynamic mechanical properties and their importance, fabrics, brief idea about the construction, cover factor, geometry of weaves, fabric properties such as strength, abrasion resistance, air permeability, bursting strength, thermal properties.

**References**


1. Booths, " Textile Testing", Butterworths, Newness, U.K. 1980
2. Wake and D.B.Wooton, Textile reinforcement of Elastomers," Applied Sciences" 1982
3. Evans," House technology" Applied Science Publishes 1979
4. F.W.Billmeyer, "Text Book of Polymer Science", Wiley – Interscience, 1971
5. Moncrief," Man Made Fibres,
6. Sadov et al, "Chemical technology of fibres and Material" Mir Publishers, Moscow 1978

## POLYMERS & ENVIRONMENT

**P 804** **3+1**

**Module 1**

Introduction, resources of polymers, comparison of total energy costs for product manufacture based on polymers, ceramics and metals, polymer production and consumption, comparison of the impact on environment by polymers and other materials, environmental pollution, non- biodegradability of polymers, drawbacks, burning of polymers, remedy for environmental problem by polymers, awareness program.

**Module 2**

Bio-degradation of polymers, introduction, enzymes, enzyme nomenclature, enzyme specificity, physical factors affecting the activity of enzymes, enzyme mechanism, chemical degradation initiates biodegradation, hydrolysis of synthetic biodegradable polymers. Development of starch based polymers, manufacture of master batch, biodegradation, assessment, soil burial test, biopolyesters, synthesis, isolation, solvent extraction, enzymatic digestion, properties, degradation, intracellular biodegradation, extra cellular biodegradation, thermal degradation, hydrolytic degradation, environmental degradation

**Module 3**

Need for recycling of plastics from urban solid wastes, waste composition, sorting and segregation of waste, plastics identification, SPI coding, primary recycling, equipments for primary recycling, specific recycling techniques, PE films, PP battery case, crushing and separation, PET films

**Module 4**

Secondary recycling, plastics wastes containing paper, hydrolytic treatment, processing of mixed plastics waste, household waste, industrial sector, TPO based materials, use of recyclable plastics in motor vehicles, recoverable material, disposal of residuals, recycling of rubber, difficulty in recycling of rubber products, reclaimator process, WTR, advantages of reclaimed rubber in cost, mixing and processing

**References**


1. Recycling of plastic materials (Ed) Francesco Paolo La Mantia, Chem Tee Publishing.
2. Degradable polymers, recycling and plastics waste management, (eds) Ann
3. Christine Albertsson and Samuel J. Huang, Marcel Dekker, New York.
4. Plastics Waste Management (ed) Nabil Mustafa, Marcel Dekkar, New York.

## POLYMER PRODUCT DESIGN

**P 805** **3+ 1**

**Module 1**

Steps in product design, functional design, aesthetic design, effect of fillers on properties and performance, safety factor, working stress, safe stress, fatigue factor, effects of cyclic loading, stress concentration, endurance limit, structural design of products under static and dynamic loads, design of beams and plates, design for stiffness, electrical use, optical use

**Module 2**

Design features of products, inside and outside corners, wall thickness, ribs, tapers, draft angles, weld lines, gate size and location, tolerances, moulded-in-inserts, plastic threads, blind holes, undercuts, hinges, functional surfaces and lettering, snap fitting, welding.

**Module 3**

Plastic gears, advantages and disadvantages, glossary of gearing terms, backlash and working clearance, materials, lubricants, frictional properties, design, moulded and cut gears, plastic bearings, rubber bearings, different types, designers checklist, pipes, dimensions and specifications, joints, manholes, pump pressure, pressure rating calculation, external loading.

**Module 4**

Hysteresis, energy absorption, damping, principles of vibration, simple harmonic motion, combination of simple harmonic motion, beats, periodic motion, system with single degree of freedom, natural frequency, forced vibrations, undamped vibration, damped vibrations, octave rules, coulomb and solid damping, frequency of damped vibrations, logarithmic decrements, critical damping, two degrees of freedom, multi degrees of freedom, vibration isolation, dynamic isolation and transmissibility, isolation of shock and transient vibrations, rubber mountings, rubber bridge bearings , rubber seals, basic configurations, design of static and dynamic seals, design of rubber products in automobiles, aviation, marine fields, hoses, beltings, couplings, cables, rubber- to- metal components, footwear, sports goods.

**References**


1. Plastic Products Design Handbook - Edward Miller
2. Plastic Products Design Engg. Handbook - S Levy & J. H. DuBois
3. Product Design With Plastics J.B.Dym Freakly and Payne "Theory and Practice of engineering With Rubber" Applied Science, London, 1978

## SPECIALITY POLYMERS

**P 806** **3+1**

**Module 1**

High temperature and fire resistant polymers, improving low performance polymers for high temperature use, polymers for low fire hazards, polymers for high temperature resistance, fluoropolymers, aromatic polymers, polyphenylene sulphide, polysulphones, polyesters, polyamides, polyketones, heterocyclic polymers.

**Module 2**

Electrical and electronic properties of polymers, insulating properties of polymers, conducting polymers, conducting mechanisms, polyacetylene, polyparaphenylene polypyrrole, organometallic polymers, photo conducting polymers, polymers in non-linear optics, polymers with piezoelectric, pyroelectric and ferromagnetic properties, photoresists for semi conductor fabrication, optical fibre telecommunication cables.

**Module 3**

Ionic polymers, synthesis, physical properties and applications, ion exchange, hydrophilicity, ionomers based on polyethylene, elastomeric ionomers, ionomers based on polystyrene, ionomers based on PTFE, ionomers with polyaromatic backbones, polyelectrolytes for ion exchange, polyelectrolytes based on carboxylates, polymers with integral ions, polyelectrolyte complexes, inorganic ionic polymers.

**Module 4**

Liquid crystalline polymers, structure, types, applications, inorganic polymers, polymers containing phosphorous, nitrogen and boron, organometallic polymers, polysiloxanes and metal chelate polymers.

**References**


1. H.F.Mark, (Ed), Encyclopedia of polymer Science & Engineering, John Wiley & Sons, New York, 1989.
2. Matrin.T.Goosey, Plastics for Electronics, Elsevier, Applied Science, 1985.
3. R.W. Dyson, Specialty Polymers, Chapman & Hall, 2nd edition, 1998.
4. Manas Chanda, Salil.K.Roy, Plastics Technology Hand book, 2nd edition, Marcel
5. Dekker, New York, 1993
6. C.Ku & R.Liepins, Electrical Properties of Polymers, Hanser Publications, Munich 1987.
7. F. Bueche, Physical properties of polymers, Wiley, New York, 1962.
8. J.Mort & G.Pfister, eds. Electronic properties of polymers, Wiley Interscience,

## CHEMICAL TECHNOLOGY LAB

**P807** **0+3**

**Determination of the following parameters**

1. Acid value of oils
2. Iodine value of oils
3. Saponification value of oils
4. Sucrose content of sugar
5. Hardness of water
6. Dissolved oxygen in water
7. BOD and COD of water
8. Available chlorine content in bleaching powder
9. Preparation and analysis of soap
10. Flash point and fire point

## PROJECT & SEMINAR

**P 808** **0+3**

Each student has to undertake a short project under the supervision of a guide. A consolidated report of the project work in the form of a dissertation has to be submitted after the completion of the work. The assessment of the project work will be based on the day-to-day performance of the student, knowledge, aptitude, sincerity, the quality & content of the project report and seminar & viva-voce.

## VIVA VOCE

**P 809**

A viva-voce will be conducted as a part of the university examination to assess the student's overall ability and knowledge in the field of Polymer Engineering and allied subjects. The candidate has to present the project report, seminar paper and educational tour report for this examination.

# B.TECH. DEGREE COURSE

## SYLLABUS



# INFORMATION TECHNOLOGY ENGINEERING BRANCH

# THIRD SEMESTER

## ENGINEERING MATHEMATICS - II

**RT301** **3+1+0**

**Module 1**

Mathematical Logic – Statements, connectives – Well formed formulas – Tautologies. Equivalence of formulas - Duality law Tautological implications – Normal forms – the theory of inference for the statement. Calculus – validity . Consistency, Theorem proving – the predicate calculus – Inference Theory of the predicate calculus.

**Module 2**

Number Theory: Prime and relatively prime numbers – modular arithmetic – Fermat's and Euler's theorems – testing for primability – Euclids algorithm – discrete logarithms.

Relations & Functions – Properties of binary relations – Equivalence relations and partitions – Functions and pigeon hole principle.

**Module 3**

Algebraic systems – general properties – Lattices as a partially ordered set – some properties of lattices – lattices as algebraic systems – sub lattices – direct product – homomorphism – some special lattices.

**Module 4**

Discrete Numeric Functions & generating Functions, Recurrence relations – Manipulations of Numeric functions – generating functions – Recurrence – relations – Linear recurrence relations with constant coefficients – Homogenious solutions – Particular solutions – Total solutions – solutions by the method of generating functions.

**Module 5**

Graph Theory: Basic concept of graphs, subgraphs, connected graphs, Paths, Cycles, Multigraph and Weighted graph – Trees – spanning trees.

**References**


1. Elements of Discrete Mathematics - C.L.Lieu. McGraw Hill.
2. Discrete Mathematical Structures with Applications to Computer Science - J.P. Trembly, R. Manohar. McGraw Hill.
3. Discrete Mathematics - Richard Johnsoubaugh (Pearson Education Asia)
4. Discrete Mathematical Structures - Bernard Kolman, Robert C. Bushy, Sharon Cutler Ross, Pearson Education Asia.
5. A first look at Graph Theory - John Clark & Derek Allan Holton, Allied Publishers.
6. Cryptography and network security principles and practice - William Stallings.

## ELECTRICAL CIRCUITS AND SYSTEMS

**T 302** **3+1+0**

**Module 1**

Introduction: - The resistance, capacitance and inductance parameters. Active element conventions, Dot convention for coupled circuits. Topological description of networks. The network equations- Kirchoff's laws – source transformations. Loop variable analysis. Duality State variable analysis. Examples.

**Module 2**

First order differential equations – solutions. Time constants. The integrity factor – examples – Initial conditions in elements Geometrical Interpretation of derivation. Evaluating initial conditions. Initial State of a network.

**Module 3**

Second order equations – internal excitation. The Laplace Transformation – Basic theorems – examples. Transform of signal waveforms – Shifted unit sep function – Ramp and Impulse function. Waveform Synthesis – Initial and final value – Convolution as a summation

**Module 4**

Impedance function – Concept of Computer frequency. Transform Impedance and transform circuits, series and parallel combinations of elements.

Theorem – Super position, reciprocity, Thevenins and Norton's theorems – proof and examples.

**Module 5**

Network functions – Terminal pairs – one port and two port networks – Ladder networks – General networks.

Poles and zeros. Pole – zero locations for transfer functions. Pole – zero plot – domain behavior, stability. Two port parameters – two port variable – short circuit admittance parameters – open circuit impedance parameters – transmission parameters – hybrid parameters – parallel connection of two port networks.

**Text Book**

1. Network Analysis – M. E. Van Valkenburg – PHI

**References**

1. Introductory Circuit Theory – Errist A. Guillemin – John Wiley & Sons
2. Network Analysis and synthesis – Franklin F Kuo – John Wiley & Sons
3. Basic Network Theory – Paul M. Chirlian – Mc Graw Hill
4. Electric Circuit Analysis, 2nd Edition – S.N.Sivanadam, Vikas Publications

## SOLID STATE ELECTRONICS

**RT 303** **2+1+0**

**Module 1**

Transistor – Biasing – Stability – Thermal runaway. Transistor As an amplifier – RC coupled amplifier, Frequency Response, Gain Bandwidth relation – Cascading of transistors – cascade Darlington pair – emitter follower.

**Module 2**

FET, FET amplifier – MOSFET, depletion and enhancement type – source drain characteristics and transfer characteristics.

**Module 3**

Oscillators – Concept of feed back – Transistorised phase shift oscillator – wein bridge Oscillator – Hartley Oscillator – Colpits Oscillator (Operation and Expression for frequency)

**Module 4**

Clipping, Clamping, Integration, Differentiation – Astable, Bistable and Monostable Multivibrators – Sweep generators. Simple Bootstrap sweep generators.

**Module 5**

Power supplies & Special semi conductor devices – Regulator power supplies – IC regulated Power supplies, 7805, 7905, LM317 – LED, LCD, Photodiode, Photo transistor, opto coupler, Seven segment display, SCR, UJT (basic concepts only), DIAC, TRIAC.

**References**


1. Integrated Electronics - Millman and Halkias, McGraw Hill.
2. Pulse Digital and Switching wave forms - Millman and Taub.
3. Electronics Devices & Circuits - Boylsted & Neshelsky, Pearson Education.


## PROBLEM SOLVING AND COMPUTER PROGRAMMING

**RT 304** **3+1+0**

**Module 1**

Problem solving with digital Computer - Steps in Computer programming - Features of a good program - Modular Programming - Structured - Object Oriented - Top down and bottom up approaches - Algorithms - Flowchart - Pseudocode, examples

**Module2**

C fundamentals: - Identifiers, keywords, data types, operators, expressions, data Input and Output statements, simple programming in C.

**Module 3**

Control statements & Functions: If - else, for, while, do - while, switch, break & continue statements, nested loops. Functions - parameter passing - void functions Recursion – Macros.

**Module4**

Structured data types: Single dimensional arrays - multidimensional arrays, strings, structures & unions - Program for bubble sort.

**Module 5**

Pointers & files - Declaration, passing pointers to a functions- Accessing array elements using pointers - Operations on pointers - Opening & Closing a file - Creating & Processing a file, Command line arguments.

**Text**

1. Programming with C - Byron S. Gottfried, Tata McGraw Hill

**References**


1. Computer Programming in C - Kerninghan & Ritchie, PHI
2. Programming with ANSI and Turbo C - Ashok N. Kamthan, Pearson Eduacation
3. Let us C - Yeaswanth Khanetkar, BPB
4. Programming in C - Stephen C. Kochan, CBS publishers
5. Using C in Program Design - Ronald Leach, Prism Books Pvt. Ltd, Bangalore
6. Mastering Turbo C - Bootle, BPB Publications
7. Programming and Problem Solving with PASCAL - Micheal Schneider, Wiley Eastern Ltd.
8. Pointers in C - Yeaswanth Khanetkar, PBP
9. C Programming - A Modern Approach - K.N. Iling W.W. Norton & Company
10. Newyork Structured and Object Oriented Problem Solving using C++ - Andrew C Staugaard Jr., PHI




## HUMANITIES

**RT 305** **2+1+0**

## PART A: PRINCIPLES OF MANAGEMENT

**Module 1**

Scientific Management, Evolution of management theory, Contributions of Taylor, Gilbreth, Gantt, Emerson, Definition and functions of management Authority, Responsibility, Delegation and Span of control, Types of structures of Organisation – Types of Business firms, Job evaluation and merit rating, Wages – Types of incentives.

**Module 2**

Procedure for ISO and ISI certification – Design, Development and implementation of re-engineering - Inspection – SQC control charts – quality assurance – TQM – ZERO defects.

## PART B: ENGINEERING ECONOMICS

**Module 3**

The Indian financial system – Reserve bank of India, functions – commercial banking system, profitability of public sector banks, development financial institutions – IDBI, ICICI, SIDBI, IRBI – Investment institutions – UTI, Insurance companies – The stock market – functions – Recent trends.

**Module 4**

Indian Industries - Industrial pattern - structural transformation – industrial growth – inadequacies of the programme of industrialization – large and small scale industries – industrial sickness and Government policy – industrial labour – influence of trade unions.

**Module 5**

The tax frame work – Direct and indirect taxes – impact and incidence – progressive and regressive – functions of the tax system – Black money – magnitude and consequences – Public debt – Debt position of the Central and State Governments – Deficit financing – revenue deficit and fiscal deficit – Problems associated with deficit financing.

**References**


1. Management - Stoner, Freeman and Gilbert.
2. Engineering Managemt - Mazda, Pearson Education.
3. Indian Economy - Ruddar Datt, S. Chand and Company Ltd.
4. A.N. Agarwal - Indian Economy Problems of Development and Planning, Wishwa Prakashan.


## DIGITAL ELECTRONICS

**T 306** **3+1+0**

**Module 1**

Review of number Systems – Binary, Octal, Hexadecimal – Conversion,
Binary codes – BCD, Self complementing, Excess – 3 and Gray code, Alphanumeric codes
Boolean Algebra – Postulates, Switching function, Sum of Product, Product of Sum, switching circuits, simplification – rules, laws and theorems, Karnaugh map, Completely and incompletely specified functions, Quine – Mc Clauskey method.
Logic gates, Realization using logic gates, Design with NAND and NOR gates.

**Module 2**

Combinational logic circuits – adder – half and full, subtractor – half and full, Serial & Parallel adders, Carry save adder, Look ahead carry adder, BCD adder, Multiplexers, Encoders, Demultiplexers, Decoders, Comparators, Implementation of logic functions using multiplexers and decoders.

**Module 3**

Logic families – positive and negative logic, TTL NAND – analysis – characteristics, open collector gate, tri-state gates, ECL & IIL logic (Brief

explanation only), CMOS – Inverter, NAND, NOR, Characteristics, properties, Comparison of logic families, Typical IC's.

**Module 4**

Sequential logic Circuits – classification, flip flops – SR, JK, Master slave, D, T, applications, Truth table and Excitation table, Conversion of one type of flip flop to another.

Memories – ROM- organization of a ROM, Programmable ROMs, EPROM, EEPROM, PLD – PLA and PAL, RAM – basic structure, static and dynamic RAM.

**Module 5**

Shift registers – SISO, SIPO, PISO, PIPO, universal shift register, applications, Ring counter, Johnson Counter.

Binary counters – Asynchronous and Synchronous – Design, decade, Up-Down counters, Typical counter IC's.

**Text Book**

1. Digital Electronics and Logic Design - B. Somanathan Nair - PHI 2002
2. Digital Fundamentals, 8th Edition - Floyd, Pearson Education.

**References**

1. Logic and Computer Design Fundamentals, 2nd Edn. - Morris Mano & Charles R. Kime, Pearson Education.
2. Digital Integrated Electronics - Taub and Shilling, McGraw Hill.
3. Digital Logic – Applications and Design - John.M.Yarbrough- Vikas Thomson Learning



## C PROGRAMMING LAB

**T 307** **0+0+4**

1. Familiarization with computer system, Processor, Peripherals, Memory etc.
2. Familiarization of operating system-DOS, Windows etc. (use of files directories, internal commands, external commands, compilers, file manager, program manager, control panel etc.)
3. Familiarization with word processing packages like MS Excel, MS Access, MS PowerPoint and MS Word.
4. Programming experiments in C to cover control structures-functions-arrays-Structures-pointers and files.

(Any experiment according to the syllabus of RT304 can be included.)

## ELECTRONIC CIRCUITS LAB

**T308** **0+0+4**

1. Characteristics – Diode, Zener Diode, Transistor, FET, UJT, Determination of parameters.
2. Rectifiers with filters- Half Wave, Full wave& Bridge
3. Simple regulator circuits- series regulator.
4. Design of a single stage RC coupled amplifier. Determination of Bandwidth, Input & Output Impedances.
5. Wave shaping. Design of clipping, clamping, RC differentiator and Integrator.
6. Design of Astable multivibrator for specified time period sharpening edges.
7. Simple sweep circuits.
8. RC Phase shift oscillator. Wein bridge oscillator.

# FOURTH SEMESTER

## ENGINEERING MATHEMATICS - III

**CMELRPTA 401** **3+1+0**

**Module 1**

Ordinary Differential Equations: Linear Differential equations with constant coefficients - Finding P.I. by the method of variation of parameters –Cauchy's equations- Linear Simultaneous eqns- simple applications in engineering problems.

**Module 2**

Partial Differential Equations - formation by eliminating arbitary constants and arbitary Functions - solution of Lagrange Linear Equations –Charpits Method – solution of homogeneous linear partial differential equation with constant coefficients – solution of one dimensional wave equation and heat equation using method of separation of variables – Fourier solution of one dimensional wave equation.

**Module 3**

Fourier Transforms: - Statement of Fourier Integral Theorems – Fourier Transforms – Fourier Sine & Cosine transforms - inverse transforms - transforms of derivatives – Convolution Theorem (no proof) – Parsevals Identity - simple problems.

**Module 4**

Probability and statistics: Binomial law of probability - The binomial distribution, its mean and variance - poisson distribution as a limiting case of binomial distribution - its mean and variance - fitting of binomial & poisson distributions - normal distribution - properties of normal curve - standard normal curve - simple problems in binomial, poisson and normal distributions.

**Module 5**

Population & Samples: Sampling distribution of mean ($\sigma$ known) –Sampling distribution of variance, F and Chi square test – Level of significance - Type 1 and Type 2 errors – Test of hypothesis – Test of significance for large samples – Test of significance for single proportion, difference proportion, single mean and difference of mean (proof of theorems not expected)

**References**


1. Higher Engineering Mathematics - B.S. Grewal, Khanna Publishers
2. Engineering Mathematies Vol.II -3rd year Part A & B - M.K. Venkataraman, National Publishing Company
3. Elements of Partial Differential Equations - Ian N.Sneddon.,McGrawhill International Edn.
4. Miller and Fread's Probability and statistics for engineers – Richard A Johnson, Pearson Education Asia / PHI
5. A text book of Engineering Mathematics (Volume II) – Bali and Iyengar, Laxmi Publications Ltd.
6. Advanced Engg. Mathematics Erwin Kreyszig, Wiley Eastern Ltd. Probability and statistical inferences – Hogg and Tanis, Pearson Education Asia

## DATA STRUCTURES & ALGORITHMS

**T402** **3+1+0**

**Module 1**

Introduction, Data structures, Algorithms-Analysis of algorithms, Time & Space Complexity, Big O notation, Complexity calculation of simple algorithms.
Basic data structures-Arrays, Records, Sparse matrix representation & addition using arrays, Polynomial representation & addition using arrays, Stacks & Queues-Sequential Implementation, Circular queue, Priority queue & D queue.

**Module 2**

Linked lists- Linked stacks and queues, Doubly linked list, applications, Circular linked list, Polynomial representation using linked list

**Module 3**

Trees-basic terminology-binary tree-binary search tree-insertion, search, traversal, deletion, need for balancing, Balanced trees-AVL Trees & B Trees (basic idea only)

**Module 4**

Graphs –representation, traversal, applications
Hashing- Hashing functions, Collision resolution
Dynamic memory management, Storage allocation and compaction.

**Module 5**

Selection sort, insertion sort, bubble sort, radix sort, tree sort, heap sort, quick sort & merge sort
Sequential search, binary search, Interpolation search

**References**


1. Introduction to Data Structures with Applications - Tremblay & Sorenson, TMH
2. Data Structures in C & C++ - Tanenbaum, et., al., Pearson Education
3. Classic Data Structures – Samanta, PHI
4. Data Structures and Algorithms – O.G.Kakde and U.A.Deshpande-ISTE Learning material
5. Data Structures and Algorithms in C++- Adam Drozdek, Vikas Thomson Learning.
6. Data Structures and Program design in C - Robert L Kruse, et.al., Pearson Education
7. Introduction to Algorithms – Thomas.H.Coreman-PHI
8. Fundementals of Data Structures in C++ - Horrowits and Sahni- Galgotia
9. Algorithms + Datastructures = Program- NiklausWirth, PHI

## LINEAR INTEGRATED CIRCUITS & APPLICATIONS

**T 403** **2+1+0**

**Module 1**

Operational Amplifiers – Block diagram, Equivalent circuit, Ideal Op Amp-characteristics, Non-ideal Op Amp - finite open loop gain, offset voltage, bias current, drift, frequency response, band width, CMRR, circuit stability and slew rate.

Inverting, Non Inverting Amplifier, Integrator. Differential Amplifiers, Instrumentation Amplifiers, V to I and I to V converters, Precision rectifiers.

**Module 2**

Active Filters: Butterworth and Chebyshev filters- I & II order filters – low pass, high pass, band pass, band reject, filter design.

Comparators, Oscillators, Multivibrators, Waveform generators.

**Module 3**

D/A converters- Weighted resistor, R-2R networks, Hybrid converters .

A/D converters- Successive approximation, Integrating ADC, Dual slope, Flash converters (parallel), Analog multipliers.

**Module 4**

Voltage regulators- voltage references, block diagram of linear voltage regulators, voltage regulator ICs and their design, three terminal voltage regulators, negative voltage regulators, dual tracking and switching regulators.

**Module 5**

PLL: Operating principle, lock range and capture range, applications of PLL, building blocks of PLL, LM 565 and its applications. Signal generators-monolithic waveform generators. IC power amplifiers.

**References**


1. OP-AMPS and Linear Integrated Circuits, 4rd Edn. - Ramakant A.Gayakwad, Pearson Education
2. OP-AMPS and Linear Integrated Circuits, 6th Edn. - Coughlin and Driscoll, Pearson Education.
3. Microelectronics Circuits - Sedra & Smith, Oxford University Press
4. Integrated Circuits - K.R.Botkar, Khanna Publishers.
5. Microelectronics - Jacob Millman & Arvin Grabel, McGraw Hill.
6. Electronics Circuits - Donald L.Schlling and Charles Belove

## COMPUTER SYSTEM ARCHITECTURE

**T 404** **3+1+0**

**Module 1 Introduction**

Organization & Architecture, Functional Units of a computer, CPU-Memory connection, Review of basic operational concepts like CPU registers, Instruction formats, Addressing modes, Instruction cycle, Interrupt, Operating system, Interconnection structures, Layered view of a computer system.

Internal architecture of a typical 8-bit Microprocessor (Intel 8085), Signals, Registers, Machine cycles

**Module 2 Instruction set**

Instruction set of 8085, Addressing modes-Register, Direct, Immediate, Indirect and Implicit addressing, examples

Instruction types – Arithmetic, Logic, Data transfer, Branch, Stack, I/O and Machine control Instructions, examples (Assembly language programming not intended)

**Module 3 CPU organization.**

Processor Organization-Single bus and 2 bus organization, execution of a complete instruction, Hardwired and micro programmed control units, Sequencing, Horizonal & vertical microprogramming.

Arithmetic-Review of addition & subtraction techniques, Carry look ahead & Carry save addition, Multiplication-array multiplier, Booth's algorithm, Division-Restoring & non- Restoring division

**Module 4 Memory Organization.**

Memory Hierarchy, characteristics, Memory system considerations, High speed techniques-Cache memory, Associative memory, Memory interleaving, Virtual memory-paging.

**Module 5 I/O Organization.**

I/O Module- Functions & Structure, I/O Processor, I/O techniques-Programmed I/O, Interrupt driven I/O, DMA

Standard I/O interfaces: RS 232 C, GPIB, SCSI

**References**


1. Microprocessor Architecture, Programming & Applications – Ramesh S Gaonkar, Penram International
2. Computer Organization & Architecture -William Stallings, Pearson Education.
3. Computer Organization-Hamacher, Vranesic & Zaky, Mc Graw Hill
4. Computer System Architecture-Morris Mano, Pearson Education.
5. Computer Organization & Design-Pal Chaudhari, PHI

## SIGNALS AND SYSTEMS

**LTA 405** **2+1+0**

**Module 1**

Dynamic Representation of Systems - Systems Attributes- Causality linearity- Stability- time-invariance. Special Signals- Complex exponentials- Singularity functions (impulse and step functions).. Linear Time-Invariant Systems: Differential equation representation- convolution Integral. Discrete form of special functions. Discrete convolution and its properties. Realization of LTI system (differential and difference equations).

**Module 2**

Fourier Analysis of Continuous Time Signals and Systems - Fourier Series- Fourier Transform and properties- Parseval's theorem- Frequency response of LTI systems. Sampling Theorem.

**Module 3**

Fourier Analysis of Discrete Time Signals & Systems - Discrete-Time Fourier series- Discrete-Time Fourier Transform (including DFT) and properties. Frequency response of discrete time LTI systems.

**Module 4**

Laplace Transform - Laplace Transform and its inverse: Definition- existence conditions- Region of Convergence and properties- Application of Laplace transform for the analysis of continuous time LTI system (stability etc.) Significance of poles & zeros- Z-Transform - Z-Transform and its inverse: Definition- existence- Region of convergence and properties- Application of Z-Transform for the analysis of Discrete time LTI systems- Significance of poles and zeros.

**Module 5**

Random Signals - Introduction to probability. Bayes Theorem- concept of random variable- probability density and distribution functions- function of a random variable. Moments- Independence of a random variable. Introduction to random process. Auto and cross correlation. wide-sense stationarity- power spectral density White noise- Random processes through LTI systems.

**References**


1. Signals and Systems: Oppenheim Alan- V- Willsky Alan. S- Pearson Edn.
2. Communication Systems: Haykin Simon- John Wiley.
3. Signals and Systems: I J Nagrarth- Tata Mc Graw Hill.
4. Signals and Systems: Farooq Husain- Umesh pub.
5. Adaptive signal processing: W Bernad- Pearson Edn.

## OBJECT ORIENTED PROGRAMMING IN C++

**T 406** **3+1+0**

**Module 1**

Need for OOP- Characteristics of Object Oriented Language- Basic concepts and terminology-C++ and object oriented programming
C++ Programming basics, loops and decisions

**Module 2**

Structures- Structure specifier, accessing, nested structures, structures and classes.
Functions- Declarations, definition, argument passing.
Variables and storage classes

**Module 3**

Objects and classes –creation and usage, member functions, constructors and destructors Arrays- Definition, accessing, Arrays as class members, arrays of objects

**Module 4**

Operator overloading, Function overloading, Inheritance, Classification of inheritance, virtual functions, Polymorphism-Run time and compile time polymorphism.

**Module 5**

Advanced OO concepts- iterations and sequences, Virtual destructors, Virtual base classes, Templates, exceptions and exceptions handling, standard library design.

**References**


1. Object Oriented Programming in C++: Robert Lafore, Galgotia Publications
2. C++ Programming language: Bjarne Stroustrup, Pearson Education
3. Object Oriented Programming in C++: Nabajyoti Barkakati, PHI
4. C++ Primer: Lippman and Zajoie, Pearson Education
5. C++ for You++: Maria Litwin & Garry Litwin, Vikas Publishing
6. Object Oriented Programming Using C++: Ira Pohl. Pearson Educatión.
7. Standard C++ with Object Oriented Programming: Paul.S.Wang, Vikas Publishing.

## C++ & DATA STRUCTURES LAB

**T 407** **0+0+4**

### Using C++ Modern Compiler

1. Desk Calculator example.
2. Name spaces and Exceptions
3. Programming with Multiple files
4. Using classes, derived classes
5. Templates
6. Standard Library, standard containers, algorithms, Strings, Streams
7. Using a Debugger

(Any experiment based on the syllabus of T 402 can be substituted.)

Simple experiments based on the syllabus of T 402 - Arrays, Stack, Queues, Trees, Simple sorting and searching techniques.

## INTEGRATED CIRCUITS LAB

**T 408** **0+0+4**

1. Characteristics of TTL and CMOS gates.
2. Realization of logic circuits using TTL and CMOS NAND/NOR gates.
3. Arithmetic Circuits- Half adder, Full adder, 4-bit adder/subtractor.
4. Realization of RS, T, D, JK and Master-Slave Flip-flops using gates and study of flip-flop ICs.
5. Shift Registers, Ring Counter and Johnson Counter.
6. Counters- synchronous and asynchronous, using flip-flops.
7. Operational amplifiers- Measurement of parameters.
8. Inverting and non-inverting amplifiers, Summing amplifiers.
9. Weinbridge Oscillator.
10. Triangular and square wave generators using OP-AMPs.
11. IC Voltage regulator, fold back protection.
12. IC power amplifier
13. VCO, PLL
14. Filters- LP, HP and BP, Notch Filter.

# FIFTH SEMESTER

## ENGINEERING MATHEMATICS - IV

**RT 501** **3+1+0**

**Module 1 QUEUEING THEORY**

General Concepts - Arrival pattern - service pattern - Queue disciplines - The Markovian model M/M/1/$, M/M/1/N - steady state solutions – Little's formula.

**Module 2 NUMERICAL METHODS**

Introduction - solution of algebraic and transcendental equations - Bisection method - Method of false position - Newton's method - Approximate solution of equations – Horner's method solutions of linear simultaneous equations - Iterative methods of solution-Jacobi's method - Gauss Seidal method.

**Module 3 FINITE DIFFERENCES**

Meaning of operators – $\Delta, \nabla, \mu, \delta, E$ - interpolation using Newton's forward and backward formula - Langrange's and Newton's divided difference interpolation formula - numerical differenciation - first and second order derivatives using forward and backward formula - numerical integration - trapizoidal rule - Simpson's 1/3 and 3/8 rules.

**Module 4 LINEAR PROGRAMMING PROBLEM**

Graphical solution of LPP- general problem - solution of LPP using simplex method - Big M method – duality in LPP.

**Module 5 TRANSPORTATION AND ASSIGNMENT PROBLEM**

Balanced transportation problem - initial basic feasible solution -Vogel's approximation method - optimum solution by Modi method - Assignment problem - Hungerian techniques

**References**


1. Operations Research - P.K. Gupta & D.S. Hira, S.Chand & Co. Ltd
2. Advanced Engg Mathematics - Ervin Kreyszig, Wiley Eastern Ltd.
3. Higher Engg. Mathematics - Dr. B.S. Grewal, Khanna Publishers.
4. Operations research Schaum's Outline Series - Richard Bronson,
5. Operations research - Panneer Selvam, PHI
6. Numerical Methods in Science & Engg. National Publishing Co.- M.K. Venkataraman,

## OPERATING SYSTEM CONCEPTS

**T 502** **4+1+0**

**Module 1 Introduction**

O.S. Objectives and functions, evolution of O.S, Basic concepts and terminology, O.S. hierarchy, Different types of O.S – multiprogramming, time sharing, real time, microkernel, multithreading, multiprocessing, distributed O.S etc. (basic idea only), Windows – 2000 overview, UNIX overview.

**Module 2 Process Management**

Process – states, model, description, process hierarchy, scheduling, scheduler organization, scheduling strategies, Process synchronization – interacting processes, co-ordinating processes, critical section, deadlock, semaphores.

Processes and Threads, Multithreading, Multiprocessing, Brief study of process management in UNIX and Win 2000.

**Module 3 Memory Management**

Memory management requirements, Techniques, Partitioning, Paging, Segmentation, Virtual memory – hardware and software support, Brief study of memory management in UNIX, Linux, Win 2000 and Solaris.

**Module 4 I/O and File Management**

Design issues, Model of I/O organization, Disk scheduling policies and algorithms – RSS, FIFO, PRI, LIFO, SSTF, SCAN, C-SCAN, FSCAN etc. , Disk cache, File management systems, file system architecture, file organization and access, Directory structure, File allocation, sharing and security, Brief study of file management in Unix and Win 2000.

**Module5 Distributed Systems**

Advantages, Disadvantages, comparison of Network and distributed O.S, Client-Server architecture, Distributed message passing – RPC, Distributed Process management, Distributed memory management, Clustering – cluster computer architecture, win 2000 cluster server.

**Text Books**

1. Operating systems, 4th Edition - William Stallings, Pearson Edn.
2. Operating system Concepts - Silber Schatz, John Wiley.

**References**

1. Operating Systems - Nutt, Pearson Edn.
2. Modern Operating System - Tannenbaum, PHI
3. Understanding Operating System - Flynn, McHoes, Thomson Publications.
4. System Programming and Operating System - Dhamdhere, TMH.
5. Guide to Operating Systems- Michel Parmer & Michel Walters, Vikas Thomson Learning

## DATA BASE MANAGEMENT SYSTEMS

**RT503** **3+1+0**

**Module 1**

Basic Concepts - Purpose of database systems-Components of DBMS – DBMS Architecture and Data Independence- Data modeling - Entity Relationship Model, Relational – Network- Hierarchical and object oriented models-Data Modeling using the Entity Relationship Model.

**Module2**

Structure of relational databases – relational databases – relational algebra- tuple relational calculus. Data definition with SQL, insert, delete and update statements in SQL – views – data manipulation with SQL

**Module 3**

Introduction to Transaction Processing- Transaction and System Concepts- Desirable properties of Transactions- Schedules and Recoverability- Serializability of Schedules-Query processing and Optimization- Concurrency Control- -assertions – triggers.

Oracle case study: The basic structure of the oracle system – database structure and its manipulation in oracle- storage organization in oracle.- Programming in PL/SQL- Cursor in PL/SQL

**Module 4**

Database Design– Design guidelines– Relational database design – Integrity Constraints – Domain Constraints- Referential integrity – Functional Dependency- Normalization using Functional Dependencies, Normal forms based on primary keys- general definitions of Second and Third Normal Forms. Boyce Codd Normal Form– Multivalued Dependencies and Forth Normal Form – Join Dependencies and Fifth Normal Form – Pitfalls in Relational Database Design.

**Module 5**

Distributed databases: Distributed Database Concepts- Data Fragmentation, Replication and Allocation Techniques- Different Types- Query Processing – semijoin -Concurrency Control and Recovery.

**Text Book**

1. Fundamentals of Database System - Elmasri and Navathe (3rd Edition),Pearson Education Asia

**References**

1. Database System Concepts - Henry F Korth, Abraham Silbershatz , Mc Graw Hill 2nd edition.
2. An Introduction to Database Systems - C.J.Date (7th Edition) Pearson Education Asia
3. Database Principles, Programming and Performance – Patrick O'Neil, Elizabeth O'Neil
4. An Introduction to Database Systems - Bibin C. Desai

## MICROPROCESSORS

**T 504** **3+1+0**

**Module 1**

Evolution of 8086 family of microprocessors – 8088 to Itanium, Internal architecture of 8086, block diagram, Registers, flags, Programming model, 8086 and 8088, 8086 memory organization, segmented memory, Physical address calculation, Memory Addressing, Addressing modes.

**Module 2**

Instruction set, Classification of instructions – Data transfer, Arithmetic and Logic instructions, Program control instructions, Simple programs in 8086 Assembly language.

IBM PC Assembly Language Programming, Program Development Tools – DEBUG, MASM, TASM etc.

**Module 3**

8086 hardware design – bus buffering and latching, bus timing – read and write, timing diagram, ready and wait states, Minimum mode and Maximum mode, 8086 Memory interface, address decoding.

**Module 4**

Comparative study of the features of the 8086, 80286, 80386, 80486, Pentium, Pentium Pro, Pentium II, Pentium III and Pentium IV Processors.

Introduction to Micro controllers – architecture, applications.

**Module 5**

Study of Peripheral chips

8255 – Programmable peripheral interface

8251 - USART

8259 – Programmable interrupt controller.

8279 – Programmable keyboard and display interface.

8237 – DMA controller.

8254 – Programmable Interval Timer

Brief study of interfacing of Stepper motor, keyboard, 7-segment display and ADC with the Microprocessors.

**References**


1. The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium II, Pentium III and Pentium IV processors. Architecture, Programming and Interfacing, 6th Edn – Barry B Bray, Pearson Education Asia
2. The 80X86 family, 3rd Edn - John Uffenbeck, Pearson Education.
3. Micro computer Systems - The 8086/8088 Family, Architecture, Programming & Design- Liu & Gibson – PHI.
4. IBM PC Assembly Language Programming- Peter Abel, PHI
5. Microprocessors and Interfacing - Douglas V. Hall, TMH
6. Advanced Microprocessors & Peripherals- Roy & Bhurchandi, TMH

## LANGUAGE PROCESSORS

**RT 505** **3+1+0**

**Module 1 Assembler**

Overview of the assembly process- Design of two pass assembler- Single pass assembler- Macros – Macro definition and usage- schematics for Macro expansion – Design of a Macro pre-processor - Macro Assembler.

**Module 2 Introduction to Compilers**

Compilers and Translators – Structure of a compiler – lexical analysis – syntax analysis – context free grammars – basic parsing techniques- top down and bottom up parsing (brief idea only)- Recursive Decent parser – Shift reduce parser.

**Module 3 Storage allocation**

Data descriptors- Static and Dynamic storage allocation – Storage allocation and access in block structured programming languages – Array allocation and access- Compilation of expressions – Handling operator priorities – Intermediate code forms for expressions –code generator.

**Module 4 Compilation of Control Structures**

Control transfer- Conditional and Iterative constructs- Procedure calls – Code optimization – Optimization transformations – Local optimization and global optimization – Compiler writing tools – Incremental Compilers

**Module 5 Loaders and Linkers**

Loading – Program relocatability – linking – various loading schemes – linkage editing – Design of linkage editor – dynamic loading – overlays – dynamic linking.

**Text Books**


1. System Programming and Operating Systems – Dhamdhere Mc Graw Hill
2. Principles of Compiler Design - Aho A.V., Ullman Narosa Publications.


**References**


1. Systems programming - Donovan, Mc. Graw Hill.
2. System Software – An Introduction to Systems Programming - Leland L. Beck, Addison Wesley.
3. Compilers – Principles Techniques And Tools – Aho, Sethi, Ullman, Pearson Education Asia

## DATA COMMUNICATION

**RT 506** **2+1+0**

**Module 1**

Communication concepts – Analog modulation – Various schemes – AM, PM, FM –Sampling theorem - Analog pulse modulation – PAM, PWM, PPM – Generation of various modulated waves (Block diagram only) –Digital Pulse modulation (PCM).

**Module 2**

Multiplexing - Frequency Division Multiplexing (FDM) – Time Division Multiplexing (TDM), Synchronous Time Division Multiplexing –Statistical time Division multiplexing – Key Techniques - ASK, FSK, PSK, DPSK - Channel capacity - Shannon`s Theorem.

**Module 3**

Digital data transmission – Serial, Parallel, Synchronous, Asynchronous and Isochronous transmission. Transmission mode- Simplex - Half duplex – Full duplex, Noise- different types of noise – Basic Principles of Switching (circuit, packet, message switching)

**Module 4**

Error detection and Correcting codes: Hamming code – Block codes and convolution codes – ARQ techniques – Transmission codes – Baudot – EBCDIC and ASCII codes – Barcodes.

**Module 5**

Terminal handling – Point to point, Multidrop lines. Components of computer communication – Concentrators - Front end Processor – Transmission media – Guided media – Twisted pair cable, coaxial cable, fibre optic cable. GSM service and GSM system architecture.

**References**


1. Electronic communication system - Kennedy, Mc Graw Hill.
2. Principles of Communication System - Taub & Schilling Mc Graw Hill.
3. Introduction to Data Communications & Networking – Behurouz & Forozan Mc Graw Hill.
4. Data Communication, Computer Networks & Open Systems - Fred Halsall Pearson Education Asia
5. Principles & Application of GSM - Vijay K. Garg Pearson Education Asia
6. Modern Digital & Analog Communication Systems – B.P Lathi Prism Books Pvt. Ltd.
7. Computer Networks - A.S. Tanenbaum, PHI
8. Data and Computer Communication - William Stallings, Pearson Education Asia
9. Communication Engineering - A. Kumar, Umesh Publications

## DBMS LAB

**T 507** **0+0+3**

**Experiments for performing the following:**

1. Creation, Updating, Deletion of tables, indexes, views, reports, Queries, Relational Operations, Trigger
2. Importing and Exporting Data.
3. Use of Link Libraries.
4. Natural Language Support
5. Administration.
6. ODBC Interface
7. Exposure to Data Base management packages (Preferably on 4 GLs like ORACLE/INTEGRA/SYBASE, Foxpro or the latest packages)
8. Exercise in Pay Roll, Inventory Management, Library Management using the packages.

(Any experiment according to the syllabus of RT 503 can be substituted)

## MICROPROCESSOR LAB

**T 508** **0+0+3**

1. Study of 8 bit /16 bit microprocessor kit.
2. Assembly language programming with 8 bit /16 bit Microprocessor kit.
3. Interfacing experiments such as: -
   a. Stepper motor control.
   b. DAC/ADC interface.
   c. Data Acquisition Board.
   d. Keyboard interfacing.
   e. Video display board.
   f. LED moving graphic display board.
   g. Serial communication.
4. IBM PC Assembly language programming using MASM/TASM.

# SIXTH SEMESTER

## PROJECT MANAGEMENT

**T601** **3+1+0**

**Module 1 PROJECT PLANNING**

Overview – Capital expenditure - Phases of capital budgeting – Project development cycle – 7-s of project management – Requirements of a project manager – Forms of project organization.

**Module 2 PROJECT ANALYSIS**

Market Analysis – Technical Analysis - Financial Analysis – Risk Analysis – Social cost Benefit Analysis.

**Module 3 CONTROL OF PROJECT**

Control Systems – Control of major constraints – Project management software & information systems.

REVIEW: Performance of Evaluation – Abaudonment Analysis – Behavioral issues in Project Management

**Module 4 TOTAL QUALITY MANAGEMENT**

Quality systems – ISO 9000 series – ISI – Benchmarking – Quality Function development (QFD) – Total Productive Maintenance (TPM) – ISO 14000.

**Module 5 CONCEPTS IN SAMPLING**

Sampling designs and schemes – Errors in sampling – Simple random sample – stratified random sample – Cluster sample.

Sample size destination – Estimating population mean – Estimating population proportion.

**References**


1. Projects preparation, Apprisal, Budgeting & Implementation – Prasanna Chandra – Tata McGraw Hill
2. PROJECTS – Planning, Analysis, Selection, Implementation & Review - Prasanna Chandra – Tata McGraw Hill
3. Project Management - Harvey Maylor - Pearson Education
4. Total Quality Management – Dale H. Besterfield – Pearson Education
5. Quality control and Improvement – Amitava Mitra – Pearson Education
6. Quality assurance and TQM – Jain & Chitale – Khanna Publishers

## SOFTWARE ENGINEERING

**RT 602** **2+1+ 0**

**Module 1 Introduction to Software engineering**

Introduction – Software and software Engg.- Phases in software development- Software development process models-Role of Management in software development –Role of Matrics and measurement –Software requirement specification(SRS) - Problem Analysis - validation .

**Module 2 Project Planning**

Cost Estimation – Uncertainties – models – COCOMO model – Project scheduling – average duration estimation – Project scheduling and milestones – staffing and personal plan – Rayleigh curve – personnel plan – team structure – software configuration – management plans – quality assurance plans – verification and validation – inspections and reviews - project monitoring plans - time sheets – reviews – cost schedule – milestone graph – risk management.

**Module 3 System Design**

Design Principles – Problem partitioning and hierarchy – abstraction – modularity – top down and bottom_up – strategies – module level concepts - coupling - cohesion – structured design methodology - verification - matrics.

**Module 4 Coding**

Top-down and Bottom-up - Structured Programming - Information Hiding - Programming style - Internal Documentation – Verification - Code Reading - Static Analysis - Symbolic execution - Proving Correctness - Code inspections – - Unit testing.

**Module 5 Testing**

Testing fundamentals - Functional and Structured Testing - Testing Process - Comparison of Verification and Validation Techniques - Reliability assessment - Programmer Productivity - Error removal efficiency.

**Text Book**


1. An integrated approach to Software Engineering - Pankaj Jalote. Narosa Publication


**References**


1. Software Engineering - Roger S. Pressman, Tata McGraw Hill
2. Software Engineering - Ian Sommervilla, Pearson Education
3. Software Engineering Theory and Practice- Shari Lawrence, Pearson Education Asia
4. Fundamentals of Software Engineering –Rajib Mall, PHI
5. Fundamentals of Software Engineering – Carlo Ghezzi, Mehdi Jazayeri, PHI

## DIGITAL SIGNAL PROCESSING

**LTA 603** **3+1+0**

**Module1**

Review of signals and systems. Introduction - advantages and limitations of Digital Signal Processing. Infinite Impulse Response (IIR) Filters - Signal Flowgraph- Basic Network structure for IIR filter- Direct- Cascade- Parallel Forms. Design of IIR Digital filters from analog filters- Butterworth design- Chebyshev design- design based on numerical solutions of differential equations- Impulse Invariant Transformation.

**Module 2**

Finite Impulse Response (FIR) Filters: Linear phase FIR filters- Frequency response of linear phase FIR filters - Location of the zeros of linear phase FIR filters. Realization of FIR- cascade - lattice design-Fourier Series method- using windows-rectangular- triangular or barlett windows- hanning- hamming- Blackman- Kaiser windows.

**Module 3**

Discrete fourier Transform: Properties-Circular convolution- Linear Convolution using DFT- relation between Z- Transform and DFT- Fast Fourier Transform: decimation – in time and Frequency - FFT algorithms – General Computation using Radix 2 algorithm.

**Module 4**

Finite word length effects in digital filters: Introduction- Number Representation - Fixed Point- Sign-Magnitude - One's-complement- Two's - complement forms - Addition of two fixed point numbers- Multiplication in Fixed Point arithmetic - Floating point numbers- Block floating point numbers- quantization - truncation- rounding - effects due to truncation and rounding- Input quantization error - Product quantization error - Co-efficient quantization error- zero-input limit cycle Oscillations - Overflow limit cycle Oscillations - Scaling- Quantization in Floating Point realization IIR digital filters - Finite Word Length Effects in FIR Digital Filters- Quantization effects in the Computation of the DFT- quantization errors in FFT algorithms.

**Module 5**

Applications of digital signal processing: Speech Processing- speech analysis- speech coding- sub band coding- channel vecoder- homomorphic vecoder- digital processing of audio signals- Radar signal processing- DSP based measurements systems. Equi ripple FIR design- PCM DSP chips- a general study.

**References**


1. Digital signal processing: Ifechor- Pearson edn.
2. Desecrate time signal processing Oppenhiem- Pearson edn.
3. Digital signal processing: Oppenhiem and Sheffer- PHI
4. Introduction to Digital signal processing: Johny R Johnson
5. Digital signal processing: Proakis and Manolakis.
6. Digital signal processing: P Ramesh Babu- Scitech Pub.

## COMPUTER NETWORKS

**RT 604** **3+1+0**

**Module 1**

Introduction: - ISO-OSI Reference Model – TCP/IP Reference Model – Comparison Network hardware-Repeaters, Routers, Bridges, Gateways, Hub, Cable Modem.

Physical Layer: - Transmission Media– ISDN system Architecture – Communication Satellites – geostationary satellites - Medium Earth Orbit Satellites- Low earth orbit satellites– Satellite v/s Fiber

**Module 2**

Data Link Layer: - Design issues-Error Detection and correction – Elementary Data link protocols- Sliding window protocols. .

LAN Protocols: - Static & Dynamic channel allocation in LAN's and WAN's. Multiple access protocols – ALOHA – Pure ALOHA – Slotted ALOHA – Carrier Sense Multiple Access protocols – persistent and non-persistent CSMA – CSMA with collision detection – IEEE 802.3 standards for LAN

**Module 3**

Network layer: -Virtual Circuits, Datagrams, Routing Algorithm – Optimality principle - Flooding - Flow Based Routing - Link state routing – Distance vector routing – Multicasting – Link state multicasting – Distance vector multicasting - Congestion Control Algorithms – General principles – Packet discarding – Choke packets - Congestion prevention policies – Traffic shaping – Leaky bucket algorithm – Flow specifications – jitter control

**Module 4**

Transport Layer: - Transport Service - Elements of transport protocols – Internet Transfer Protocols UDP and TCP – ATM – Principle characteristics.

**Module 5**

Application Layer: -Domain name system – DNS name space – Resource records – Name servers – operation of DNS - Electronic Mail – MIME

Mobile networks: - Mobile telephone systems, Bluetooth - Components – Error correction – Network topology – Piconet and scatternet – L2CAP layers – Communication in Bluetooth networks

**References**


1. Computer Networks (Fourth Edition): Andrew S.Tanenbaum, Pearson Education Asia/ PHI
2. An Introduction to computer networking: Kenneth C. Mansfield Jr., James L. Antonakos, Prentice-Hall India
3. Communication Networks: Leon, Garcia, Widjaja Tata McGraw Hill.
4. Computer Networks (Second Edition): Larry L Peterson & Bruce S Davie, (Harcourt India)
5. Computer Networking: James F Kurose & Keith W Ross, Pearson Education
6. Introduction to Data Communications and Networking: Behrouz, Forouzan, McGraw Hill

## NETWORK COMPUTING

**RT 605** **3+1+0**

**Module 1**

HTML Documents

Basic Tags for Font & Paragraph Formatting Lists, Tables, Frames, image Maps

Cascading Style Sheets

Style Element, Inline style sheets, Embedded style sheets, External Style sheets, CLASS Attribute, Absolute and relative positioning of elements, DIV & SPAN Tags.

**Module 2**

Dynamic HTML Pages

Client side scripting - Java Script – variables, Arithmetic operations – message boxes, Arrays, control statements, functions, event handling, document object model.

Dynamic updating of pages with JAVA Script.

Embedding ActiveX controls - using the structured graphics – ActiveX Control.

**Module 3**

**Java programming** – Features of Java, Creating & using classes in Java – Static classes – Inheritance – Final methods, variables and classes – Interfaces - Nested classes – Inner classes – Anonymous Inner classes – Exception handling – Creating & using exceptions, Multithreaded programs and thread synchronization, creating and using packages, Creating GUI with AWT and Swing – -JDK1.1 event model

**Module 4**

**Network Programming with Java** - Features of Java – Applets & Application – Life cycle of applets - Security features for applets - Inter applet communication – Threads & Thread synchronization – TCP/IP Programming with Java – Iterative & Concurrent servers, Datagrams, IP multicasting, RMI (Structure and Working of a simple RMI Program only)

**Module 5**

HTTP Protocol working – HTTP methods, GET, PUT, DELETE, POST, HEAD

Server side scripting – HTML Forms & CGI – GET & POST, Basic working of a CGI supported web server – Simple CGI program in C to validate user name & Password.

Email: Working of SMTP and POP protocols (Overview only).

**Text Books**

**Module 1,2,5**


1. Internet and World Wide Web – How to program - Deitel, Deitel & Nieto, Pearson Education Asia
2. HTML, DHTML, Java Script, Perl, CGI - Evan Bayross, BPB

**Module 3,4,5**

1. Java 2 Complete reference - Herbert, Schildt, Tata McGraw Hill
2. The Java Programming Language 3rd Edition - Arnold, Gosling, Holmes, Pearson Education Asia
3. Using Java 2 Platform - Joseph Weber, PHI
4. Computer Networks - Tenanbaum, PHI/ Pearson Education Asia

**References**


1. Unix Network Programming - Stevens W Richard, PHI
2. TCP/IP Protocol suite, 2/e - Behrouz A. Forouzan, TMH


## PERSONAL COMPUTER HARDWARE

**T 606** **4+1+0**

**Module 1 Introduction to PC**

Hardware components – study of motherboards –Different types of ports, slots and connectors-Add-on cards-Power supply– SMPS- function & operations.

**Module 2 Storage Devices**

Floppy – Floppy Disk Controller - Disk Physical specification & operations – Disk magnetic properties – Cylinders – Clusters – Hard disks – Hard disk drive operation – Magnetic data storage - Sectors – Disk formatting – partitioning - Hard disk features – Hard disk data transfer modes –Programmed I/O – Direct memory access – Ultra DMA – Data addressing – Standard CHS addressing – Extended CHS addressing – Logical Block Addressing.

**Module 3 Optical Storage**

CD ROM, CD Technology, Sector layout, CD-R, CD-RW, CDROM, drive specifications- data transfer rate – Access time – Constant linear velocity – constant angular velocity - Buffers – Interface – Magneto optical drives – WORM devices –DVD- RAID – Holographic storage.

**Module 4 Memory Management in PC**

Parity – ECC – Static & Dynamic RAM – Memory Addressing – Segmented addressing - 64 KB Limits – 640 KB barrier – Logical, segmented, virtual, linear and physical memory addresses – Extended and Expanded memory – Cache memory – Video memory – HMA - Flat memory model – Advanced memory technologies.

**Module 5 Bus Structures**

ISA, PCI, PCMCIA, AGP, USB, Hard Disk Interfaces – IDE, EIDE, ATA – Communication ports – Serial – Parallel port – Keyboard / Mouse Interface connectors.

**References**


1. PC Hardware Complete Reference - Craig Zacker & John Rourke, Tata McGraw Hill

2. Inside the PC (8th Edition) - Peter Norton, Techmedia Publications
3. The Indispensable PC Hardware Book - Messmer, Pearson Education
4. Troubleshooting and Repairing Your PC - Corey Candler, Wiley
5. Upgrading and repairing PC's (4th edition) - Scott Mueller, Pearson Education
6. IBM PC Assembly Language Programming - Abel, PHI
7. PC Upgrading Maintenance & Trouble shooting guide - Dr. S. K. Chauhan, Kataria

## SYSTEMS PROGRAMMING LAB

**T607** **0+0+3**

1. Symbol table construction
2. Single pass and two pass assembler.
3. Macro processor module binder (with limited Instruction set)
4. Lexical analyzer.
5. Bottom Up and Top Down Parser.
6. Code generation.
7. Generation of code for linkers & loaders.
8. Study on UNIX: UNIX Shell Programming, Basic exercises in Processor Management – concurrent processing – memory management – implementation of shared memory and semaphores for process synchronization – device management – dead lock handling, implementation of simple protocols

(Any experiment according to the syllabus of T 502 and RT 505 can be substituted.)



## MINI PROJECT

**T608** **0+0+3**

The aim of the mini project is to prepare the students for the final year project. The topic for the mini project should be simple as compared to the main project, but should cover all the aspects of a complete project.

# SEVENTH SEMESTER

## OBJECT ORIENTED MODELING AND DESIGN

**RT 701** **2+1+0**

**Module 1**

**Introduction**: object oriented development-modeling concepts – object oriented methodology – models – object oriented themes-Object Modeling– links and associations – advanced links and association concepts – generalization and inheritance - grouping constructs – a sample object model- Advanced Object Modeling: aggregation – abstract classes – generalization as extension and restriction – multiple inheritance – metadata – candidate keys – constraints

**Module 2**

**Dynamic modeling:** Events and states – Operations – Nested state diagrams – Concurrency – Advanced dynamic modeling concepts – A sample dynamic model – Relationship of Object and Dynamic models.

**Functional modeling:** Functional models – Data Flow Diagrams - Specifying operations – Constraints – A sample functional model – Relation of functional to Object and Dynamic models.

**Module 3**

**Analysis:** Analysis in object modeling, dynamic modeling and functional modeling, Adding operations- Iterating the analysis

**System Design:** Breaking system into subsystems - Identifying concurrency-allocating subsystems to processors and tasks, managing of data stores. Handling of global resources- handling boundary conditions-Common Architectural Frameworks

**Module 4**

**Object Design:** Overview of Object design – Combining the three models – Designing algorithms – Design optimization – Implementation of control – Adjustment of inheritance - Design of association – Object representation – Physical packaging – Documenting design decisions-Comparison of methodologies

**Module 5**

**Other Models:** Booch's Methodology- Notations, models, concepts. Jacobson Methodology- architecture, actors and use-cases, requirement model, Analysis Model, Design model, Implementation model and Test Model-Unified Modeling Language (UML).

**Text Books**

1. Object Oriented Modeling and Design -JamesRumbaugh, Prentice Hall India
2. Object Oriented Analysis and Design with Applications - Grady Booch, Pearson Education Asia

**References**

1. Object Oriented Software Engineering - Ivan Jacobson, Pearson Education Asia

2. Object Oriented Software Engineering - Berno Bruegge, Allen H. Dutoit, Pearson Education Asia
3. Object Oriented Analysis and Design using UML - H. Srimathi, H. Sriram, A. Krishnamoorthy
4. Succeeding with the Booch OMT Methods -A practical approach - Lockheed Martin, Addison Wesley
5. UML and C++ practical guide to Object Oriented development - Richard C.Lee & William, Prentice Hall India.

## COMPUTER GRAPHICS

**RT 702** **3+1+0**

**Module1**

**Introduction to Computer Graphics:** Basic concepts in Computer Graphics – Applications of Computer Graphics, Interactive Graphics system – Raster scan and Random scan systems – Generating a raster image, Application of raster scan graphics. Video Display Devices, Display processors – Display files – graphical input & output devices.

**Module 2**

**2D Graphics:** Line drawing algorithms – DDA, Bresenham's – Bresenham's Circle drawing algorithm - 2D Transformations, Clipping – Line clipping – Polygon Clipping, Windowing.

**Module 3**

**3D Graphics:** 3D display methods, 3D Object Representation – Polygon Surfaces – Quadratic surfaces – Spline Representations – Bezier Curves and Surfaces – B-Spline Curves and Surfaces, 3D Transformations.

**Module 4**

**3D Rendering:** Three-Dimensional Viewing-Projections, Clipping, Visible Surface Detection – Classification of Visible surface detection algorithms – Back-face Detection, Depth- Buffer Method, Scan-line Method.
Surface Rendering Methods-Basic illumination Models – Polygon–rendering Methods, Gouraud Shading, Ray-Tracing Methods.

**Module 5**

**Advanced Technologies:** Fractals – Classification of Fractals – Self-Squaring Fractals, Animation- Raster Animation, Morphing.

**Text Book**

1. Computer Graphics (C version) - Donald Hearn & Pauline Baker (Pearson Education Asia)

**References**

1. Computer Graphics- Donald Hearn & Pauline Baker (Prentice Hall of India)

2. Principles of Interactive Computer Graphics – William .N. Newman, Robert .F. Sproull (second edition), McGraw Hill edition
3. Computer Graphics Principles & Practice - Foley, VanDam, Feiner, Hughes (second edition in C), Addison Wesley
4. Fundamentals of Computer graphics & - D. P. Mukherjee, Prentice Hall of India multimedia
5. Java 2 complete reference - Herbert, Schildt, Tata McGraw Hill
6. Computer Graphics - Roy A Plastack & Gordon Kally (Schanmi Series McGraw Hill edition)

## MODERN COMMUNICATION SYSTEMS

**T 703** **3+1+0**

**Module 1 Optical Fibre communication**

Advantages, Disadvantages, System block diagram, Fibre types, Cable configurations, Light propagation through optical fibre, Fibre configurations, Acceptance angle and acceptance cone, Cable losses, Light sources, Light detectors.

**Module 2 Microwave communication**

Advantages, Analog Vs Digital Microwave, Frequency modulated microwave radio system – Transmitter, Repeater, Receiver (block diagram only) Microwave terminal station – transmitter and receiver, path characteristics – fading.

**Module 3 Satellite Communication**

Satellite orbits, Geostationary satellites, Satellite classifications, Spacing, Frequency allocation, Satellite uplink and down link models (block diagram only), Earth station, Multiple accessing – FDMA, TDMA, CDMA, Satellite Radio Navigation, GPS (Basic idea only)

**Module 4 Mobile Communication**

Mobile communication services, Cellular telephone, Concepts – Cells, Frequency reuse, Interference, Cell splitting, Segmentation and Dualisation, Call system layout, Call processing, Analog and Digital Cellular Telephones, Block diagram of a typical transceiver, PCSS Mobile telephone system.

**Module 5 Advanced Concepts**

Concepts of Wireless LAN, ISDN-Protocol, Architecture, B-ISDN, ATM
Blue tooth Technology
WAP and WWW- Architecture, Protocols and Applications.

**Text Book**

1. Electronic Communication Systems, Fundamentals Through Advanced, 4th Edn - Wayne Tomasi, Pearson Education.

**References**

1. Electronic Communication Systems, TMH, 4th Edition. - Kennedy

2. Electronic Communications, PHI, 4th Edition. - Roddy & Coolen
3. Mobile Communications - Jochen Schiller, Pearson Education.
4. Electronic Communication systems, 3rd Edition - Frank R Dungan, VikasThomson Learning

## MULTIMEDIA TECHNIQUES

**T 704** **2+1+0**

### Module 1 INTRODUCTION

Definition of multimedia, multimedia, hardware, software applications and software environments, - Media Types - Analog and digital video, digital audio, music and animation - Analog & Digital video - Memory storage - Basic tools - Authoring tools.

### Module 2 BUILDING BLOCKS

Text - Hyper text - Sound - Sound cards - Standards - Image - Image types - Image compression, RLE, JPEG, MPEG - Fractal and Wavelet Compressions - Image file types - Animation - Capture and Playback techniques, (basic ideas only)

### Module 3 MULTIMEDIA ENVIRONMENTS

The Compact Disc family, CD-interactive, Digital Video Interactive, QuickTime, Multimedia PC and Microsoft Multimedia Extensions.

### Module 4 MULTIMEDIA PROGRAMMING

Framework: Overview, Media classes, Transform classes, Format classes and Component classes - Problems related to programming - Composition, Synchronisation, Interaction, Database integration.

### Module 5 ADVANCED MULTIMEDIA

Moving pictures - Techniques realistic image synthesis, Virtual Reality - Full motion digital video - Video capture techniques - multimedia networks - Desktop video conferencing - Future multimedia.

### References

1. Multimedia Programming Objects, Environments & Framework.- Simon J. Gibbs, Dionysios C. Tsischritziz (Addison-Wesley Publishing Co.)
2. Multimedia: Computing, Communications andApplications- Ralf Steinmentz and Klara Nahrstedt, Pearson Education.
3. Multimedia making it work - Tay Van Ghan – Osborne Tata Mcgraw Hill
4. Authoring Interactive multimedia - Arch C Luther
5. Optimizing your Multimedia PC - L.J. Skibbe, Susan Lafe Meister - Comdex
6. Multimedia Bible - Winn L. Rosch, Sams
7. Multimedia in Action - James E. Shuman, Vikas Publication
8. Multimedia Power Tools - Peter Jellam, Random house Electronic Pub.
9. Multimedia Computing - Mathew E. Hodger & Russel M. Sasnett, Addison wesley
10. Integrated Multimedia Systems - Palikom, The communication Wall Overview

## WEB TECHNOLOGIES

**RT 705** **2+1+0**

**Module 1**

Introduction to SGML – features - XML, XML as a subset of SGML – XML Vs HTML – Views of an XML document – simple XML documents – Starting & Ending of Tags – Attributes of Tags – Entity References – Comments - CDATA section

**Module 2**

Document Type declarations – Creating XML DTDs – Element type declaration – Attribute List Declaration – Attribute types – Attribute defaults – Displaying XML Data in HTML browser as HTML tables – Storing XML data in HTML document – Converting XML to HTML with XSL minimalist XSL style sheets – XML applications

**Module 3**

Java Beans: Features – Designing Java Beans – Creating and using properties – Induced - bound and constrained properties - using and creating events – Introspection – creating & using BeanInfo clauses – customization – providing custom property editors and GUI interfaces.

**Module 4**

JSPs - Creating simple JSP Pages – templating – Request time expression – Request & Response objects – Reading parameter values – Using Javabeans in JSPs - Reading & setting Properties of JavaBeans – Connecting forms & bean properties – Serialized beans – declaring variables & methods in pages – scriptlets – conditionals, loops & execution handling in JSPs with scriptlets – Accessing beans via scriptlets.

**Module 5**

EJB – Basics of EJB – Types of Beans – Development of Session Beans – Steps – Creating & Implementing Interfaces – Writing Deployment descriptors – Packaging and deploying bean - using the bean from a client – Development of stateful session bean. Entity beans – Features (Basics of developing and using entity beans)

**References**

**Module1, 2**

1. XML by Example: Building Ecommerce applications - Sean McGrath, Pearson Education Asia

**Module 3**

1. Using JAVA 2 Platform Special Edition - Joseph L. Weber, Prentice Hall of India
2. Java 2, AWT, Swing, XML and JavaBeans Programming Black Book - Steven Holzner, Wiley Dreamtech

**Module 4**

1. Java Server pages - Larne Pekowsky – Pearson Education Asia
2. JSP: Java server pages - Barry Burd, IDG Books India

**Module 5**

1. Mastering Enterprise Java Beans and the Java 2 Platforms, Enterprise Edition - EdRoman (WILEY computer publishing)
2. EJB Design Patterns - Floyd Marinescu

**Additional Reference**

1. Internet & Web Technologies - Raj Kamal, TMH

## ELECTIVE -I

**T 706** **3+1+0**

## LIST OF ELECTIVE SUBJECTS

| | | |
|---|---|---|
| 1. | CMELRPTA 706-01 | Optimization Techniques |
| 2. | T 706-02 | Digital Image Processing |
| 3. | RT 706-03 | Principles of real time systems |
| 4. | RT 706-04 | Windows Programming |
| 5. | RT 706-05 | Mobile Computing |
| 6. | RT 706-06 | Software Architecture |
| 7. | T 706-07 | Optical Communication |

**Note**

New Elective subjects related to the recent trends in Information Technology can be added to this list. Institutions offering such courses should submit the detailed syllabus and get it approved from the University before offering the course.



## OPTIMIZATION TECHNIQUES (ELECTIVE - I)

**CMELRTA 706-1** **3+1+0**

**Module1 Classical optimization techniques**

Single variable optimization – Multivariable optimization with no constraints – Hessian matrix – Multivariable saddle point – Optimization with equality constraints – Lagrange multiplier method – Multivariable optimization with inequality constraints – Kuhn- Tucker conditions.

Module 2 **One-dimensional Unconstrained minimization**

Elimination methods – unrestricted search method – Fibonacci method – Interpolation methods – Quadratic interpolation and cubic interpolation methods.

**Module 3 Unconstrained minimization**

Gradient of a function – Steepest descent method – Newton's method – Powells method – Hook and Jeeve's method.

**Module 4 Integer – Linear programming problem**

Gomory's cutting plane method – Gomory's method for all integer programming problems, mixed integer programming problems.

**Module 5 Network Technique**

Shortest path model – Dijkstra's Algorithm – Floyd's Algorithm – minimum spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm.

**References**


1. Optimization theory and application - S.S. Rao, New Age International P. Ltd.
2. Optimization Concepts and applications in Engineering - A. D. Belegundu, T.R. Chandrupatla, Pearson Education Asia.
3. Principles of Operations Research for Management - F. S. Budnick, D. McLeavey, R. Mojena, Richard D. Irwin, INC.
4. Operation Research an introduction - H. A. Taha, Eastern Economy Edition.
5. Operation Research – R. Panneerselvam, PHI


## DIGITAL IMAGE PROCESSING

**T 706-2** **3+1+0**

**Module 1**

Introduction to Digital Image Processing, The Fourier and Z-Transform of Multi dimensional Sequences, Digital image processing in practice, Digitalizing images, Characteristics of an image digitiser, Types of Image Digitisers, Image processing software, Software organization, processing sequence the gray level histogram, Introduction to histograms, Uses of histograms, Relations between histogram and image.

**Module 2**

Point operations, Uses, Linear point operations, Point operations and the histogram, Applications of point operations, Introduction to algebraic operations, Applications, Geometric operations, Grey level interpolation, Spatial transformation, applications, geometric operations, linear filtering theory - Harmonic signals and complex signal analysis.

**Module 3**

Convolution operation, Applications of digital filtering some useful functions, Convolution filtering – Dimension sampling, Reconstruction of images from its samples, Nyquist rate, Aliasing and foldover frequencies, Non rectangular grid sampling, Practical limitation in sampling and construction, Display aperture and interpolation, Moire effect and flat field response.

**Module 4**

Processing sampled data, Computing data, Truncation, Optics and System analysis, Diffraction limited optical systems, Abbreviation in an imaging system, Applications of Digital image processing – Image restoration, Approaches and models, Super resolution, System identification, DTF from degraded image spectrum, noise modeling.

**Module 5**

Image Segmentation by Thresholding, Optimal threshold selection, Gradient optical threshold selection, Gradient based methods, Region growing techniques – Segmented image structure. Measurement and classification size, shape, Measurements, Feature selection, Classification 3 dimensional image processing optical sectioning, CAT Stereo – Metric ranging, Stereoscopic image display – shaded surface display.

**References**


1. Digital Image Processing- Kenneth R. Castleman, Prentice Hall.
2. Digital Image Processing – Rafael C Gonzalez & Richard E Woods, Pearson Education
3. Discrete Time Signal Processing- Oppenheim and Schafer, Prentice Hall of India.
4. Fundamentals of Digital Image Processing- Anil K. Jain, Prentice Hall of India.
5. Introducing Digital Image Processing- Jensen J.R, Prentice Hall.
6. Image Processing, Analysis & Machine Vision –Sonka, Hlavac & Boyle, Thomson Learning


## PRINCIPLES OF REAL TIME SYSTEMS (ELECTIVE - I)

**RT706-3** **3+1+0**

**Module 1**

Introduction to Real Time Systems – Structure of real time systems, real time computer, task classes – Periodic, Aperiodic, critical, Non-critical, definition of real time systems – real time systems, embedded systems - Hard real time systems, soft real time systems, real time design issues.

**Module 2**

Real time kernel – polled loop systems, co-routines, interrupt driven systems – sporadic, fixed rate systems, hybrid systems, task control block - task status, scheduling – uniprocessor scheduling – traditional rate monotonic, rate monotonic deferred server, EDF, IRIS tasks – multiprocessor scheduling – utilization balancing algorithm, next-fit, bin- packing algorithm, myopic offline, buddy strategy (no need of proofs) fault tolerant scheduling.

**Module 3**

Communication – Communication Media and message sending topologies, network architecture issues, protocols – contention – based, token - based, stop and go multiloop, polled bus, hierarchal, round robin, fault tolerant routing – clocks and synchronization – fault tolerant synchronization in hardware, synchronization in software.

**Module 4**

Fault tolerance – definition, cause of failure, fault types, fault detection and containment, redundancy – hardware, software, time, information, integrated

failure handling – reliability – parameter values – series – parallel systems, NMR clusters, combinational model, master chain model, fault latency, transient faults, software error models.

**Module 5**

Programming Languages – Desired language characteristics, Real time databases, characteristics, main memory databases, Transaction, Disk schedule algorithms, Databases for hard real time systems, maintaining serialization constituency.

**Text Book**

1. Real Time Systems - C.M Krishna, Kang G. Shini (M?C Graw Hill)

**Reference**

1. Real Time Systems, Design & Analysis - Philip Laplante (IEEE)

## WINDOWS PROGRAMMING (ELECTIVE - I)

**R706-4** **3+1+0**

**Module 1**

Introduction -Concepts of Windows Programming- Event Driven Programming – Languages that support Windows Programming – Visual Basic – Java – Visual C++

Visual Basic Programming: Basic Language features – Variables, data types, constants, control statements – Forms – Creating and Using basic Controls – text boxes, labels, buttons - Event handling procedures – Properties Window – Common properties for Controls. Message boxes

**Module 2**

Visual Basic Programming (Contd) Standard Controls – List boxes, Comboboxes, Image box, picture box, Shape controls, Timer, Scrollbars, Frames, Checkboxes, Option Boxes – Frames - File, Drive and Directory List boxes - MDI and SDI interfaces – Menus

**Module 3**

ActiveX controls - RichTextBox, Tree View Control, List view Control, Progessbar, Flexgrid Control, Common dialog Controls – Font, File, Print Dialogs – Creating Custom activex controls – Creating Events and properties for ActiveX controls.

**Module 4**

Graphics and Multimedia – Drawing Graphics in Windows - setting colors - Drawing text, lines, ellipses, arcs, circles – plotting points –Filling figures with colors and patterns – Using clipboards to transfer images between applications Printing graphics and text – Creating animations with Picture clip control - applying image effects – stretching, flipping, embossing, egraving, blurring, sweeping – Using the Multimedia Control – Handling multimedia Errors

**Module 5**

Database Access – Using DAO, RDO and ADO for accessing databases – Creating tables, inserting, deleting and updating records – Using the Data Control – Using the ADO Data Control

Using Windows API: Using DLL Procedures in Visual Basic – Declare statement – Handling C++ and Windows Data types – Playing sound with API funtions – Capturing Images from the screen – Handling mouse outside Applications window – Making an 'always on top' window.

**References**


1. Visual Basic 6 Programming Black Book - Steven Holzner (Dreamtech Press)
2. Programming Windows fifth Edition - Charles Petzlod (Microsoft Press)
3. Visual Basic - Ivan Petrosaus (BPB)
4. Visual Basic - Garry Cornell (BPB)
5. Using Visual Basic - Resselman (PHI)


## MOBILE COMPUTING (ELECTIVE - I)

R706-5 **3+1+0**

**Module 1**

Introduction - Short History, Mobile telephone systemsSimplified Reference model. Multi carrier modulation. Cellular systems.

**Module 2**

Wireless Communication Systems -Telecommunication Systems-GSM & DECT-Architecture and Protocols.Satellite Systems-GEO, LEO, MEO.

Broadcast Systems-Broadcast transmission, Digital Audio Broadcasting-Multimedia Object Transfer Protocol. Digital Video Broadcasting.

**Module 3**

Wireless LAN and ATM - Infra red and Radio Transmission, Infrastructure and ad hoc networks, 802.11- Bluetooth- Architecture, Applications and Protocol. Layers, Frame structure. Comparison between 802.11 and 802.16.

Wireless ATM- Services, Reference Model, Functions, Radio Access Layer. Handover- Reference Model, Requirements, Types, handover scenarios.

Location Management, Addressing, Access Point Control Protocol (APCP).

**Module 4**

Mobile Network and Transport Layers - Mobile IP- Goals, Requirements, IP packet delivery, Advertisement and discovery, Registration, Tunneling and Encapsulation, Optimization, Reverse Tunneling, IPv6, Dynamic Host configuring protocol, Ad hoc networks – Routing, DSDV, Dynamic source routing, Hierarchical Algorithms.

Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Transmission.

**Module 5**

Wireless Application Protocol & World Wide Web

WAP- Architecture, Protocols-Datagram, Transaction, Session.-Wireless Application Environment-WML- Features, Script- Wireless Telephony Application.
WWW- HTTP, Usage of HTML, WWW system architecture.

**Text Book**

1. Mobile Communications – Jochen Schiller, Preason Education Asia

**References**

1. Computer Networks – Andrew S. Tanenbaum, PHI
2. Communication Networks -Fundamental Concepts and Key Architectures Leon-Garcia & Indra Widjaja, Tata McGraw Hill

## SOFTWARE ARCHITECTURE (ELECTIVE - I)

**R706-6** **3+1+0**

**Module 1**

Introduction to Software architecture – Architectural styles – pipes and filters – data abstract and object oriented organization – Event based, implicit invocation, Layered systems – Repositories – Interpreters – Process control – Heterogeneous Architectures.

**Module 2**

Shared Information Systems – Integration in software Development Environment – Integration in the design of Buildings – Architectural structures for based information systems

**Module 3**

Guidance for user interface architecture Artificial design space – Formal models and specifications-The value of architectural formalism – Formalizing the architecture of a specific system – Formalizing the architectural style – Formalizing an architectural design space

**Module 4**

Linguistic issues - Requirements for architecture – Description languages – first class connectors – Adding implicit invocation to factorial processing languages.

**Module 5**

Tools for architectural design – Unicon – Exploiting style in architectural design environments – Architectural interconnection

**Reference**

1. Software Architecture – perspectives on an emerging discipline- Mary Shaw, David Garlan, PHI

## OPTICAL COMMUNICATION

**T 706-7** **3+1+0**

**Module 1**

Optical fibres: Graded index and step index fibres- refractive index profiles, numerical aperture propagation of optical beams in fibres. Mode characteristics and cut off conditions (mathematical derivations required). MCVD technique for fibre fabrication, losses in fibres- attenuation, absorption, scattering and radiation losses.

**Module 2**

Signal distortion in fibres – Intra model and inter model distortion – group delay , material and wave guide dispersion. Optical sources : Light Emitting diodes – LED structures – surface and edge emitters, mono and hetero structures – internal – quantum efficiency , injection laser diode structures – comparison of LED and ILD.

**Module 3**

Optical Detectors: PN junction photo diodes, PN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance. Optical amplifiers (OAs): Need for OAs, Principles of operations of various OAs – SLAs, fibre amplifiers (FRA, FBA, EDFA). Comparison of performance.

**Module 4**

Optical communication systems: Direct detection and heterodyne receivers. SNR, advantage of coherent optical communications. Optical digital communications. Transmission link analysis, point to point links – system consideration – link power budget and rise time budget.

**Module 5**

Classification of light wave systems – linear systems: Intensity modulated Direct Detection (IMDD) and coherent systems. Non linear systems. Introduction to solitons –Solitons communications using lumped amplifiers, Bit error Rate performance.

**References**


1. Optical Fibre Communications- Gerd Keiser, Mc Graw Hill.
2. Fiber Optic Communications, 4th Edition. - Joseph C.Palais, Pearson Education.
3. Optical Fibre Communications- Senior, PHI.
4. Fibre Optic Communication – D C Agarwal, Wheeler Pub.
5. Optical Communication Components & Systems – Franz & Jain, Narosa Publishing.
6. Optical Communication Systems – Gowar, PHI

## MULTIMEDIA LAB

**T 707** **0+0+3**

1. Programs for
   a. Point plotting
   b. Line and circle drawing
   c. Line and Polygon clipping
   d. Transformations
   e. Hidden line elimination
   f. Curves
2. Web page design with HTML
3. Multimedia development using PowerPoint, 3D Studio, Adobe Photoshop.
4. Familiarization of latest multimedia development tools.

## COMMUNICATION SYSTEMS LAB

**T 708** **0+0+3**

1. Analog optical communication experiments based on optical communication kits / benches
2. Digital optical communication experiments based on optical communication kits / benches
3. Digital communication experiments based on trainer kits.
4. Design of digital filters (software simulation using MATLAB/ SIMULINK)
5. FFT, DFT Implementation using software simulation (MATLAB/ SIMULINK)
6. Study of transmission media – coaxial cables – Types-Hubs-Bridges-Repeaters-Routers-Gateways –Switches
7. Study of modems-NIC-Cable connectors and their usages
8. Study of Internet-accessing, services and applications
9. Simple network programming experiments in Java.



## PROJECT & SEMINAR

**T 709/ T 808** **0+0+3**

Each student is required to present a technical paper on subject approved by the department. The paper should, in general, reflect the state of the art technology. Report should be submitted to the department.

In addition to the seminar, the students shall undertake a project work (as a team or individually) in the 7th semester itself in consultation with the guide (s). On completion of the project work in the 8th semester, each student shall present the work done before a panel of staff members, and submit a report of the project work to the department.

# EIGHTH SEMESTER

## SECURITY IN COMPUTING

**RT 801** **2+1+0**

**Module1**

Introduction: Security basics – Aspects of network security – Attacks – Different types – Hackers – Crackers – Common intrusion techniques –Trojan Horse, Virus, Worm – Security services and mechanisms.

**Module 2**

OS Security – Protection Mechanisms –Authentication & Access control – Discretionary and Mandatory access control – Authentication mechanisms – Official levels of computer security (DoD) - Security breaches – Concept of a hole - Types of a holes – Study of the security features for authentication, access control and remote execution in UNIX, WINDOWS 2000

**Module 3**

Cryptography: Basic Encryption & Decryption – Transposition & substitution ciphers – Caesar substitution – Polyalphabetic substitutions – Crypt analysis – Symmetric key algorithms – Fiestel Networks – Confusion – Diffusion – DES Algorithm – Strength of DES – Comparison & important features of modern symmetric key algorithms – Public key cryptosystems – The RSA Algorithm – Diffice Hellman key exchange – comparison of RSA & DES – Message Authentication & Hash functions – Digital signature

**Module 4**

Network & Application Security: Kerberos – X509 Authentication service – IP security Architecture – Secure socket layer – Electronic mail security – Pretty Good privacy – S/MIME – secure Electronic Transactions – Firewalls - Security mechanisms in JAVA platform – Applet security – Security policy and SecurityManager.

**Module 5**

Database Security: - Security issues – SQL security DAC based on granting & revoking privileges – MAC 4 multilevel security – Statistical database security.

**Text Books**

**Module1, 4**

1. Network Security Essentials Applications & Standards - William S., Pearson Education Asia

**Module2**

1. Modern operating System - Andrew S. Tanenbaum, Pearson Education Asia
2. Using JAVA 2 platform - Joseph L. Weber, Prentice Hall of India

**Module3**

1. Cryptography and network security principles and practice - William Stallings, Pearson Education Asia
2. Information theory coding and cryptography - Ranjan Bose, TMH

**Module 4,5**

1. Designing security Architecture Solutions - Jay Ramachandran, Wiley Dreamtech

**Module 5**

1. Database Security Mechanisms for Computer Network - Sead Muftic, John wiles

**References**


1. Security in Computing - Charles P. Pfleeger IEEE Computer Science Press
2. Database Security Mechanisms for Computer Network - Sead Muftic, John wiles
3. Designing Security Architecture Solutions – Jay Ramachandran, Wiley dreamtech
4. Firewalls Complete - Marcus Gonsalvus, TMH
5. Networking Technologies - Jaisal, Galgotia Publication
6. Security in Computer Operating System - G.O.Shea, NCC Blackwell Manchester Oxford
7. Mastering JAVA security: Cryptography, Algorithms and Architecture - Rich Helton, Wiley Dreamtech
8. Implementing IPv6 - Mark A. Miller P.E, IDG Books


## INFORMATION SYSTEMS AND MANAGEMENT

**T 802** **3+1+0**

**Module 1**

Introduction, Management and Systems, Classical and systems approach to organization, Organizational theory, Management and organizational behaviour, Factors affecting productivity, Leadership Styles, Organizational Effectiveness, Managerial Grid, Tasks and functions of Management, General management system, ERP & Related technologies, MIS, DSS, EIS.

**Module 2**

The management process and information needs, Data Bank concept, Information systems for decision making, Automation of Decision making, Management science and the Decision rule, Decision assisting Information systems – MIS, DSS, EIS, ERP.

**Module 3**

Management Information systems, Strategic and Project Planning for MIS, Conceptual system design, detailed system design, Implementation and maintenance. (Brief study only)

**Module 4**

ERP, Introduction, ERP-modules, benefits, market, Implementation Life cycle, Vendors, Consultants and Users, Future direction in ERP.

**Module 5**

Decision Support Systems – Managers and decision making, Decision Support Tools, Concept of DSS, Components, Basic concepts of Data Mining, Data Warehousing and Knowledge Management, Knowledge based decision support – Basic concepts only.

**References**

**Module 1,2&3**

1. Information Systems for Modern Management - Murdick, Ross & Claggett, PHI.

**Module 4**

2. Enterprise Resource Planning- Alexis Leon, TMH

**Module 5**

3. Decision Support Systems And Intelligent systems - Efraim Turban, Jay E. Aronson, Pearson Education.
4. Managing Information Technology- Bhushan Dewan, Vikas Publishing

## E-COMMERCE

**T803** **2+1+0**

**Module1 Introduction to Electronic Commerce**

E-Commerce Framework, Anatomy of E-Commerce Applications, E-Commerce Consumer & Organization Applications. E- Commerce and World Wide Web – Internet Service Providers, Architectural Framework for Electronic Commerce.

**Module 2 Electronic Payment Systems**

Types of Electronic Payment Systems, Digital Token Based Electronic Payment System, Smart Cards, Credit Cards, Credit card based Payment system, Online payment process, Risk in Electronic Payment Systems, Designing Electronic Payment Systems.

**Module 3 Electronic Data Interchange**

EDI – Architecture, Application in Business, EDI-Legal, Security and Privacy Issues, EDI standardization, EDI Envelope for Message Transport, Internet based EDI, EDI and MIME, Value added Network, EDI Gateways.

**Module 4 Intra Organizational E-Commerce**

Internal Information System, Work-flow Automation and Coordination, customization and internal Commerce, Supply Chain Management, Document Library, Types of Digital Documents, Technological Architecture for Internal Commerce, Corporate Data Warehouses, advantages of Data Warehouses.

**Module 5 Recent Trends in E-Commerce**

Marketing on the Internet, Advertising on the Internet, Multimedia in E-Commerce, Video Conferencing with Digital Videos, Broad Band Telecommunication, Frame & Cell Relays, Switched Multimegabit Data Service (SMDS), Asynchronous Transfer Mode, Mobile Computing and Wireless Computing.

**Text Book**

1. Frontiers of Electronic Commerce - Ravi Kalakota & Andrew B Whinston/Pearson Education

**References**


1. Global Electronic Commerce – J Christopher Westland & Theodore H K Clark
2. E- Commerce The cutting edge of Business - Kamlesh K Bajaj & Debjani Nag / Pearson Education


## ARTIFICIAL INTELLIGENCE

**RT 804** **3+1+0**

**Module 1**

Introduction – Definitions – AI application areas – Example problems- Problems and problem spaces - Problem characteristics – Problem solving by searching. Searching strategies – Breadth first search, Uniform cost search, DFS, Depth – Limited search, Bi-directional search – Constraint satisfaction search.

**Module 2**

Informed search, A* algorithm, Heuristic functions – Inventing Heuristic functions - Heuristic for constraint satisfaction problem – Iterative deepening – Hill climbing – Simulated Annealing.

**Module 3**

Game playing and knowledge structures – Games as search problem – Imperfect decisions – Evaluation functions – Alpha – Beta pruning – state of art game programs. Introduction to frames and semantic nets.

**Module 4**

Knowledge and Reasoning – Review of representation and reasoning with Logic – Inference in first order logic, Inference rules involving quantifiers, modus ponens, Unification, forward and backward chaining – Resolution.

**Module 5**

Introduction to Prolog – Representing facts – Recursive search – Abstract data types – Alternative search strategies – Meta predicates, Matching and evaluation, meta interpreters – semantic nets & frames in prolog.

**Text Books**

**Module 1,2,3,4**


1. Artificial Intelligence – A modern approach - Stuart Russell – Peter Narang, Pearson Education Asia
2. Artificial Intelligence - Rich E. - McGraw Hill Booq Company


**Module 5**


3. Artificial Intelligence - George F Luger, Pearson Education Asia


**Reference**


1. An Introduction to Artificial Intelligence – Eugene Charniak & Drew McDermot, Pearson Education Asia

## ELECTIVE - II

**T 805** **3+1+0**

**List of elective subjects**

| | | |
|---|---|---|
| 1. | CMELRPTA 805-01 | Advanced Mathematics |
| 2. | RT 805-02 | Client Server Computing |
| 3. | T 805-03 | High Performance Computing |
| 4. | RT 805-04 | Analysis and Modeling of Digital Systems |
| 5. | RT 805-05 | Distributed Computing |
| 6. | RT 805-06 | User Interface Design |
| 7. | T 805-07 | Satellite & Mobile Communication |
| 8. | T 805-08 | Data Compression |

**Note:**

New Elective subjects related to the recent trends in Information Technology can be added to this list. Institutions offering such courses should submit the detailed syllabus and get it approved from the University before offering the course.



## ADVANCED MATHEMATICS (ELECTIVE - II)

**CMELRTA 805-1** **3+1+0**

**Module 1 Green's Function**

Heavisides, unit step function – Derivative of unit step function – Dirac delta function – properties of delta function – Derivatives of delta function – testing functions – symbolic function – symbolic derivatives – inverse of differential operator – Green's function – initial value problems – boundary value problems – simple cases only

**Module 2 Integral Equations**

Definition of Volterra and Fredholm Integral equations – conversion of a linear differential equation into an integral equation – conversion of boundary value problem into an integral equation using Green's function – integral equation with separable Kernels – Integral equations of convolution type – Neumann series solution.

**Module 3 Gamma, Beta functions**

Gamma function, Beta function – Relation between them – their transformations – use of them in the evaluation certain integrals – Dirichlet's integral – Liouville's extension of Dirichlet's theorem – Elliptic integral – Error function.

**Module 4 Power Series solution of differential equation**

The power series method – Legendre's Equation – Legendre's polynomial – Rodrigues formula – generating function – Bessel's equation – Bessel's function of the first kind – Orthogonality of Legendre's Polynomials and Bessel's functions.

**Module 5 Numerical solution of partial differential equations**

Classification of second order equations- Finite difference approximations to partial derivatives – solution of Laplace and Poisson's equations by finite difference method – solution of one dimensional heat equation by Crank – Nicolson method – solution one dimensional wave equation.

**References**


1. Linear Integral Equation - Ram P.Kanwal, Academic Press, New York
2. A Course on Integral Equations - Allen C.Pipkin, Springer – Verlag
3. Advanced Engg. Mathematics - H.K.Dass, S.Chand
4. Advanced Engg. Mathematics - Michael D.Greenberge, Pearson Edn. Asia
5. Numrical methods in Engg. &Science - B.S.Grewal, Khanna Publishers
6. Generalized functions - R.F. Hoskins, John Wiley and Sons.
7. Principles and Techniques of Applied Mathematics - Bernard Friedman, John Wiley and sons
8. Principles of Applied Mathematics - James P.Keener, Addison Wesley.
9. Numerical methods - P.Kandasamy, K.Thilagavathy, K.Gunavathy, S.Chand & co


## CLIENT SERVER COMPUTING (ELECTIVE - II)

**RT 805-2** **3+1+0**

**Module 1 INTRODUCTION**

History - uses - Client Server Computing & Hetrogenous Computing - Cross Platform Computing Distributed Computing - The costs of Client Server Computing - Advantages and Disadvantages - Client Server Databases.

**Module 2 DESIGNS**

Fundamentals of client server design - Managing the interaction of client and server - Communications Techniques protocols & Client server interaction protocols - Preparing applications for client server - Optimizing applications for client server - Example client server implementations - Request acceptance dispatching - Execution of requests - Client server interaction using message.

**Module 3 MULTITASKING**

Multi programming vs multitasking - Processor - Advantages and draw backs of multiple processor - Child and parent processor - Case study Novell Netware and Windows NT - Developing server applications - Threads - Server communication model.

**Module 4 SYNCHRONIZATION**

Scheduling implementations - processing queues - context switching pre emptive systems - critical sections - mutual exclusion - semaphores - semaphore implementations in NT & Netware.

**Module 5 COMMUNICATIONS**

Network communication - Inter process communication - Building portable client server applications.

**References**


1. Novell's Guide to Client-Server Application & Architecture - Jeffrey D.Schqnk, Novell Press.
2. Client Server Computing - Dawna Travis Dewire, McGraw Hill.
3. Developing Client Server Applications -W.H.Inman, BPB.
4. Guide to Client Server Databases - Joe Salemi, BPB.
5. Client Server Strategies - David Vaskevitch, Galgotia.


## HIGH PERFORMANCE COMPUTING

**T 805-3** **3+1+0**

**Module1**

Introduction to parallel processing - Trends towards parallel processing - Parallelism in uniprocessor - Parallel computer structures-Architecture classification schemes - Indian contribution to parallel processing.

**Module 2**

Principles of pipelining and vector processing - Linear pipelining - Classification of pipeline processors - General pipelines - Instruction and Arithmetic pipelines – Design of Pipilined instruction unit-Prinnciples of Designing Pipeline Processors-Instruction prefetch and branch handling- Dynamic pipelines - Architecture of Cray-1.

**Module 3**

Array processors - SIMD array processors - Interconnection networks - Static vs dynamic networks - mesh connected networks - Cube interconnection networks - Parallel algorithms for array processors - SIMD matrix multiplication-Parallel sorting on array processors - Associative array processing - Memory organization.

**Module 4**

Multiprocessor architectures and Programming - Loosely coupled and Tightly coupled multiprocessors - Interconnection networks - Language features to exploit parallelism - Process synchronisation mechanisms.

**Module 5**

Dataflow computers - Data driven computing and Languages - Data flow computers architectures - Static data flow computer -Dynamic data flow computer -Data flow design alternatives.

**Text Book**


1. Computer Architecture & Parallel Processing - Kai Hwang & FayeA.Briggs, McGraw Hill


**References**


1. Elements of Parallel computing - V. Rajaraman - PHI
2. Super Computers - V. Rajaraman - Wiely arstern

**Module 2 Design Process**

Human Interaction with computers, Importance of Human Characteristics, Human consideration, Human Interaction speeds – Understanding Business function

**Module 3 Screen Designing**

Design goals - screen meaning and purpose, organizing screen elements- ordering of screen data and content – screen navigation and flow – visually pleasing composition – amount of information – focus and emphasis – presenting information simply and meaningfully – information retrieval on web – Statistical graphics – Technological considerations in Interface Design.

**Module 4 Windows and components**

Menus and navigation schemes, selection of windows, Selection of device based and screen based controls - text and messages – icons and images – Multimedia – colours- uses, problems, choosing colours.

**Module 5 Software tools**

Specification methods, interface building tools

**Interaction devices:** keyboard and function keys - pointing devices- speech recognition, digitization and generation – image and video displays – printers.

**Text Books**

1. The Essential Guide to User Interface Design – Wilbert O. Galitz, Wiley Dreamtech
2. Designing the User Interface – Ben Shneiderman, Pearson Education Asia

**References**

1. Human Computer Interaction – John M. Carroll, Pearson Education Asia
2. The Essentials of User Interface Design - Alan Cooper, Wiley Dreamtech



## SATELLITE AND MOBILE COMMUNICATION

**T 805-7** **3+1+0**

**Module 1**

Satellite Communication – review of basic concepts - emerging trends in communication satellites- orbits – Geosynchronous and sun synchronous orbits – Kepler laws – power systems and eclipses – station keeping – altitude control and stabilization, Frequency plan and reuse Transponders, relative power levels- Transmission path and path loss – power and link budget calculations – S/N ratio- saturation flux density and noise consideration – EIRP.

**Module 2**

Multiple access Techniques, Satellite earth station, special purpose communication satellite, satellite launch vehicles.

3. Parellel Processing for Super Computers & AI - Kai Hwange & Douglas Degneot
4. Mc Graw Hill
5. Advanced computer Architecture - Sima, Fountain and Kacsuk, Pearson Edn
6. High Performance Computer Architecture - Harold S. Stone, Addison Wesley.
7. Advanced Computing - Vijay P.Bhatkar, Asok V.Joshi, Aritban Basu, Asok K.Sharma.
8. Parallel Computers, Architecture and Programming – Rajaraman & Murthy, PHI

## ANALYSIS AND MODELING OF DIGITAL SYSTEMS (ELECTIVE - II)

**RT 805-4** **3+1+0**

**Module 1**

Introduction to VHDL: Digital system design - Role of hardware description language- Modeling digital systems – events, propagation delays and concurrency – waveforms and timing – signal values – shared signals – simulation model – synthesis model – Field Programmable Gate Arrays.

**Module 2**

Basic language concepts simulation: signals – Entity architecture – concurrent statements – Constructing VHDL models using CSAs – delays.

Synthesis: Interface from declarations, simple CSA statements, conditional signal assignment statements, and selected signal assignment statements.

**Module 3**

Modeling behavior Simulation: The process construct – programming constructs – the wait statement – attributes – generating clocks and periodic waveforms – using signals – modeling state machines – constructing VHDL models – programming errors.

Synthesis: language directed view – inference from within process – issues – signals vs. variables – latch vs. flip flop – the wait statement – state machine.

**Module 4**

Modeling structure: Describing structure – structural VHDL model – hierarchy, abstraction and accuracy – generics – component instantiation and synthesis – the generate statement

Subprograms: functions – procedures – sub program and operator overloading – packages and libraries.

**Module 5**

Basic I/O operations – the package TEXTIO – ASSERT statement – terminology and directory structure – simulation mechanics – synthesis mechanics – identifiers – data objects – data types – operators.

**Text Book**

1. Introductory VHDL - Sudhakar Yalamanchili, Pearson Education Asia.

**Reference s**


1. VHDL primer - J Bhaskar, Pearson Education Asia
2. Analysis and modeling of digital systems - Zainalabedin Navabi, McGraw Hill.


## DISTRIBUTED COMPUTING (ELECTIVE - II)

**RT805-5** **3+1+0**

**Module I Introduction**

Introduction to Distributed Systems, evolution, characteristics, design issues, user requirements, Network technologies and protocols – overview, MACH, AMOBEA- overview.

**Module 2 Distributed file system**

File service components, design issues, interfaces, implementation techniques, Sun Network File System – architecture and implementation, other distributed file systems – AFS, CODA. Name services – SNS name service model.

**Module 3 Communication in distributed systems**

Client server communication, Group communication, Message passing – features, synchronizations, RPC – model, implementation, stub generation, messages, marshalling, Server management. Distributed shared memory – Architecture, design issues, structure of shared memory space, replacement strategy, thrashing. Synchronization – clock synchronization, event ordering, mutual exclusion

**Module 4 Resource and Process management**

Features of scheduling algorithms, Task assignment approach, load balancing, load sharing, Process migration mechanisms, Threads – scheduling.

**Module 5 Consistency maintenance**

Transaction recovery – methods- intention lists, Fault tolerance – failures, Byzantine failures. Deadlocks in distributed systems – detection and prevention, centralized and distributed approaches.

**References**


1. Distributed Systems – Concepts and designing - George Coulouris, Jean Dellimore Tim Kindberg, Pearson Education Asia
2. Distributed Operating Systems - Andrew S. Tenenbaum Pearson Education Asia
3. Distributed Operating Systems - Concepts and designing - Pradeep. K.Sinha, PHI


## USER INTERFACE DESIGN (ELECTIVE - II)

**RT 805-6** **3+1+0**

**Module 1 Introduction**

Importance of user interface – definition, importance of good design, brief history – Graphical User Interface – Web User Interface – Principles of User interface design.

**Module 2 Design Process**

Human Interaction with computers, Importance of Human Characteristics, Human consideration, Human Interaction speeds – Understanding Business function

**Module 3 Screen Designing**

Design goals - screen meaning and purpose, organizing screen elements- ordering of screen data and content – screen navigation and flow – visually pleasing composition – amount of information – focus and emphasis – presenting information simply and meaningfully – information retrieval on web – Statistical graphics – Technological considerations in Interface Design.

**Module 4 Windows and components**

Menus and navigation schemes, selection of windows, Selection of device based and screen based controls - text and messages – icons and images – Multimedia – colours- uses, problems, choosing colours.

**Module 5 Software tools**

Specification methods, interface building tools

**Interaction devices:** keyboard and function keys - pointing devices- speech recognition, digitization and generation – image and video displays – printers.

**Text Books**

1. The Essential Guide to User Interface Design – Wilbert O. Galitz, Wiley Dreamtech
2. Designing the User Interface – Ben Shneiderman, Pearson Education Asia

**References**

1. Human Computer Interaction – John M. Carroll, Pearson Education Asia
2. The Essentials of User Interface Design - Alan Cooper, Wiley Dreamtech



## SATELLITE AND MOBILE COMMUNICATION

**T 805-7** **3+1+0**

**Module 1**

Satellite Communication – review of basic concepts - emerging trends in communication satellites- orbits – Geosynchronous and sun synchronous orbits – Kepler laws – power systems and eclipses – station keeping – altitude control and stabilization, Frequency plan and reuse Transponders, relative power levels- Transmission path and path loss – power and link budget calculations – S/N ratio- saturation flux density and noise consideration – EIRP.

**Module 2**

Multiple access Techniques, Satellite earth station, special purpose communication satellite, satellite launch vehicles.

**Module 3**

Spread spectrum Communication – Direct Sequence or Pseudo noise. Frequency hopping. Time hopping. Hybrid and Chirp spread spectrum systems. Applications of spread Spectrum.

**Module 4**

Mobile cellular communications – introduction – basic cellular system-performance criteria – uniqueness of mobile radio environment – operation of cellular systems – elements of cellular radio system design – general description – Frequency reuse – co channel interference reduction factor – desired C/I from a normal case in an omni directional antenna systems – hand off mechanism – cell splitting – consideration of the components of cellular system.

**Module 5**

Digital cellular systems – multiple access schemes – Global Systems for Mobile (GSM)- TDMA-CDMA-Miscellaneous Mobile systems. Intelligent cell concept. CDMA cellular radio network. Advanced intelligent network (AIN). AIN for mobile communications.

**References**


1. Electronics Communication 4th ed - Dennis Roody & John Coolen, PHI
2. Mobile Cellular Telecommunication -William C.Y Lee, Mc Graw Hill
3. Satellite Communications - D C Agarwal, Khanna Publishers.
4. Mobile Communications Satellite (Theory and Applications) - Tom Lodgdon, Mc Graw Hill.
5. Mobile and Personal Communication System and Services – Raj Pandya, PHI




## DATA COMPRESSION

**T 805-8** **3+1+0**

**Module 1**

Introduction – signal compression - fixed rate Vs variable rate – lossless Vs lossy compression – sources, channels and codes – components of compression system – issues – quantization – optimal and adaptive quantization.

**Module 2**

Predictive coding – DPCM – linear prediction – adaptive prediction – delta modulation – adaptive delta modulation.

**Module 3**

Transform coding – orthogonal transformations – bit allocation – performance gain of transform coding – sub band coding – coding based on models of human perception (human auditory system and visual system)

**Module 4**

Vector quantization – introduction – memoryless vector quantizers – llyod algorithm – vector quantization design – tree structured VQ – multistep VQ – product codes – grain/shape VQ – lattice VQ – feedback vector quantization –

vector predictive quantization – vector tree and trellis coders – adaptive VQ – VQ for speech coding – VQ for image coding.

**Module 5**

Compression standards – CELP standard for speech – JPEG standard for still images – ISO/MPEG standard for audio and video – introduction to fractal image compression – application of wavelet analysis in signal compression – data compression – review of entropy coding – Huffman, runlength, arithmetic and ziv – lempel coding.

**References**


1. Gersho A. Gray R.M, Vector Quantization and Signal Compression, Kluwer Academic Publishers.
2. Jayant N.S & Noll P., digital Coding of Waveforms – Principle and /applications to Speech and Video. – Prentice Hall.
3. Nelson M. Jean & Loup Gailly, The Data compression book, BPB publications.
4. Solari S.J, Digital Video/Audio Compression, McGrawHill.
5. Kondoz A.M, Digital Speech, John Wiley.
6. Rao R.M & Bopadikar A.S, Wavelet Transforms – Introduction to Theory and Applications, Addison Wesley & Longman Inc.


## ELECTIVE - III

**T 806** **3+1+0**

**List of elective subjects**

| | | |
|---|---|---|
| 1. | T 806-01 | Information Theory and Coding |
| 2. | RT 806-02 | Embedded Systems |
| 3. | RT 806-03 | Neural Network |
| 4. | RT 806-04 | Genetic Algorithm and Applications |
| 5. | RT 806-05 | Advanced Networking Trends |
| 6. | RT 806-06 | Data Processing and Analysis Techniques |
| 7. | RT 806-07 | Bio metrics |
| 8. | T 806-08 | Fuzzy Systems |

**Note**

New Elective subjects related to the recent trends in Information Technology can be added to this list. Institutions offering such courses should submit the detailed syllabus and get it approved from the University before offering the course.

## INFORMATION THEORY AND CODING

**T 806-1** **3+1+0**

**Module 1**

Information Theory: Concept of amount of information, units – entropy, marginal, conditional and joint entropies – relation among entropies – mutual information, information rate, channel capacity – redundancy and efficiency of a

channel, symmetric channels – binary symmetric channel (BSC), binary erasure channel (BEC), deterministic and noiseless channels – capacity of band limited Gaussian channels, Shannon – Hartley theorem – band width – SNR trade off – capacity of a channel of infinite bandwidth , optimum modulation systems.

**Module 2**

Source coding: Instantaneous codes – construction of instantaneous codes – Kraft's inequality, coding efficiency and redundancy, noiseless, coding theorem – construction of basic source codes –Shannon –Fano Algorithm, Huffman Coding. Cryptography: Secret key Cryptography, block and stream ciphers, DES, public key cryptography, Diffie- Hellman Public key distribution – RSA system, digital signatures.

**Module 3**

Codes for error detection and correction -parity check coding – linear block codes – error detecting and correcting capabilities – generator and parity check matrices – standard array and syndrome decoding – Hamming codes – encoding and decoding.

**Module 4**

Cyclic codes – description – generator and parity check matrices – encoding of cyclic codes – syndrome computation and error detection, decoding of cyclic codes, BCH codes- description and decoding. Reed Solomon codes, burst error correction –block and convolutional interleaving.

**Module 5**

Convolutional codes - encoding – time and frequency domain approaches, state. Tree and Trellis diagrams – Transfer function and minimum free distance – maximum likelihood decoding of convolutional codes – The Viterbi Algorithm. Sequential decoding – Stack Algorithm. ARQ schemes – performance of ARQ – Probability of error and throughput.

**References**


1. Communication Systems - Simon Haykin, John Wiley & Sons Pvt. Ltd.
2. Principles of Communication Systems - Taub & Schilling, Tata Mc Graw Hill, New Delhi.
3. Principles of Digital Communication - Das, Mullick & Chatterjee. Wiley Eastern Ltd.
4. Information and Coding Theory - Dr. P. S. Sathya Narayana Probability Dynaram Publications, Bangalore.
5. Error Control Coding Fundamental s and Application - Shu Lin & Daniel J.Costello Prentice Hall Inc., Englewood Cliffs, NJ.

## EMBEDDED SYSTEMS (ELECTIVE - III)

**RT806-2** **3+1+0**

**Module1 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 2 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 3 Embedded Communication System**

Serial Communication. PC-to-PC Communication. Serial Communication with the 8051 Family of Micro-controllers. Protocol Converter. Voice-over-IP. Embedded Applications over Mobile Network example MP3 Sound Player.

**Module 4 Real Time & Database Applications**

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

**Module 5 Java Applications & Future Trends in Embedded Systems**

Networked Java-Enabled Information Appliances. Embedded Process Control System. Mobile Java Applications. Appliance Control using Jini. System on a Chip (SOC). Smart Cards and the Cashless Society. Security in Embedded Systems.

**Text Book**

1. Programming for Embedded Systems - Dreamtech Software Team. Wiley Dreamtech

**Reference**

1. Fundamentals of Embedded Software where C and Assembly Meet – Daniel W Lewis.

## NEURAL NETWORKS (ELECTIVE -III)

**RT806-3** **3+1+0**

**Module 1**

Introduction - Principles - artificial neuron - activation functions - Single layer & multilayer networks - Training artificial neural networks - Perception - Representation - Linear separability - Learning - Training algorithms.

**Module 2**

Back Propagation - Training algorithm - Applications - network configurations - Network paralysis - Local minima - temporal instability.

**Module 3**

Counter Propagation networks: Kebenon layer - Training the cohenen layer - Pre initialising the wright vectors - statistical properties - Training the Grosbery layer - Full counter propagation network - Application.

**Module 4**

Statistical methods - Boltzmann's Training - Cauche training - Artificial specific heat methods - Applications to general non-linear optimization problems.

**Module 5**

Hopfield nets - Recurrent networks - stability - Associative memory - applications - Thermo dynamic systems - Statistical Hopfield networks - Bidirectional associative memories - Continous BAM - Adaptive resonance theory - Architecture classification - Implimentation.

**Text Book**

1. Neural Computing Theory & Practice - Philip D. Wasserman.

**References**

1. Neural Networks - Simon Haykins
2. Adaptive Pattern Recognition & Neural Networks - Pay Y.H.
3. An Introduction to neural computing - Chapman & Hall



## GENETIC ALGORITHMS AND APPLICATIONS (ELECTIVE - III)

**RT806-4** **3+1+0**

**Module 1 Architecture-Altering Operations**

Introduction, Previous Methods of Determining the Architecture of a Multi-Part Program - On the origin of new function- Architecture-Altering operations for Subroutines -Automatically Defined Iterations, Loops, Recursion, Storage. Self-Organization of Hierarchies and Program Architecture - Rotating the Tires on an Automobile – Boolean Parity Problem- Time-Optimal Robot Control Problem - Multi-Agent Problem - Using Architecture Altering Operations for Subroutines. Transmembrane Segment Identification Problem using Architecture-Altering Operations for Iterations-Fibonacci Sequence- Cart Centering.

**References**

**Module 1,2&3**

1. Information Systems for Modern Management - Murdick, Ross & Claggett, PHI.

**Module 4**

2. Enterprise Resource Planning- Alexis Leon, TMH

**Module 5**

3. Decision Support Systems And Intelligent systems - Efraim Turban, Jay E. Aronson, Pearson Education.
4. Managing Information Technology- Bhushan Dewan, Vikas Publishing

## E-COMMERCE

**T803** **2+1+0**

**Module1 Introduction to Electronic Commerce**

E-Commerce Framework, Anatomy of E-Commerce Applications, E-Commerce Consumer & Organization Applications. E- Commerce and World Wide Web – Internet Service Providers, Architectural Framework for Electronic Commerce.

**Module 2 Electronic Payment Systems**

Types of Electronic Payment Systems, Digital Token Based Electronic Payment System, Smart Cards, Credit Cards, Credit card based Payment system, Online payment process, Risk in Electronic Payment Systems, Designing Electronic Payment Systems.

**Module 3 Electronic Data Interchange**

EDI – Architecture, Application in Business, EDI-Legal, Security and Privacy Issues, EDI standardization, EDI Envelope for Message Transport, Internet based EDI, EDI and MIME, Value added Network, EDI Gateways.

**Module 4 Intra Organizational E-Commerce**

Internal Information System, Work-flow Automation and Coordination, customization and internal Commerce, Supply Chain Management, Document Library, Types of Digital Documents, Technological Architecture for Internal Commerce, Corporate Data Warehouses, advantages of Data Warehouses.

**Module 5 Recent Trends in E-Commerce**

Marketing on the Internet, Advertising on the Internet, Multimedia in E-Commerce, Video Conferencing with Digital Videos, Broad Band Telecommunication, Frame & Cell Relays, Switched Multimegabit Data Service (SMDS), Asynchronous Transfer Mode, Mobile Computing and Wireless Computing.

**Text Book**

1. Frontiers of Electronic Commerce - Ravi Kalakota & Andrew B Whinston/Pearson Education

**Module 2 Genetic Programming Problem Solver (GPPS)**

Elements of GPPS 1.0-Problems Illustrating GPPS 1.0 - Elements of GPPS 2.0 - Problems Illustrating GPPS 2.0 - Previous Work on Automated Analog Circuit Synthesis.

**Module 3 Automated synthesis of analog electrical circuits**

Synthesis of a Low-pass Filter and High-pass Filter The Role of Crossover in Genetic Programming.

**Module 4 Evolvable Hardware**

Evolvable Hardware and Rapidly Re-configurable Field-Programmable Gate Arrays

**Discovery of cellular Automata Rules**: Discovery of a Cellular Automata Rule for the Majority Classification Problem.

**Module 5 Programmatic Motifs for molecular Biology**

Automatic Discovery of Protein Motifs –Programmatic Motifs and the Cellular Location Problem.

**Parallelization and Implementation Issues**: Computer Time- Parallelisation of Genetic Programming –Implementation Issues.

**Reference**

1. Johin R. Koza, Forrest H Bennett III, David Andre, Martin A. Kean. " Genetic Programming III: Darwinian Invention and Problem Solving". Morgan Kaufmann, 1999.



## ADVANCED NETWORKING TRENDS (ELECTIVE – III)

**RT806-5** **3+1+0**

**Module I**

Ethernet Technology – Frame format – Interface Gap – CSMA/CD – 10 mbps Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless Ethernet – SONET – Sonet multiplexing, Sonet frame structure

**Module 2**

ISDN - Definition - Protocol architecture - System architecture - Transmission channels - ISDN interface, B-ISDN.

**Module 3**

ATM – ATM Principles – BISDN reference model – ATM layers – ATM adaption Layer – AAL1, AAL2, AAL3/4, AAL5 – ATM addressing – UNI Signaling – PNNI Signalling

**Module 4**

SATELLITE COMMUNICATION: Satellite communication principles - Geo stationary satellites - block schematic of satellite earth station - VSAT - VSAT networks - applications in personnel communication. (basic ideas only)

**Module 5**

Wireless Lan – Infrared Vs Radio transmission – Infrastructure & ad hoc n/w – IEEE 802.11 – Hiper Law – Bluetooth – Physical Layer – MAC layer – Networking - Security

**References**

**Module 1**

1. An introduction to Computer Networking - Kenneth C Mansfield. Jr., James L. Antonakos. PHI

**Module 1,2,3**

1. Communication Networks Fundamental Concepts & Key Architecture - Leon-Garcia – Widjaja, Tata McGraw Hill
2. Mobile Communication - Jochen Schiller, Pearson Education Asia

## DATA PROCESSING AND ANALYSIS TECHNIQUES (ELECTIVE - III)

**RT806-6** **3+1+0**

**Module 1**

Introduction to COBOL programming -elements of COBOL divisions, sections and paragraphs -Table writing - complete program in COBOL using various options verbs, statements-conditions and conditional statements.

**Module 2**

Table Handling – Occur clause – PERFORM verb – SET verb, SEARCH verb – Occurs depending clause – Sorting a Table.

**Module 3**

Processing of various file structures in COBOL Language – File description – Fixed Length Record – Statements – Sequential File with variable length record – Sorting and merging of files – Direct access files.

**Module 4**

Data warehousing – Definition – Multidimentional datamodel – OLAP operation – Data warehouse architecture – Warehouse Server – Metadata – OLAP Engine.

**Module 5**

Data mining – Definitions, KDD Vs Data mining, DBMS Vs DM – DM Techniques, Issues and Challenges in DM – DM application areas.

**References**


1. COBOL programming - M.K. Roy & D Ghosh Dastidar, Tata McGraw Hill
2. Data mining Techniques - Arun K Pujari (Universal Press)
3. Data mining Concepts and Techniques- Jawei Han & Micheline Kamber (Morgan Kunfmann Pub.)
4. Data Mining - Pieter Adriaans, Dolf Zantinge, Person Education Asia
5. Structured COBOL Programming- E. Rajasekar & S.Selvi (Anuradha Agencies)
6. Structured COBOL - A. S. Philippakis & Leonard, J. Kazmier (Tata McGraw Hill)

## BIOMETRICS (ELECTIVE - III)

**RT806-7** **3+1+0**

**Module 1**

Introduction – Benefits of biometric security – verification and identification – basic working of biometric matching – accuracy – false match rate – false nonmatch rate – failure to enroll rate – derived metrics – layered biometric solutions

**Module 2**

Finger scan – features – components – operation (steps) – competing finger scan technologies – strength and weakness

Facial scan - features – components – operation (steps) – competing facial scan technologies – strength and weakness

**Module 3**

Iris scan - features – components – operation (steps) – competing iris scan technologies – strength and weakness

Voice scan - features – components – operation (steps) – competing facial scan technologies – strength and weakness

**Module 4**

Other physiological biometrics-Handscan-retina scan- AFIS (automatic fingerprint Identification systems)-Behavieral Biometrics-Signature scan-Key stroke Scan.

**Module 5**

Biometrics Application – Biometric Solution Matrix-Bioprivacy-Comparison of privacy factor in different biometrics technologies - Designing privacy sympathetie biometric systems-Biometric standards - (BioAPI, BAPI) - Biometric middleware.

**Reference**

1. Biometrics -Identify Verification in a Networked World - Samir Nanavati, Michael Thieme, Raj Nanavati- WILEY-dreamtech

## FUZZY SYSTEMS

**T 806-8** **3+1+0**

**Module 1**

Introduction to Fuzzy sets and systems. Basics of fuzzy sets membership function, support of a fuzzy set, height – normalized fuzzy set, $\alpha$ – cuts (decomposition of a fuzzy set), set theoretic definitions on fuzzy sets, complement, intersection and union equality.

**Module 2**

Subsethood – basic definition based on membership functions. The law of the excluded middle and law of contradiction on fuzzy sets. Properties of fuzzy sets operations (logical proof only). Extension of fuzzy sets concepts – type –2 and level 2 fuzzy sets – examples.

**Module 3**

Operations on fuzzy sets – intersection, algebraic sum – product, bounded sum – product, drastic sum product, t -norms and t -conorms (s-norms) on fuzzy sets, typical parameterized t – norms and s-norms (with simplified proof). Extension principle and its applications.

**Module 4**

Fuzzy relation. Resolution form of a binary fuzzy relation. Operations on fuzzy relations – projection, max. – min. and min. and max., compositions cylindric extension. Similarity relations – reflexivity, symmetry, transitivity.

**Module 5**

Further operations on fuzzy sets and proposed by Zadeh – concentration dilation, contrast Intensification, a linguistic hedges, computation of the meaning of values of a linguistic variable, fuzzy algorithms, fuzzy engineering – applications of fuzzy controls, case studies.

**References**


1. Neural Fuzzy Systems - C.T Lin & C.S George Lee, Prentice Hall.
2. Fuzzy Systems Hand Book - Earl Cox, Associated Press.
3. Fuzzy Sets and Fuzzy Logic- Theory and Applications - Klir and Yuan, Prentice Hall of India.
4. IEEE Trans on Systems, Man & Cybernetics, vol. SMC – 3, No.1, January 1973, pp 28-44
5. Fuzzy Engineering - Bart Kosko, Prentice Hall.
6. Fuzzy Thinking, Bart Kosko - Hooper Collins Publications.




## INTERNET LAB

**T 807** **0+0+4**

1. Familiarization of Internet Accessing and Trouble shooting
2. Internet Programming with JAVA applets
3. Web development with XML, JAVA script, JAVA beans.
4. Implementation of Search Engine
5. Web Development with JSP and EJB
6. Familiarization to the latest web development tools

(Any experiment according to the syllabus of RT 605 and RT 705 can be substituted)

## PROJECT & SEMINAR

**T 709 / T808** **0+0+4**

Each student is required to present a technical paper on subject approved by the department. The paper should, in general, reflect the state of the art technology. Report should be submitted to the department.

In addition to the seminar, the students shall undertake a project work (as a team or individually) in the 7th semester itself in consultation with the guide (s). On completion of the project work in the 8th semester, each student shall present the work done before a panel of staff members, and submit a report of the project work to the department.

## VIVA VOCE

**T 809**

A comprehensive viva voce examination will be conducted to assess the student's overall knowledge in the specified field of Engineering. At the time of viva voce, certified report of seminar, mini project and project work are to be presented for evaluation.

# B.TECH. DEGREE COURSE

## SYLLABUS



# APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING BRANCH

# THIRD SEMESTER

## ENGINEERING MATHEMATICS - II

**CMELPA 301** **3+1+0**

**Module 1**

Vector differential calculus: Differentiation of vector functions- scalar and vector fields- gradient - divergence and curl of a vector function - their physical meaning - directional derivative - scalar potential- conservative field – identities - simple problems.

**Module 2**

Vector integral calculus: Line- surface and volume integrals- work done by a force along a path- application of Green's theorem- Stoke's theorem and Gauss divergence theorem.

**Module 3**

Function of complex variable: Definition of analytic function and singular points- derivation of C.R. equations in Cartesian co-ordinates- harmonic and orthogonal properties- construction of analytic function given real or imaginary parts- complex potential- conformal transformation of functions like $Z^n$, $e^z$, 1/z, Sin z, $z + k^2/z$ - bilinear transformation- cross ratio- invariant property- simple problems.

**Module 4**

Finite differences: meaning of $\Delta\nabla$, E, $\mu$, $\delta$ - interpolation using Newton's forward and backward formula- central differences- problems using Stirling's formula- Lagrange's formula and Newton's divided difference formula for unequal intervals.

**Module 5**

Difference Calculus: Numerical differentiation using forward and backward differences. Numerical integration- Newton-Cote's formula- trapezoidal rule- Simpson's $1/3^{rd}$ and $3/8^{th}$ rule- simple problems- difference equations - solutions of difference equations.

**References**


1. Advanced Engg. Mathematics: Erwin Kreyzing- Wiley Eastern. Pub.
2. Higher Engg. Mathematics: B. S. Grewal- Khanna publishers.
3. Numerical methods in Science and Engineering: M K Venkataraman- National Pub.
4. Numerical methods: S Balachandra Rao- University Press.
5. Advanced Engineering Mathematics: Michael D Greenberg- PHI.
6. Theory and Problems of Vector analysis: Murray Spiegel- Schaum's- Mc Graw Hill.

## NETWORK THEORY

**LA 302** **2+1+0**

**Module 1**

Source transformation- Mesh and Node voltage Analysis – Coupled circuits – Dot conventions – Analysis of coupled circuits.

**Module 2**

Network theorems-Super position theorem- Reciprocity theorem - Thevenin's theorem- Norton's theorem- Millman's theorem- Maximum power transfer theorem- Tellegen's theorem- Graph of a network -Trees- co-trees -Incident matrix- cut- set matrix-tie-set matrix- Analysis of networks- equilibrium equations.

**Module 3**

Fourier Analysis and Laplace transform - Fourier analysis of periodic signals- Trignometric and exponential forms- Non periodic signals and Fourier transforms- Frequency spectrum of periodic waveforms - Laplace Transform- Review of theorems-Laplace transform of important signal waveforms - Periodic functions- Initial value and final value Theorems- DC&AC transients- Solution of network problems using Laplace transform.

**Module 4**

Two-port Networks and Filters - Voltage and Current ratios of two - port networks -Admittance- impedance- hybrid and transmission parameters of two port networks. Passive filters as two port networks- Characteristics of ideal filters-Image impedance- Constant K low pass- High pass and Band pass filters- m-derived filters-Composite filters.

**Module 5**

Network Synthesis – Realizability concept – Hurwitz property – positive realness – properties of positive real function – Synthesis of R, L, RC and LC driving point functions – Foster and Cauer forms.

**References**


1. Network analysis -M.E Van Valkenburg, PHI
2. Circuits and Networks – analysis & synthesis – A. Sudhakar & S P ShyamMohan
3. Network and Systems -D Roy Chaudhary
4. Network analysis and synthesis -Franklin F Kuo – John Wiley & Sons
5. Engineering Circuit Analysis -W H Hayt & Jack Kennerly – Mc-Graw Hill

## ELECTRICAL TECHNONOGY

**LA 303** **2+1+0**

**Module 1**

D.C.Generator - O.C.C. – Condition for self excitation – field critical resistance – critical speed – Load characteristics of generators – Losses – power flow diagram – efficiency – Condition for maximum efficiency – Applications.

**Module 2**

D C motor - starter – 3 point and 4 point starters – torque equation – speed equation – speed torque – characteristics of shunt, series and compound motors – Losses – efficiency – Brake test – Swinburne's test – speed control – field control – armature control – series parallel control – applications.

**Module 3**

Transformers - transformer on no-load and load operation – phasor diagram – equivalent circuit – regulation – losses and efficiency – o.c. and s.c. test – applications – Design of step down transformers like 230/6-0-6V. – Basic principles of 3 phase tranformer – autotransformer – applications.

**Module 4**

A.C Machines - 3 phase induction motors – rotating magnetic field – torque equation – slip – torque-slip characteristics – operating characteristics – starting of 3 phase induction motors – starters – single phase induction motors – constructional features – types – working and characteristics only (no analysis) – constructional features of synchronous machines – principle of operation of alternator – emf equation – regulation by emf and mmf method – principle of operation of synchronous motor – starting of synchronous motor.

**Module 5**

Special Machines - A C and D C servo motors – synchros – constructional features – working of a tachogenerator – stepper motors – construction, working, applications and specifications of stepper motors – universal motors - constructional features – typical applications – criteria for selection of motors – electromagnetic relays – contactors.

**References**


1. Electrical & Electronic Technology: Hughes, Pearson Education
2. Electrical Technology: H. Cotton
3. Electrical Machines: R.K.Rajput
4. Electrical Design Estimating & Costing: K.B.Raina & Bhattacharya
5. Electrical Machines & Power systems: Vincent Del Toro

## SOLID STATE DEVICES

**LA 304** **3+1+0**

**Module 1**

Energy bands and charge carriers in semiconductors: energy bands- metals- semiconductors and insulators- direct and indirect semiconductors- charge carriers in semiconductors: electrons and holes- intrinsic and extrinsic material- n-material and p-material- carrier concentration: fermi level- EHPs- temperature dependance- conductivity and mobility- drift and resistance- effect of temperature and doping on mobility- hall effect.

**Module 2**

Diffusion of carriers- derivation of diffusion constant D- Einstein relation- continuity equation- p-n junctions: contact potential- equilibrium fermi levels- space charge at junctions- current components at a junction: majority and minority carrier currents- zener and avalanche breakdown- capacitance of p-n junctions.

**Module 3**

p-n junction diodes: volt-ampere characteristics- switching time- rectifier action- Zener diodes: volt-ampere characteristics- Tunnel diodes: tunneling phenomena- volt-ampere characteristics- Varactor diodes- Photo diodes: detection principle- light emitting diodes.

**Module 4**

Bipolar junction transistors: npn and pnp transistor action- open circuited transistor- biasing in active region- majority and minority carrier distribution- terminal currents- amplification and switching- $\alpha$ and $\beta$ gain factors- emitter efficiency $\gamma$- schottky transistors- photo transistors.

**Module 5**

Field effect transistors: operation- pinch off and saturation- pinch off voltage- gate control- volt-ampere characteristics- MOSFETS: n MOS and p MOS: comparison- enhancement and depletion types- control of threshold voltage- MOS capacitance.

**References**


1. Solid state electronic devices - Ben G Streetman- Pearson Education
2. Microelectronic Devices - Nagchaudhari, Pearson Education
3. Integrated electronics – Millman and Halkias- Mc Graw Hill.
4. Physics of semiconductor devices - S M Sze- Mc Graw Hill.
5. Semiconductor devices – Nagchoudhary- Tata Mc Graw Hill.
6. Physics of semiconductor devices - Shur- PHI.
7. Theory of Semiconductor devices - Karl Hess- PHI.

## ELECTRONIC CIRCUITS - I

**LA 305** **3+1+0**

**Module 1**

Rectifiers and Power supplies: Half wave- full wave and bridge rectifiers- working- analysis and design- C filter analysis- regulated power supplies: series and shunt- design of regulated power supplies for specified output conditions- current limiting- short circuit protection- IC regulated power supplies.

**Module 2**

Transistor as an amplifier: Transistor at low frequencies- h parameter model analysis- expression of voltage and current gain- input and output impedance- CE- CB and CC configurations- comparison- transistor parameters from static characteristics- FET: operation- characteristics- small signal model.

**Module 3**

Transistor Biasing: operating point- DC and AC load lines- Q point selection- bias stability- definition of stability factors- derivation of stability factor for $I_{CO}$ variation- fixed bias- collector to base bias- self bias circuits- bias compensation- compensation for $I_{CO}$ and $V_{BE}$.

**Module 4**

RC Coupled amplifier: working- analysis and design- phase and frequency response- FET amplifier: biasing- analysis and design.

**Module 5**

Wave shaping circuits: clipping- clamping- RC integration - differentiation- transistor as a switch- astable multivibrator- working and design - UJT- working and applications- simple sweep circuit.

**References**


1. Electronic devices and circuits: Boylsted & Nashelsky- Pearson Edn.
2. Integrated Electronics: Millman & Halkias- Mc Graw Hill.
3. Electronic Principles: Malvino- Tata Mc Graw Hill.
4. Electronic devices and circuits: Bogart- UBS.
5. Electronic devices and circuits: Allen Mottershed- PHI.
6. Electronic devices: Floyd- Pearson Edn.
7. Electronic devices and applications: B Somanathan Nair- PHI.
8. Electronic devices and circuits: J B Gupta- S K Kataria & Sons Pub.

## COMPUTER PROGRAMMING

**LA 306** **3+1+0**

**Module 1 Introduction to C**

C fundamentals - The character set - identifiers and keywords - Data types - constants - variables and arrays - declarations - expressions - statements - symbolic constants- arithmetic operators - Relational and Logical operators - The conditional operator - Library functions - Data input and output - getchar – putchar, scanf, printf - gets and puts functions - interactive programming.

**Module 2 Control Statements**

While - do while - for - nested loops -if else switch- break - continue - The comma operator - go to statement, Functions - a brief overview - defining a function - accesing a function - passing arguments to a function - specifying argument - data types - function prototypes - Recursion.

**Module 3 Program Structure**

Storage classes - Automatic variables - external variables - multi file programs. Arrays: defining an array - processing an array - passing arrays in a function – multi dimensional arrays - array and strings. Structures and unions: defining a structure - processing a structure - user defined data types - passing structure to a function - self referential structures - unions.

**Module 4 Pointers**

Fundamentals - pointer declaration - passing pointers to a function - pointers and one dimensional arrays - operations on pointers - pointers and multi dimensional arrays- passing functions to other functions.

**Module 5 Data Files**

Opening and closing of a data file - creating a data file - processing a data file, low level programming - register variables – bit wise operation - bit fields - enumeration - command line parameters - macros - the C pre-processor.

**Text Book**

1. Programming with ANSI and Turbo C: Ashok N Kanthane, Pearson Edn.

**References**

1. Theory and problems of programming with C- Gottfried, Schaum's series.
2. The C programming language - Kernighan & Ritche, PHI.
3. Programming Techniqes through C - Venkateshmurthy, Pearson Edn.
4. Programming in C - Balaguruswamy, Tata Mc Graw Hill.
5. Programming Ansi C - Ram Kumar.
6. Computer Programming - Rajaraman, PHI.

## ELECTRICAL ENGINEERING LAB

**LA 307** **0+0+4**

1. Measurement of Electric power (single phase and three phase) and energy using wattmeter and energy meter.
2. Study of star-delta connections.
3. O.C.C. and Load characteristics of D.C. generators.
4. Swinburne's test.
5. Load characteristics of D.C. shunt, series and compound motors
6. O.C and S.C test on single-phase transformer.
7. Load test on step-up/step-down transformer; calculation of efficiency and regulation at different power factors.
8. Study of starting of three phase induction motors and load test on squirrel cage induction motor.
9. Load test on slipring induction motor.
10. Study of stepper and servomotors.
11. Load test on single phase induction motor.
12. Pre-determination of regulation of the alternator by emf and mmf method.

## BASIC ELECTRONICS LABORATORY

**A 308** **0+0+4**

1. Familiarization of CRO, DVM, AF generator etc and Soldering practice.
2. Characteristics - Diode, Transistor, FET, UJT. Determination of parameters.
3. Design and testing of DC power supplies for specified output.
4. Design of Single stage RC coupled amplifier. Determination of Band width.
5. Design of FET amplifier. Determination of Band width.
6. Wave shaping. Design of clipping, clamping, RC differentiator & Integrator.
7. Design of Astable multi-vibrator for specified time period - sharpening of edges.
8. Simple sweep circuit.
9. Familiarization of data sheets of components – OA79, 1N4001, SZ6.8, BC107, BC547, BC557, BFW10, 2N2646.
10. Simulation of simple circuits using Spice.

**Note**

Students may assemble the circuits of the experiments on a universal P.C.B. and verify the results in order to get soldering practice

# FOURTH SEMESTER

## ENGINEERING MATHEMATICS - III

**CMELRPTA 401** **3+1+0**

**Module 1**

Ordinary Differential Equations: Linear Differential equations with constant coefficents - Finding P.I. by the method of variation of parameters –Cauchys equations- Linear Simultaneous eqns- simple applications in engineering problems.

**Module 2**

Partial Differential Equations - formation by eliminating arbitrary constants and arbitary Functions - solution of Lagrange Linear Equations –Charpits Method – solution of homogeneous linear partial differential equation with constant coefficients – solution of one dimensional wave equation and heat equation using method of separation of variables – Fourier solution of one dimensional wave equation.

**Module 3**

Fourier Transforms: - Statement of Fourier Integral Theorems – Fourier Transforms – Fourier Sine & Cosine transforms - inverse transforms - transforms of derivatives – Convolution Theorem (no proof) – Parsevals Identity - simple problems.

**Module 4**

Probability and statistics: Binomial law of probability - The binomial distribution, its mean and variance - poisson distribution as a limiting case of binomial distribution - its mean and variance - fitting of binomial & poisson distributions - normal distribution - properties of normal curve - standard normal curve - simple problems in binomial, poisson and normal distributions.

**Module 5**

Population & Samples: Sampling distribution of mean ($\sigma$ known) –Sampling distribution of variance, F and Chi square test – Level of significance - Type 1 and Type 2 errors – Test of hypothesis – Test of significance for large samples – Test of significance for single proportion, difference of proportion, single mean and difference of means (proof of theorems not expected).

**References**


1. Higher Engineering Mathematics - B.S. Grewal, Khanna Publishers.
2. Engineering Mathematics Vol.II -3rd year Part A & B - M.K. Venkataraman, National Publishing Company
3. Elements of Partial Differential Equations - Ian N.Sneddon.,McGraw Hill.
4. Miller and Fread's Probability and statistics for engineers – Richard A Johnson, Pearson Education Asia / PHI.
5. A text book of Engineering Mathematics (Volume II) – Bali and Iyengar, Laxmi Publications Ltd.
6. Advanced Engg. Mathematics Erwin Kreyszig, Wiley Eastern Ltd.
7. Probability and statistical inferences – Hogg and Tanis, Pearson Education Asia.

## DIGITAL ELECTRONICS AND LOGIC DESIGN

**LA 402** **3+1+0**

**Module 1**

Gates –Inverter - OR gates - AND gates - NOR Gates - De Morgan's Theorems - NAND Gates – EXCLUSIVE - OR Gates - Tristate Inverter - TTL Circuits - Digital Integrated Circuits - 7400 Devices - TTL Characteristics - TTL Overview - AND OR- NOT Gates - Open-Collector Gates – CMOS gates.

**Module 2**

Boolean Algebra and Karnaugh Maps - Boolean Relations - Sum-of-Products method - Algebraic Simplification - Karnaugh maps – Pairs – Quads - and Octets - Karnaugh Simplifications - Don't-Care Conditions. Multiplexers - de-multiplexers - decoder and encoder.

**Module 3**

Arithmetic-Logic Units - Binary Addition - Binary Subtraction - Half Adders - Full Adders - Binary Adders - signed Binary Numbers - 2's Complement - 2's-Complement Adder-Subtractor.

**Module 4**

Flip Flops - RS Latches - Level Clocking - D Latches - Edge-Triggered D & T Flip-Flops - Edge-Triggered JK Master-slave Flip-Flop.

**Module 5**

Registers and Counters - Buffer Registers - Shift Registers - Controlled Shift Registers - Ripple Counters - Synchronous Counters - Ring counters - Modulo counters - Three-State Register. ROMs – PROMs and EPROMs - RAMs. A small TTL Memory.



**References**


1. Digital Fundamentals: Floyd, Pearson Edn.
2. Fundamentals of digital circuits: A Anand Kumar, PHI
3. Digital Integrated Electronics: Taub and Shilling, McGraw Hill,
4. Digital electronics: D C Green, Pearson Edn.
5. Digital Logic and state machine design: Comer, Oxford.
6. Digital electronic principles and applications: A K Maini, Khanna Pub.
7. Digital electronic principles: Malvino and Leach, Mc Graw Hill.
8. Logic and computer design fundamentals: M Morris Mano, Pearson Edn.


## COMMUNICATION ENGINEERING

**LA403** **3+1+0**

**Module 1**

Introduction: communication systems – Modulation - need for modulation-bandwidth- Amplitude modulation - theory- mathematical representation-frequency spectrum - USB & LSB- power relation- Frequency modulation -

theory- mathematical representation- frequency spectrum- Phase modulation- comparison of AM- FM- PM.

**Module 2**

Radio transmitters: AM transmitter - block diagram - Solid state modulators - circuit explanation- FM transmitter - reactance modulator- varactor diode modulator- Amstrong modulator.

**Module 3**

Radio receivers: Tuned radio frequency receiver- superheterodyne receiver - block schematic- selectivity- sensitivity- importance of IF - image frequency rejection - AM receivers - schematic explanation - RF amplifiers - circuit explanation - Mixer circuits - IF amplifiers - circuit explanation- simple diode detector - Automatic gain control circuit - simple and delayed AGC - FM receivers - block schematic explanation - amplitude limiting - FM demodulators: slope detectors- phase discriminator- ratio detectors.

**Module 4**

Side band communication: Single side band transmission - suppression of carrier - balanced modulator - filtering of unwanted sideband - SSB receivers - block schematic explanation - pilot carrier receiver - suppressed carrier receiver - Vestigial side band transmission - transmitter and receiver responses - advantages of VSB in television.

**Module 5**

Telephone Systems - Telephone subscribers loop circuit - subscribers line interface circuit - Pulse and tone signaling - Frequency assignments - Electronic telephone - block schematic of a telephone set- block schematic of single line analog SLIC board - two wire repeaters - Electronic private automatic branching exchange - basic block schematic- Power line communication: block schematic explanation- Facsimile - FAX transmitter and receiver.



**References**


1. Electronic communication Systems: Wayne Tomasi- Pearson Edn.
2. Electronic communication: Roody and Coolen- PHI.
3. Electronic Communication systems: George Kennedy- Mc Graw Hill.
4. Electronic and radio engineering: A P Mathur.
5. Telephony and Carrier current engineering: P N Das.
6. Modern communication Systems: Couch- PHI.


## ELECTRONIC CIRCUITS - II

**LA 404** **3+1+0**

**Module1**

High frequency equivalent circuit of a transistor. Hybrid pi model- explanation of components -r parameters in terms of h parameters -Tuned amplifiers -principle - single tuned and double tuned amplifiers -frequency response -applications (no analysis) -multistage amplifiers -frequency response.

**Module2**

Feedback -different types -positive, negative, voltage, current, series and shunt feedback -Feedback in amplifiers -its effect on amplifier performance -typical feedback arrangements -emitter follower - darlington emitter follower -cascade amplifier (principles only) -difference amplifier.

**Module 3**

Oscillators -conditions for oscillation -analysis and design of RC phase shift oscillator, general form of oscillator circuit -working of Hartley, Colpitt's, Crystal, tuned collector and Wien Bridge oscillators.

**Module 4**

Mono-stable multi vibrator -analysis - design - applications - triggering - Bistable multi-vibrator -analysis and design -different methods of triggering -commutating capacitor -Schmitt trigger -working -design.

**Module 5**

Large signal amplifier -harmonic distortion -analysis of class A, class B, class C and class D amplifiers -complimentary and symmetry stage -sweep generators - voltage and current sweeps -time base generators -linearisation -miller and bootstrap sweeps - applications.

**References**


1. Electronic devices and circuits -Boylsted & Neshelsky, Pearson Edn.
2. Integrated electronics -Millman & Halkias, Mc Graw Hill
3. Electronic principles -Malvino
4. Electronic devices and circuits -Bugart
5. Microelectronics Digital and Analogue -Botkar.




## SIGNALS AND SYSTEMS

**LTA 405** **2+1+0**

**Module1**

Dynamic Representation of Systems - Systems Attributes- Causality- linearity- Stability- time-invariance. Special Signals- Complex exponentials- Singularity functions (impulse and step functions).. Linear Time-Invariant Systems: Differential equation representation- convolution Integral. Discrete form of special functions. Discrete convolution and its properties. Realization of LTI system (differential and difference equations).

**Module 2**

Fourier Analysis of Continuous Time Signals and Systems - Fourier Series- Fourier Transform and properties- Parseval's theorem- Frequency response of LTI systems. Sampling Theorem.

**Module 3**

Fourier Analysis of Discrete Time Signals & Systems - Discrete-Time Fourier series- Discrete-Time Fourier Transform (including DFT) and properties. Frequency response of discrete time LTI systems.

**Module 4**

Laplace Transform - Laplace Transform and its inverse: Definition- existence conditions- Region of Convergence and properties- Application of Laplace transform for the analysis of continuous time LTI system (stability etc.) Significance of poles & zeros- Z-Transform - Z-Transform and its inverse: Definition- existence- Region of convergence and properties- Application of Z-Transform for the analysis of Discrete time LTI systems- Significance of poles and zeros.

**Module 5**

Random Signals - Introduction to probability. Bayes Theorem- concept of random variable- probability density and distribution functions- function of a random variable. Moments- Independence of a random variable. Introduction to random process. Auto and cross correlation. wide-sense stationarity- power spectral density White noise- Random processes through LTI systems.

**References**


1. Signals and Systems: Oppenheim Alan- V- Willsky Alan. S- Pearson Edn.
2. Communication Systems: Haykin Simon- John Wiley.
3. Signals and Systems: I J Nagrarth- Tata Mc Graw Hill.
4. Signals and Systems: Farooq Husain- Umesh pub.
5. Adaptive signal processing: W Bernad- Pearson Edn.




## RELIABILITY AND HUMANITIES

**LA 406** **2+1+0**

**Module 1**

Concepts of reliability: Definition of reliability- failure- classification of failures- measures of reliability- failure rate- mean time between failures (MTBF)- mean time to failure (MTTF).

**Module 2**

Failure pattern and fitting curves: Graphical plots- Bath tub curves- Hazard models- Constant hazard models- Linearly increasing hazard model- Weibull model.

**Module 3**

Manufacture for Quality and reliability: The need for prototype tests- the quality standard- planning to achieve required quality- basic concepts of sequencing.

**Module 4**

Control charts in statistical quality control: statistical quality control advantages-types of control charts- X and R chart- P chart- C chart- Re-engineering- Zero defects.

**Module 5**

Human relations: Human Behavior- Scope of Industrial psychology-Theories of Motivation-Handling of workers grievances-Workers participation in management-Industrial discipline-Industrial disputes-Industrial fatigue-Wages and incentives.

**References**


1. Reliability Engineering: L S Sreenath.
2. Reliability Engineering: A K Govil.
3. Industrial Engineering & Management: Banga and Sharma.


## ELECTRONIC CIRCUITS LAB

**LA 407** **0+0+4**

**List of experiments**

1. Power amplifiers: Design of class A and class AB push pull stage – verification of power output.
2. IC power amplifier.
3. Oscillators: Design of RC phase shift, Hartley & Colpitts oscillators.
4. Design of Mono-stable and bi-stable multi-vibrators.
5. Design of bootstrap sweep generator.
6. Schmitt trigger.
7. SCR, Triac firing circuits.
8. Feedback amplifier, design of two stage RC coupled amplifier.
9. Tuned amplifiers.
10. Design and testing of DC regulated power supplies (Fixed and variable).
11. Simulation of above circuits using PSPICE.

**Note**

New experiments may be added in accordance with subject LA 404

## COMPUTER PRORAMMING LAB

**LA 408** **0+0+4**

### Part 1

1. Computer hardware familiarization.
2. Familiarization of MS-DOS commands, Microsoft Windows.
3. Familiarization of Microsoft Word, Adobe Acrobat Reader.

### Part 2

Programming Experiments in C/C++: Programming experiments in C/C++ to cover control structures, functions, arrays, structures, pointers and files, classes, operator & function overloading, inheritance, polymorphism.

# FIFTH SEMESTER

## ENGINEERING MATHEMATICS - IV

**CMELPA501** **3+1+0**

**Module 1**

Complex Integration: Line Integral –Cauchy's integral theorem- Cauchy's integral formula-Taylor's series-Laurent's series- zeros and singularities-Residues- residue theorem-Evaluation of real integrals using contour integration involving unit circle and semicircle.

**Module 2**

Numerical solution of algebraic and transcendental equations: Successive bisection method-Regula falsi method - Newton –Raphson method – solution of system of linear equations by Jacobi's iteration method and Gauss-Siedel method.

**Module 3**

Numerical solution of ordinary differential equation: Taylor's series method-Euler's method –Modified Eulers method - Runge – Kutta method (IV order)-Milne's predictor corrector method.

**Module 4**

Z – Transforms: Definition of Z transform- properties –Z transform of polynomial functions – trigonometric functions, shifting property, convolution property-inverse transform – solution of $1^{st}$ & $2^{nd}$ order difference equations with constant coefficients using Z transforms.

**Module 5**

Linear programming: graphical solution – solution using simplex method (non – degenerate case only) – Big-M method, two phase method- Duality in L.P.P.-Balanced T.P. – Vogels approximation method – Modi method.



**References**


1. Advanced Engineering Mathematics – Ervin Kreyszig, Wiley Eastern limited.
2. Numerical methods in Engineering & Science – Dr. B.S.Grewal, Kanna Publishers.
3. Higher Engineering Mathematics - Dr. B.S.Grewal, Kanna Publishers.
4. Numerical methods in Science & Engineering - Dr. M.K.Venkitaraman, National Publishing company.
5. Quantitative techniques Theory & Problems - P.C.Tulsian, Vishal Pandey, Pearson Education Asia.
6. Complex variables and applications - Churchill and Brown,McGraw-Hill.
7. Operations research - Panneer Selvam, PHI.
8. Engineering Mathematics Vol. III -S Arumugam, A.T.Isaac,A , Somasundaram, Scitech publications
9. Advanced Mathematics for Engg.students Vol. III- S.Narayanan, T.K.M.Pillay, G.Ramanaigh, S.Vishwananthan printers & publishers.

## POWER ELECTRONICS

**LA 502** **2+1+0**

**Module 1**

Power semiconductor Devices - History of development of Power Electronic devices- Constructional features- Characteristics- rating and specification- gate/base drive circuits-protection including cooling and application consideration of diodes- SCRS, GTO, BJTS, MCT, MOSFET and IGBT. Series and parallel operations of SCR- Electromagnetic interference.

**Module 2**

AC to DC Converters - Operation and analysis of Single phase and multi-phase uncontrolled and controlled rectifiers with R, RL and back EMF load- effect of source inductance- free wheeling effect- power factor improvement methods for phase Controlled rectifiers- filters. PWM chips: SG3524 and TL 494- Block schematic.

**Module 3**

AC to AC Voltage Converter - Operation and analysis of single phase integral cycle and phase controlled converters- Configuration of three phase controllers.

**Module 4**

DC to DC Converters - Chopper classification- Step down- step up and four quadrant converters operation- analysis and control with R, RL and EMF load- current and voltage Commutation circuits.

**Module 5**

DC to AC Converters - Single phase and three phase bridge inverters- VSI and CSI- voltage control - PWM & Square wave operation- Harmonics and their reduction techniques.



**References**


1. Power Electronics: Rashid Muhammad, Pearson Edn.
2. Power Electronics: Harish C Ray, Galgotia Pub.
3. Thyristors and Applications: Ramamoorthy.
4. Power Electronics: Converter, Applications and Design, Mohan Ned, John Wiley,
5. Power Semiconductor Circuits: Dewan, S.B. and Satrughan A. John Wiley & Sons, 1975.
6. Thyristorised Power Controllers: Dubey, G.K., Doradlla, S. R., Wiley Eastern, 1987.

## BASIC INSTRUMENTATION

**A503** **3+1+0**

**Module 1**

Generalized configuration of Instrumentation system: Definition of measuring parameters - Calibration, Static and dynamic, Standards of measurements, Measurements errors, Accuracy, Precision, Sensitivity, Resolution, Significant figures.

**Module 2**

Measurement of resistance, inductance and capacitance using bridges - Wheatstone, Kelvin, Maxwell, Hay, Schering bridges, Megger, Q meter, Electronic multimeter, vector voltmeter, vector impedance meter.

**Module 3**

Signal generators - Audio generators, Function generators, Sweep frequency generators, Pulse generators, RF generators, Frequency synthesizer.

**Module 4**

Digital instruments: Digital voltmeter - dual slop, successive approximation types, Digital measurement of time interval, phase, period, frequency, ratio of two frequencies, Digital LCR meter, Digital IC tester.

**Module 5**

The cathode ray tube, Deflection amplifier, Wave form display, Oscilloscope time - base, Dual trace oscilloscope, Dual beam and split beam, Oscilloscope controls-measurements of voltage, frequency and phase, pulse measurements, Lissajous figures, Z axis modulation, oscilloscope probes.

Special oscilloscopes - Delayed time base oscilloscope and controls Analog Storage oscilloscope, Storage oscilloscope controls, Sampling oscilloscope, Digital storage oscilloscope - Operation, Analog to digital conversion and storage, digital memory, digital - to- analog conversion, DSO controls, DSO applications Spectrum analyzer, Distortion meter.

**Text Books**


1. A.D. Cooper and W.D.Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice - Hall of India Pvt.Ltd., New Delhi, 1995.
2. D.A.Bell, Electronic Instrumentation and Measurements, Englewood Cliffs, N.J., 1994


**References**


1. T.S.Rathore, Digital Measurements Techniques, Narosa Publishers, Bombay, 1997
2. Beckwith, Mechanical Measurement 5/e, Pearson Education.
3. Doeblin, Measurement Systems-Application and Design, Mc Graw Hill, N.Y.1990.

## COMPUTER ORGANISATION AND ARCHITECTURE

**LA504** **2+1+0**

**Module 1**

Basic structure of computer hardware and software- addressing methods and machine programming sequencing- different addressing modes- instruction sets- computer arithmetic logic design- fast adders- multiplication- Booth's algorithm- fast multiplication- integer division- floating point numbers.

**Module 2**

Control unit- instruction execution cycle- sequencing of control signals- hardwired control- PLAs- micro programmed controls- control signals- micro instructions - Micro program sequencing- branch address modification- pre fetching of micro instructions.

**Module 3**

Memory organization- semi conductor RAM memories- internal organization- bipolar and MOS devices- dynamic memories- multiple memory modules and interleaving- cache memories -mapping functions - replacement algorithms- virtual memories- address translation-page tables - memory management units- secondary memories- disk drives- standards.

**Module 4**

Input-Output organization- accessing I/O devices- direct memory access (DMA)- interrupts and interrupt handling- handling multiple devices- device identification- vectored interrupts- interrupt nesting- daisy chaining- I/O interfaces- serial and parallel standards- buses-scheduling- bus arbitrations- printers- plotters- VDUs.

**Module 5**

Introduction to parallel processing and architecture- classification- array processors- pipeline architecture- interconnection- networks- multistage networks- message passing architecture.

**References**


1. Computer organization – Hamacher C V, Mc Graw Hill.
2. Computer Systems and Architecture – Vincent P Heuring, H F Jordan, Pearson Edn.
3. Computer organization and Design – Pal Choudhary
4. Computer organization and Architecture – Hayes J P
5. Computer Org. & Architecture- Stallings, Pearson Education.

## LINEAR INTEGRATED CIRCUITS

**LA 505** **3+1+ 0**

**Module 1**

Introduction to operational amplifiers – Basic differential amplifier - dual input balanced output and unbalanced output- Internal block schematic of op amp - Pin identification- power supply requirements - typical data sheet - Op-amp parameters - ideal op amp - transfer curve - equivalent circuit- open loop configurations - frequency response of op amps - compensating networks - slew rate and its effect.

**Module 2**

Op amp in closed loop configuration: Different feed back configurations- Voltage series feedback and voltage shunt feedback - concept of virtual ground- voltage follower - V/I converters and its applications - Differential amplifiers with one op amp and 3 op amps- Use of offset minimizing resistor ($R_{OM}$) and its design.

**Module 3**

Op amp applications- Summer- Subtractor- Log amplifier- Antilog amplifier- Comparators: zero crossing- using voltage reference- regenerative (Schmitt trigger) comparators- Astable and monostable multivibrators- Triangular and sawtooth wave generators- Integrator and differentiator- RC phase shift and Wien bridge oscillators-Sample and hold circuit- Peak detector circuit.

**Module 4**

Filters and timers: LPF- HPF- BPF- Notch and all pass filters- I order and II order filters- Switched capacitor filter- Switched capacitor integrator. 555 timers – Functional block diagram- Astable multivibrator, monostable multivibrator and its applications.

**Module 5**

Specialized ICs and applications: Voltage regulator ICs – 78XX and 79XX series- 317 variable regulators- 1723 switching regulators- 566 VCO chip- Phase locked loop(PLL) - capture and lock range- 565 PLL - PLL applications: Frequency multiplication and division- AM demodulation- FM detection- FSK demodulation - LM 380 power amplifier - intercom using LM 380- 8038 Function generator chip - applications.

**References**


1. Op amps and Linear Integrated circuits: Ramakand Gaykwad- PHI publications.
2. Op amps and Linear Integrated circuits: R F Coughlin- Pearson Education.
3. Op amps and Linear Integrated circuits: Ravi Raj Dudeja- Umesh Publications.
4. Linear Integrated circuits: Roy Choudhary & Jain- Wiely Eastern Publications.
5. Integrated circuits: K R Botkar

## TRANSDUCERS AND RECORDING SYSTEMS

**A506** **3+1+0**

**Module 1**

Transducers - definition and classification, Electrical transducers, selecting a transducer

Temperature measurements: standards and calibration, thermal expansion methods - bimetalic thermometers, liquid in glass thermometers, vapour pressure thermometers.

**Module 2**

Termocouple - principle, fundamental laws, reference junction considerations, types of thermocouples, industrial thermocouples, thermopiles. Resistance temperature detectors - Principle measurements using three wire and four wire bridge circuits, solid state sensors, quartz thermometers, optical pyrometers, digital thermometers.

**Module 3**

Displacement transducers: variable resistance transducers, variable inductance transducers, LVDT - construction, principle, characteristics, advantages, Variable capacitance transducers, piezo-electric transducers, digital displacement transducers.

**Module 4**

Strain measurements: strain gauges - different types, resistive- semiconductor and optical strain gauges, strain gauge circuits, temperature compensation, Practical Applications

**Module 5**

Recorders: Strip chart recorders, galvanometric recorders, servo recorders, oscillographic recorders, magnetic recorders, direct recording, FM recording, digital recorders, electro mechanical recorders.

Display devices, Classification of displays, cathode ray tube, LEDs in direct and indirect bandgap materials, typical uses of LEDs, Liquid crystal displays, theory of liquid crystal display operation, typical use of LCDs.

**Text Books**


1. Beckwith: Mechanical Mesurements 5/e, Pearson Education
2. D V S Murthy, Transducers and Instrumentation, prentice Hall of India Pvt. Ltd., New Delhi
3. B S Sonde, Transducers and Display Systems, Tata Mc Graw Hill, New Delhi, 1979


**References**


1. E A Doeblin, Measurements Systems - Application and Design, Mc Graw Hill, N Y, 1990.
2. J W Dally, W.F Riley and K G McConnel, Instrumentation for Engineering Measurements, John Wiley and sons Inc., N.Y, 1993.

## DIGITAL IC LABORATORY

**LA 507** **0+0+4**

**List of experiments**

1. TTL & CMOS characteristics (7400, CD4001)
2. Interfacing of TTL & electromagnetic relay using transistor, opto coupler (4N33) & Darlington arrays (ULN2803).
3. Logic family interconnection (TTL to CMOS & CMOS to TTL)
4. Design of half adder & full adder using gates.
5. Design and testing of ripple & synchronous counters using JK flip flops(7473, 7476)
6. Counters using shift registers (Ring counter & Johnson counter).
7. Study of counter ICs (7490, 74190).
8. Design of astable & mono-stable multi-vibrators using gates.
9. Design of mono-shots using dedicated ICs (74123).
10. Logic design using multiplexers (74150).
11. Logic design using decoders (74138).
12. Adders, Subtractors, multipliers.
13. Design of 7 segment display circuits-static/dynamic (7447, FND542).
14. PRBS generator.
15. Digital circuit simulation using electronic work bench/ similar working tools.

**Note**

Any experiment related to LA402 may be added to the above list.



## MEASUREMENTS LAB

**A 508**

1. Triggered linear sweeps circuits.
2. Op amp measurements: input offset voltage, input offset current, open loop gain, common mode input resistance, slew rate, CMRR, full power band width comparison of different classes of opamps (2 expts)
3. Op Amp basic circuits, Multivibrators and Oscillators
4. Dual trace generator.
5. ADC & DAC. (2expts).
6. Instrumentation amplifier & differential amplifiers measurements
7. Sample and hold circuits & measurements of rise time and fall time
8. Transducer measurements.
    a. Diode thermometer
    b. LVDT
    c. strain gauge.
    d. pressure transducer.
    e. thermocouple (2 expts)
9. Voltage regulators, Ics - LM 723,78XX, 79XX family.
   Study of Storage Oscilloscopes.

# SIXTH SEMESTER

## INDUSTRIAL MANAGEMENT & ECONOMICS

**LA 601** **3+2+0**

### PART A: Industrial Management

**Module 1**

Modern concept of Management: Scientific management-Functions of management-Planning - Organising- Staffing – Directing – Motivating - Communicating- Co-ordinating- Controlling - Organisational structures- Line, Line and staff and Functional relationships- Span of control- Delegation- Management by Objectives.

**Module 2**

Personnel management: Objectives and functions of personnel management- Recruitment-Selection and training of workers- Labour Welfare- Industrial Fatigue- Industrial disputes-Trade Unions- Quality circles. Formation of companies: Proprietory-Partnership-Joint stock companies- Public sector- Joint sector and Co-operative sector.

**Module 3**

Marketing Management: Pricing- Promotion- Channels of distribution- Market research-Advertising. Production Management: Batch and mass production- Inventory control- EOQ-Project planning by PERT/CPM- Construction of Network (Basic ideas only).

### PART B: Economics

**Module 4**

Theory of demand and supply- Price mechanism- Factors of production- Land, labour, capital and organization- National income- Difficulties in estimation- Taxation- Direct and indirect taxes- Progressive and regressive- Black money- Inflation-Causes and consequences.

**Module 5**

Indian financial system- Reserve bank of India: Functions - Commercial banking system-Development financial institutions - IDBI- ICICI- SIDBI- IRBI- NABARD- Investment institutions – UTI - Insurance companies - Indian capital market- Stock market- Functions- Role of the public sector - Privatisation- Multinational corporations and their impact on the Indian economy.

**References**


1. Industrial Management - O P Khanna, Dhanpat Rai Pub.
2. Industrial Management - K.K. Ahuja, Khanna Pub.
3. Marketing Management - Philip Kotler, PHI
4. Indian economy - A.N. Agarwal, Wishwa Prakashan
5. Modern economic theory - K.K Dewett, Shyam Lal charitable trust.

## MICROPROCESSORS AND MICROCONTROLLERS

**A602** **3+1+0**

**Module 1**

Introduction to microprocessors and microcomputers: Function of microprocessors- architecture of 8085- pin configuration and functions – tristate bus concept - generation of control signals - bus timings – de-multiplexing $AD_0$-$AD_7$ – flags - memory decoding - interfacing of RAM and EPROM - I/O addressing - I/O mapped I/O - and memory mapped I/O schemes - instruction execution - fetch/execute cycle - instruction timings and operation status.

**Module 2**

Atmel AT89C51 microcontroller – features - pin configurations - internal block schematic - pin descriptions - PORT0, PORT1, PORT2, PORT3, idle & power down mode - power control register - program protection modes - flash programming & verification.

**Module 3**

Memory organization - program memory - data memory - direct & indirect addressing area - Program status word - register banks - addressing modes - instruction set – arithmetic - logical and data transfer instructions - Boolean instructions - program branching instructions - Programming examples.

**Module 4**

Machine cycles – interrupts - interrupt sources - interrupt enable register - interrupt priority - interrupt control system - interrupt handling - single step operation - port bit latches and buffers - port structures and operation - accessing external memory – programming examples.

**Module 5**

Timer0 & Timer1 - TMOD SFR - mode0, mode1, mode2, mode3 - TCON SFR - serial interface - SCON SFR - mode0, mode1, mode2, mode3- block schematics- baud rates- power on reset circuit- ONCE mode- on chip oscillator- external program & data memory timing diagrams- I/O port timings – programming examples.

**References**


1. The 8051 Microcontroller: Muhammad Ali Mazidi, Pearson Education.
2. The 8051 Microcontroller: Kenneth J Ayala, Penram International
3. Microprocessors and Architecture: Ramesh S Goankar
4. Microcomputers and Microprocessors: John Uffenbeck, PHI
5. Web site of Atmel - www.atmel.com

## DIGITAL SIGNAL PROCESSING

**LTA 603** **3+1+0**

**Module1**

Review of signals and systems. Introduction - advantages and limitations of Digital Signal Processing. Infinite Impulse Response (IIR) Filters - Signal Flowgraph- Basic Network structure for IIR filter- Direct- Cascade- Parallel Forms. Design of IIR Digital filters from analog filters- Butterworth design- Chebyshev design- design based on numerical solutions of differential equations- Impulse Invariant Transformation.

**Module 2**

Finite Impulse Response (FIR) Filters: Linear phase FIR filters- Frequency response of linear phase FIR filters - Location of the zeros of linear phase FIR filters. Realization of FIR- cascade - lattice design-Fourier Series method- using windows-rectangular- triangular or Barlett windows – Hanning – Hamming – Blackman - Kaiser windows.

**Module 3**

Discrete fourier Transform: Properties-Circular convolution- Linear Convolution using DFT- relation between Z- Transform and DFT- Fast Fourier Transform; decimation – in time and Frequency - FFT algorithms – General Computation using Radix 2 algorithm.

**Module 4**

Finite word length effects in digital filters: Introduction- Number Representation - Fixed Point- Sign-Magnitude - One's-complement- Two's - complement forms - Addition of two fixed point numbers- Multiplication in Fixed Point arithmetic - Floating point numbers- Block floating point numbers- quantization - truncation- rounding - effects due to truncation and rounding- Input quantization error - Product quantization error - Co-efficient quantization error- zero-input limit cycle Oscillations - Overflow limit cycle Oscillations - Scaling- Quantization in Floating Point realization IIR digital filters - Finite Word Length Effects in FIR Digital Filters- Quantization effects in the Computation of the DFT- quantization errors in FFT algorithms.

**Module 5**

Applications of digital signal processing: Speech Processing- speech analysis- speech coding- sub band coding- channel vecoder- homomorphic vecoder- digital processing of audio signals- Radar signal processing- DSP based measurements systems. Equi ripple FIR design- PCM DSP chips- a general study.

**References**


1. Digital signal processing: Ifechor- Pearson edn.
2. Desecrate time signal processing: Oppenhiem- Pearson edn.
3. Digital signal processing: Oppenhiem and Sheffer- PHI
4. Introduction to Digital signal processing: Johny R Johnson
5. Digital signal processing: Proakis and Manolakis.
6. Digital signal processing: P Ramesh Babu- Scitech Pub.

## INDUSTRIAL INSTRUMENTATION - I

**A604** **2+1+0**

**Module 1**

Functional descriptions of measuring Instruments-Functional elements of an Instrument, active and passive transducers, analog and digital modes of operation, null and deflection methods, static and dynamic characteristics.

**Module 2**

Basic methods of force measurement- characteristics of elastic force transducers, resolution of vector forces and moments in to rectangular components

**Module 3**

Torque measurement - torque measurement on rotating shafts, dynamometers, gyroscopic force and torque measurement, vibrating - wire force tranducers, strain gauge, feedback and optical methods.

**Module 4**

Level measurement-float displacer, bubbler, capacitance, radioisotope and ultrasound type. Flow meters: Area flow meters, mass flow meters, positive displacement type and electric type flow meters.

**Module 5**

Pressure measurement - Manometers, elastic types, bell gauges, electrical types. Vacuum measurement, differential pressure transmitters, sound pressure level measurement, accoustic intensity.

**References**


1. Doebelin - Measurement systems - Application and Design-IVth ed.. MGL, 1990
2. Patranabis - Principles of Industrial Instrumentation - 2nd ed., TMH, 1996
3. James W.Dally - Instrumentation for Engineering Measurement - 2nd ed., 1993, Wiley International




## DATA COMMUNICATION

**A605** **3+1+0**

**Module 1**

Data transmission concepts and terminology - Analog and digital data transmission- transmission impairments - transmission media

Data encoding - digital data, digital - signals - digital data, analog signals - analog data, digital signals - analog data analog signals. Asynchronous and synchronous transmission - error detection techniques interfacing.

**Module 2**

Multiplexing: Frequency division multiplexing - synchronous time division multiplexing - statistical time division multiplexing.

Circuit Switching: Introduction - single node networks - digital switching concepts - digital private & branch exchange - control signaling

Packet switching: principles - example systems, virtual circuits and data grams - routing traffic control - X.25

**Module 3**

Local and metropolitan area networks: LAN/MAN technology - different topologies - optical fibre bus - medium access control protocols - LAN/MAN standards

**Module 4**

Computer Communication Architecture protocols - the OSI model - the TCP/IP protocol - System network architecture - principles of inter networking - the bridge - routing with bridges - connectionless internetworking - connection oriented internetworking

**Module 5**

ISDN: overview of ISDN - transmission structure - user access - ISDN protocols - broad band ISDN.

**References**


1. William stallings - Data and Computer Communication (4th ed.)-PHI
2. Larry Haghes - Introduction to Data Communication - a practical approach - Jones and Bartiett Publishers




## CONTROL SYSTEM THEORY

**A606** **3+1+0**

**Module 1**

Laplace transforms to linear systems, transfer function of linear systems-- simple mechanical and electromechanical systems. Analogous Systems: force voltage and force current analogy. Block diagram algebra, signal flow graphs - Mason's gain formula.

**Module 2**

Standard test signals - Time response of first and second order systems - natural frequency and damping ratio. Time response specifications. Steady state and dynamic error coefficients.

**Module 3**

Concept of stability, Routh's stability criterion, root locus technique - stability analysis.

Frequency response analysis: frequency Open loop and closed loop control systems: examples, applications of domain specification, Bode plots.

**Module 4**

Nyquist plots, gain margin and phase margin, Nyquist stability criterion. Closed loop frequency response; Constant M and N circles, Nichols chart

**Module 5**

Introduction to control system design - preliminary considerations - lead, lag and lead - lag compensation, Design of lead compensators and lag compensators. Elements of discrete control systems - transfer functions of discrete data systems stability of closed loop discrete system - jury's test bilinear transformation method

**Text Books**

1. I J Nagarath and M.Gopal - Control Systems Engineering - New Age International Ltd. - New Delhi
2. B.C Kuo - Automatic Control Systems-Prentice Hall of India - New Delhi

**Reference**

1. K Ogata - Modern Control Engineering - Prentice hall of India - New Delhi

## INSTRUMENTATION LAB

**A607** **0+0+3**

1. Measurements using different types of transducers
   a. Variable capacitance type
   b. Variable inductance type
   c. LVDT
   d. Thermocouples and RTDs
   e. Photocells
2. Measurement of level, distance, vibration
3. Calibration of pressure gauges, temperature transmitter, E to P Conveter, differential pressure transmitter etc
4. PC based data acqusition system
5. Phase locked loops, frequency to voltage converter, voltage to frequency converter
6. GPIB/RS232C interfacing of function generator and universal counter with PC
7. Robotic trainer kit - PC based control of robotic actions
8. Programmable logic controllers - ladder disgrams

## MINI PROJECT

**A608** **0+0+3**

Each student should conceive, design, develop and realize an electronic product. The basic elements of product design - the function ergonomics and aesthetics - should be considered while conceiving and designing the product. The electronic part of the product should be an application of the analog & digital system covered up to the 6$^{th}$ semester. The student should submit the report at the end of the semester. The product should be demonstrated at the time of examination.

# SEVENTH SEMESTER

## MICRO-CONTROLLER BASED SYSTEM DESIGN

**LA701** **2+1+0**

**Module 1**

Various logic families - features – comparison – PLA – PAL- GAL -comparison – combinational PAL – PAL with flip-flops – study of 16L8, 22V10 GAL – dual port RAM – FIFO - FPGA - gate arrays.

**Module 2**

Embedded C compiler – advantages – memory models – interrupt functions – code optimization - 89C2051 micro-controller- architecture-comparison with 89C51- design of a simple trainer circuit using 89C51/89C2051 µC – interfacing of DIP switch, LED, 7 segment display, alphanumeric LCD – relay interface – design of a traffic light control system - interfacing programs using C and assembly language.

**Module 3**

Analog to digital converters- single slope, dual slope, successive approximation, sigma delta, flash – comparison - typical ICs - A/D interface – digital to analog converters – different types – D/A interface - optically isolated triac interface- design of a temperature control system- interfacing programs using C and assembly language.

**Module 4**

Serial bus standards - $I^2C$ bus, SPI bus – operation – timing diagrams – 2 wire serial EEPROM – 24C04 – 3wire serial EEPROM – 93C46 - interfacing - serial communication standards - RS232, RS422, RS485 – comparison – MAX232 line driver/ receiver - interfacing – interfacing programs using C and assembly language - low voltage differential signaling – PC printer port – registers – interfacing - universal serial bus – PCI bus.

**Module 5**

Matrix key board interface - AT keyboard – commands – keyboard response codes - watch dog timers - DS1232 watch dog timer – real time clocks – DS1302 RTC – interfacing - measurement of frequency - phase angle - power factor – stepper motor interface - dc motor speed control – L293 motor driver - design of a position control system - interfacing programs using C and assembly language.

**References**


1. The 8051 Microcontroller: Muhammad Ali Mazidi, Pearson Education.
2. The 8051 Microcontroller: Kenneth J Ayala, Penram International.
3. Digital fundamentals: Floyd, Pearson Education.
4. Programming and customizing the 8051 µC: Myke Predko, TMH
5. Programming with ANSI C and turbo C: Kamthane, Pearson Education.
6. Microcomputers and Microprocessors: John Uffenbeck, PHI.
7. Web site of Atmel semiconductors - www.atmel.com

## VLSI TECHNOLOGY

**LA 702** **3+1+0**

**Module 1**

Process steps in IC fabrication: Crystal growth and wafer preparation- Czochralski process- apparatus- silicon shaping, slicing and polishing- Diffusion of impurities- physical mechanism- Fick's I and II law of diffusion- Diffusion profiles- complementary (erfc) error function- Gaussian profile- Ion implantation- Annealing process- Oxidation process- Lithography- Photolithography, Fine line lithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisation- patterning- wire bonding and packaging.

**Module 2**

Monolithic components: Isolation of components- junction isolation and dielectric isolation- Transistor fabrication- buried layer- impurity profile- parasitic effects- monolithic diodes- schottky diodes and transistors- FET structures- JFET- MOSFET- PMOS and NMOS, control of threshold voltage ($V_{th}$)- silicon gate technology- Monolithic resistors- sheet resistance and resistor design- resistors in diffused regions- MOS resistors- monolithic capacitors- junction and MOS structures- IC crossovers and vias.

**Module 3**

CMOS technology: Metal gate and silicon gate- oxide isolation- Twin well process- Latch up- BiCMOS technology- fabrication steps- circuit design process- stick diagrams- design rules- Capacitance of layers- Delay- Driving large capacitance loads- Wiring capacitance- Basic circuit concepts- scaling of MOS structures- scaling factors- effects of miniaturization.

**Module 4**

Subsystem design and layout- Simple logic circuits- inverter, NAND gates, BiCMOS circuit, NOR gates, CMOS logic systems – bus lines- arrangements- power dissipation- power supply rail distribution- subsystem design process- design of a 4 bit shifter.

**Module 5**

Gallium Arsenide Technology: Sub-micro CMOS technology- Crystal structure- Doping process- Channeling effect- MESFET- GaAs fabrication- Device modeling.

**References**


1. VLSI technology: S M Sze, Mc Graw Hill pub.
2. Basic VLSI design: Douglas Pucknell, PHI.
3. Principles of CMOS VLSI Design: H E Weste, Pearson Edn.
4. Integrated Circuits: K R Botkar, Khanna Pub.
5. CMOS circuit design layout and simulation: Barter, IEEE press.
6. Introduction to VLSI: Conway, Addison weslay.

## INDUSTRIAL INSTRUMENTATION - II

**A703** **3+1+0**

**Module 1**

Measurement viscosity of density, specific gravity scales used in petroleum industries-Different methods of measuring consistency and viscosity –Methods for measuring moistures and humidity – Electrical conductivity – Dielectric constant-Automatic electric psycho meter

**Module 2**

PH and conductivity meters- pH measurement – pH electrode station – various types of electrodes – Installation and maintenances of pH meters – conductivity meters – Electrical conductivity of solution – cell construction operating principles.

**Module 3**

Gas Analysis – Chemical absorption, thermal conductivity, magnetic type, Gas chromagraphy, infrared and ultraviolet light, mass spectometer, propotional counters, Geigor Muller counter, Scintillation counter.

**Module 4**

Measurement of speed- Mechanical- Electrical- Electronic methods- stroboscopic method –Measurement of acceleration- various types- calibrations.

**Module 5**

Power plant instrumentation- Diesel electrical power plants, Gas turbine power plants, gas and steam turbines combined cycles, nuclear reactors, fluctuating loads on power plants. Instrumentation and control of power plants.

**References**


1. DOEBLIN: Measurement systems, applications and design, Mc Graw Hill. Pub.Co.
2. D.Patranabis: Principles of Industrial Instrumentation, Mc Graw Hills Pub.Co.
3. NAKRA, CHAUDBRY: Instrumentation Measurement and Analysis Mc Graw Hill. Pub.Co.
4. ECKMAN: Industrial Instrumentation- Wiley Eastern


## PROCESS DYNAMICS AND CONTROL

**A 704** **2+1+0**

**Module 1**

Process Dynamics – Process Variables – Degree of freedom – Characterization of physical systems – Dynamics of liquid, gas and thermal process – Interacting and non interacting systems – Continuous and batch process – Self regulation and servo regulation operation – Problems.

**Module 2**

Control actions and controllers – Basic control actions – Characteristics of two position, multi position, floating, proportional I, D Control modes – Composite control modes – PI, PD, PID control modes – pneumatic and electronic controllers to realize various control actions

**Module 3**

Optimum controller settings: Evaluation criteria, 1/4$^{th}$ decay ratio, IAE, ISE, ITAE – determination of optimum settings for mathematically described process using time response and frequency response – Tuning – Process reaction curve method, Continuous cycling metho, Damped oscillation method.

**Module 4**

Final control element: I/P converter – Pneumatic, electric and hydraulic actuators – Valve positioner – Control valves – Effective valve characteristics, Valve body – globe, butterfly, diaphragm, Ball valves – Value seizing, cavitation, flouting.

**Module 5**

Complex control system: Cascade control – Feed forward control, Ratio control, Multivariable control. Piping and Instrumentation diagram, Case study – Distillation column control – Combustion control and drum level control in steam boiler.

**References**


1. Peter Harriot, Process control – Tata McGraw Hill
2. D. Patranabis, Principles of Process Control – Tata McGraw Hill
3. Curtis Johnson, Process Control Instrumentation Technology – Eastern economy Edition
4. D.P. Eckman, Automatic Process Control – Wiley Eastern
5. Bela G Liptak, Process Control, Instrument Engineers Handbook
6. Donald R Coughanowr, Process System Analysis and Control – McGraw Hill




## BIOMEDICAL INSTRUMENTATION

**A 705** **3+1+0**

**Module 1**

Human Anatomy & Physiology: Anatomy & Physiology of major systems of the body. Principles of generation and propagation of bioelectric potentials. Electrical activity of heart, propagation of action through nerves, conduction velocity and latency. EMG, EMC, ECG, ERG, EEG, EGG, MEG. Electrical Safety - Physiological effects of electricity, Micro & macro shock hazards. Electrical safety codes & Standards. Protection of patients, power distribution and equipment design

**Module 2**

Electrodes & Transducers: Bio potential electrodes - different types of electrodes, polarisable & nonpolarisable electrodes. Theory of electrode - skin interface. Electrode behaviour & circuit models. Electrodes for stimulation.

Transducers, Leads & electrodes: transducers for biological applications - transduction principles, different types - active and passive transducers, implantable transducers, transducers for pressure, flow, pulse, respiration. Chemical sensors.

Leads & Electrodes: Types, Materilas, properties, characteristics. Method of application and selection - equivalent circuits of leads & electrodes.

**Module 3**

Biopotential amplifiers, recoders & monitors:

Amplifiers: for ECG, EMG & EEG - basic requirements, design considerations - frequency, gain etc.

ECG: Working principles, electrode systems and clinical applications

EEG: Working Principles, lead system and clinical applications

EMG: Working Principles and clinical applications. Evoked potential systems, determination of conduction velocity and latency.

Phonocardiolography - principle and clinical applications

Biopotential recording - Noise, motion artfact and other considerations

Recorders: Potentiometre, galvanometre, electrostatic UV recorder and magnetic tape recorder

**Module 4**

Diagnosis and therapeutic Equipments:

Diagnosis Equipments - Electronic BP Monitors, pulse monitors, electrocardioscope, spirometer, pulse oxi meter, ECG machine, EEG machine, EMG machine, EOG machine, ERG machine, PH meter, auto analyser, gas analysers.

**Module 5**

Therapeutic Equipments - Pacemakers, Defibrillator, heart - lung machine, nerve and muscle stimulators, dialysis machines, Surgical diathermy equipment, micro wave - short wave and ultrasound diathermy equipments, Nebuliser, Inhalator, Aspirator, Humidifier and ventillators.

Electrical Safety - Physiological effects of electricity, Micro & macro shock hazards. Electrical safety codes & Standards. Protection of patients, power distribution and equipment design.

**Text Books**


1. Leslie Cromwell, Fred J. Weibell and Erich A Pferffer - Biomedical Instrumentation and Measurements - Prentice Hall of India, 1990
2. R.S Khandpur - Handbook of Biomedical Instrumentation - Tata Mc Graw – Hill


**References**


1. John G. Webster - Medical Instrumentation - Application and Design - Houghton mifflin company, Boston
2. John C. Cobbold - Tranducers for Biomedical measurements - John wiley & Sons
3. Jacob Kline- Hand book of Biomedical Engineering - Academic Press INC

## OPTIMIZATION TECHNIQUES (ELECTIVE - I)

**CMELRTA 706-1** **3+1+0**

**Module1 Classical optimization techniques**

Single variable optimization – Multivariable optimization with no constraints – Hessian matrix – Multivariable saddle point – Optimization with equality constraints – Lagrange multiplier method - Multivariable optimization with inequality constraints – Kuhn-Tucker conditions.

**Module 2 One-dimensional unconstrained minimization**

Elimination methods – unrestricted search method – Fibonacci method – Interpolation methods – Quadratic interpolation and cubic interpolation methods.

**Module 3 Unconstrained minimization**

Gradient of a function – Steepest descent method – Newton's method – Powells method – Hooke and Jeeve's method.

**Module 4 Integer – Linear programming problem**

Gomory's cutting plane method – Gomory's method for all integer programming problems, mixed integer programming problems.

**Module 5 Network Techniques**

Shortest path model – Dijkstra`s Algorithm – Floyd`s Algorithm – minimum spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm.

**References**


1. Optimization theory and application: S.S. Rao, New Age International P. Ltd.
2. Optimization Concepts and applications in Engineering: A. D. Belegundu, T.R. Chandrupatla. Pearson Education Asia.
3. Principles of Operations Research for Management: - F.S.Budnick, D. McLeavey, R. Mojena, Richard D. Irwin, INC
4. Operation Research an introduction: H. A. Taha, Eastern Economy Edition.
5. Operations Research: R. Panneerselvam, PHI


## OBJECT ORIENTED PROGRAMMING IN C++ (ELECTIVE - I)

**LA706-2** **3+1+0**

**Module 1**

Introduction to loops: Evolution of object oriented languages - Support for experiments and structure - process of language translation – Need of objects - Definition of Object - Oriented Language.

**Module 2**

Encapsulation & Inheritance: Building classes - Declaring objects Member functions - constructors and destructors members access control.

**Module 3**

POLYMORPHISM - Virtual functions - Defining virtual functions – Usage of virtual functions - Abstract classes - simulation using abstract classes.

**Module 4**

OVERLOADING: Overloading functions - Overloading operators to provide new meaning - Selecting Friend or Member Functions for Operator Overloading.

**Module 5**

DYNAMIC OBJECTS: Dynamic object allocation - Using references with dynamic memory allocation - Inline functions outside class definitions - Friend functions. Applications - Object oriented databases case study – some language (Simula, Smalltalk, C++, Ada) features.

**References**


1. Data abstraction & OOP in C++: Gordenkeeth, Wiley Eastern.
2. Object oriented programming with C++: E. Balaguruswamy, TMH.
3. C++: Strostrout.
4. Object Oriented Programming in C++: Nabajyoti Bjarne.


## FUZZY SYSTEMS (ELECTIVE - I)

**A 706-3** **3+2+0**

**Module 1**

Introduction to Fuzzy sets and systems. Basics of fuzzy sets membership function, support of a fuzzy set, height - normalised fuzzy set, $\alpha$ - cuts (decomposition of a fuzzy set), set theoretic definitions on fuzzy sets, complement, intersection and union equality, subsethood - basic definition based on membership functions.

**Module 2**

The law of the excluded middle and law of contradiction on fuzzy sets. Properties of fuzzy sets operations (logical proof only). Extension of fuzzy sets concepts - type-2 and level 2 fuzzy sets - examples.

**Module 3**

Operations on fuzzy sets - intersection, algebraic sum - product, bounded sum - product, drastic sum product, t-norms and t-conorms(s - norms) on fuzzy sets, typical parameterised t - norms and s-norms (with simplified proof). Extension principle and its applications.

**Module 4**

Fuzzy relation. Resolution form of a binary fuzzy relation. Operations on fuzzy relations - projection, max-min, and min and max, compositions cylindric extension. Similarity relations - reflexivity, symmetry, transitivity.

**Module 5**

Further operations on fuzzy sets and proposed by Zadeh - concentration dilation, contrast Intensification, a linguistic hedges, computation of the meaning of values

of a linguistic variable, fuzzy algorithms, fuzzy engineering - applications of fuzzy controls, case studies.

**References**


1. C.T lin & C S George Lee. Neural Fuzzy Systems, Prentice Hall.
2. Earl Cox. Fuzzy Systems Handbook, Associated Press
3. Klir and Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall of India.
4. IEEE Trans on Systems, Man & Cybernetics, vol. SMC - 3, No.1, January 1973, pp 28-44
5. Bart Kosko. Fuzzy Engineering, Prentice Hall.
6. Bart Kosko. Fuzzy Thinking, Hooper Collins Publications.


## ARTIFICAL INTELLIGENCE & EXPERT SYSTEMS (ELECTIVE - 1)

**LA706-4** **3+1+0**

**Module 1 Introduction**

Definitions- AI applications- Data, information and knowledge problems and problem space, problem characteristics, forward and backward reasoning means – ends – analysis – puzzle problems, Tower of Hanoi problem, game playing.

**Module 2 Search**

Search strategies, AND OR graphs, Heuristic search methods A and AO* algorithms, MIN – MAX strategies, Alpha – Beta cut offs.

**Module 3 Knowledge representation**

Propositional logic predicate logic, conversion of WFF to clause form, resolution, Unification, resolution – refutation system, question answering – non monotinic reasoning, fuzzy logics.

**Module 4 Knowledge Structure**

Semantic nets, frames, scripts, conceptual dependency – learning knowledge acquisition, different methods of learning.

**Module 5 Knowledge engineering and Expert Systems**

Structure of an expert system, distinctive features – case studies.

**Text Books**


1. Rich E., Artificial Intelligence, MGH


**References**


1. Nison N.J., Problem solving methods in Artificial Intelligence, MGH
2. Winston P.H., Artificial Intelligence, Academic Press, 1977

## PRINCIPLES OF REAL TIME SYSTEMS (ELECTIVE - I)

**LA 706-5** **3+1+0**

**Module 1**

Introduction to Real Time Systems – Structure of real time systems, real time computer, task classes – Periodic, Aperiodic, critical, Non-critical, definition of real time systems – real time systems, embedded systems - Hard real time systems, soft real time systems, real time design issues.

**Module 2**

Real time kernel – polled loop systems, co-routines, interrupt driven systems – sporadic, fixed rate systems, hybrid systems, task control block - task status, scheduling – uni-processor scheduling – traditional rate monotonic, rate monotonic deferred server, EDF, IRIS tasks – multiprocessor scheduling – utilization balancing algorithm, next-fit, bin- packing algorithm, myopic offline, buddy strategy (no need of proofs) fault tolerant scheduling.

**Module 3**

Communication – Communication Media and message sending topologies, network architecture issues, protocols – contention – based, token - based, stop and go multi-loop, polled bus, hierarchal, round robin, fault tolerant routing – clocks and synchronization – fault tolerant synchronization in hardware, synchronization in software.

**Module 4**

Fault tolerance – definition, cause of failure, fault types, fault detection and containment, redundancy – hardware, software, time, information, integrated failure handling – reliability – parameter values – series – parallel systems, NMR clusters, combinational model, master chain model, fault latency, transient faults, software error models.

**Module 5**

Programming Languages – Desired language characteristics, Real time databases, characteristics, main memory databases, Transaction, Disk schedule algorithms, Databases for hard real time systems, maintaining serialization constituency.

**Text Book**

1. Real Time Systems - C.M Krishna, Kang G. Shini (McGraw Hill)

**References**

1. Real Time Systems, Design & Analysis - Philip Laplante (IEEE)
2. Real Time Systems - Krishna, Tata McGraw Hill

## MICROPROCESSOR AND MICROCONTROLLER LAB

**LA707** **0+0+3**

1. Familiarization of 8085 trainer kit, manual code entry, simple examples.
2. Design and construction of a simple flash programmer for 89C51/89C2051 μC.
3. Study of Intel Hex file format.
4. Computer aided assembly language program development for 89C51/89C2051.
5. Use of assembler, linker and simulator for 89C51/89C2051.
6. Programming examples. Sorting, arithmetic operations (Using assembler, simulator).
7. Programming examples using Embedded 'C' compiler for 89C51/89C2051.
8. Programming examples using timer, external interrupts.
9. Design and construction of the following interfacing modules.
    a. A/D converter.
    b. D/A converter.
    c. Alphanumeric LCD display.
    d. Matrix keyboard interface.
    e. Seven segment display.
    f. Extending I/O port using shift registers (74HC595, 74HC165).
    g. Stepper motor.
    h. Infra red transmission and reception.
    i. Opto isolated I/P and O/P.
    j. Serial EEPROM.
    k. Real time clock.
    l. Interfacing using RS 232 and printer port.

**Note**

Any other embedded processor with similar or better capability may be used instead of 89C51/89C2051.



## INDUSTRIAL ELECTRONICS LAB

**A 708** **0+0+3**

**List of Experiments**

1. Linear Ramp Firing Circuit.
2. Study of PWMIC TL 494.
3. Battery Charger.
4. Step up DC – DC Converter.
5. Push pull DC – DC Converter.
6. Application of Opto coupler IC MCT2E.
7. AC Phase Control Circuit.
8. Study of DC Drive.
9. Regulation Characteristics of DC Drive.
10. Half bridge and Full bridge Converters

## PROJECT DESIGN & SEMINAR

**A 709** **0+0+2**

### PROJECT DESIGN

The student is expected to complete the design of the project work and submit the design phase report.

### SEMINAR

The student is expected to present a seminar in one of the current topics in Electronics, Instrumentation, Computers, Information Technology, Control Systems and related areas. The student will undertake a detailed study on the chosen subject and submit seminar report at the end of the semester.

# EIGHTH SEMESTER

## COMPUTER NETWORKS

**LA 801** **3+1+0**

**Module 1**

Network goals -topologies- configurations-concept of internet- ISO-OSI 7 Layer Standard -peer processes-Functions of each layer-TCP/IP reference model - Transmission media -description and characteristics - base band and broad band transmission-synchronous and asynchronous -full duplex, half duplex links- Concepts of WAP technology.

**Module 2**

MODEMS-serial communication standards - X-21 digital interface- Need for data link layer-stop and wait and sliding window protocol-HDLC-terminal handling-polling-multiplexing- concentration-virtual circuit and data-grams - routing - congestion control.

**Module 3**

LAN- base band and broad band Lan's - carrier sense networks-CSMA/CD -ring network- shared memory -IEEE802 standards-introduction to X-25. Transport layer- design issues- establishing and releasing connection - flow control – buffering - crash recovery - a simple transport protocol on X-25.

**Module 4**

Session layer- design issues -data exchange - dialogue management - synchronization- remote procedure call-client server model - Presentation layer-data presentation-compression- network security-privacy- cryptography-presentation layer in ARPANET.

**Module 5**

Application layer - virtual terminal - file transfer protocol-E-mail-introduction to distributed system - ATM-protocol architecture -ATM logical connections -ATM cells -cell transmission- ATM adaptation layer -AAL protocols -basic principles of SDH and SONET.

**References**


1. Computer Networks: Andrew S Tannenbaum, Pearson Education.
2. An Engineering Approach to Computer Networking: Keshav, Pearson Education.
3. Computer Networking: A Top Down Approach: Kurose Pearson Education.
4. Computer Network & Internet: Comer, Pearson Education.
5. Data communication: Hausly
6. Computer Networks, protocols standards & interfaces, Uyless Balack
7. Local Area Networks: William Stallings, Pearson Education.
8. Understanding Data Communication and networks- 2nd ed-William A Shay (Vikas Thomson Learning)

## MODERN CONTROL THEORY

A802 **3+1+0**

**Module 1**

Limitation of Conventional Control Theory. Concepts of state variable and state model - state model for linear time invariant systems.

State space representation of dynamic systems: physical notion of system state, block diagram representations. Lagrang's equations – examples

**Module 2**

Transformation of state variables, solution of differential equations in state space form, interpretation and properties of the state transition matrix, solution by the laplace transform, the resolvent, transfer function from state model, state space representations of transfer functions.

Decomposition of Transfer functions: Direct, cascade and parallel decomposition technique.

**Module 3**

State space modelling of systems: Inverted pendulum on a cart, Temperature control - two capacitance system, spring coupled masses, distillation column, instrument servo, missile guidance dynamics. Controllability and Observability: Physical interpretation, Kalman's and Gilbert's tests, Effect of pole - zero cancellation, detectability and stabilisability.

**Module 4**

Shaping the dynamic response - Design of regulators for single input single output systems, Bass- gura pole placement formula, Multiple input systems, disturbances and tracking systems: exogenous variables.

Linear observers: Need of observers, structure and properties of observers, pole placement for single output systems.

**Module 5**

Introduction to MATLAB - MATLAB functions - m - files- analysis and design of control systems using MATLAB, Simulink - construction and analysis of simple models - modelling of systems given in module II

**References**


1. B.Friedland - Control System Design - An Introduction to state space methods - Mc Graw Hill, Inc. N Y
2. T. Kailath - Linear systems - Prentice Hall Inc., Englewood cliffs, N J
3. C. Chen - Analog and Digital Control System Design - Transfer function, State Space and algebraic methods, Saunders College Publishing, N.Y
4. A Nagooe Kani – Advanced Control Theory

## ADVANCED MICROPROCESSORS

**LA 803** **3+1+0**

**Module 1**

Intel 8086 Microprocessor - Internal architecture – Block diagram – Minimum and maximum mode operation – Interrupt and Interrupt applications – DMA data transfer – 8087 math coprocessor.

8086 memory organization – even and odd memory banks – segment registers – logical and physical address – advantages and disadvantages of physical memory

**Module 2**

Addressing modes used in 80x86 family

Data addressing mode – register addressing, immediate addressing, direct addressing, register indirect addressing, base plus index addressing, register relative addressing, base relative plus index addressing, scaled addressing.

Program memory addressing modes - direct program memory addressing, relative program memory addressing.

Stack memory addressing mode.

**Module 3**

Intel 80286 Microprocessor

80286 Architecture, system connection – Real address mode operation – Protected mode operation

**Module 4**

Intel 80386 Microprocessor

80386 Architecture and system connection – Real operating mode – 386 protected mode operation – segmentation and virtual memory – segment privilege levels and protection – call gates – I/O privilege levels – Interrupts and exception handling – task switching – paging mode – 80386 virtual 86 mode operation.

**Module 5**

Advanced Intel Microprocessors

80486 – Processor model – Reduced Instruction cycle – five stage instruction pipe line – Integrated coprocessor – On board cache – Burst Bus mode.

Pentium – super scalar architecture – u-v pipe line – branch prediction logic – cache structure – BIST (built in self test) – Introduction to MMX technology.

**References**


1. The Microprocessors, 6th Edition - Barry B. Brey Pearson Edu.
2. Microprocessor and Interfacing 2nd Edition - Douglous V. Hall TMH
3. The 80x86 family - John Uffenbeck

## COMPUTERISED PROCESS CONTROL

**A804** **3+1+0**

**Module 1**

Programmable Logic Devices:
Basic Concepts- Programming Technologies. Programmable Logic Array (PLA)- Programmable Array Logic (PAL)- Design and Application

**Module 2**

Programmable Logic Controllers:
Combinational logic controllers, sequential logic controllers, logic controller design using programmable logic devices, Introduction to programmable logic controllers - PLC programming languages, Commercially available PLCs, Microprocessor based PLCs.

**Module 3**

Distributed Control Systems - Part 1
Basic packages, cost estimating, data highways – field buses, multiplexers and remote terminal units, CRT displays, flow sheet symbols, I/O hardware and setpoint stations.

**Module 4**

Distributed Control Systems - Part II
Supervisory computer tasks and configurations, system integration with PLCs and computers, Fibre - Optic local area networks: MAP and TOP, Fieldbuses, MAP, TOP.

**Module 5**

Network protocols:
Printers, Operator interfaces, workstations, wiring practices and signal conditioning, communication systems, case study- Allen- Bradlley Protocol (AB. Protocol)



**References**

1. Enrique Mandado, Jorge Marcos, Serafin A Perrez, - Programmable Logic Devices and logic Controllers - Prentice Hall- 1996
2. Dobrivoje Popovic and Vijay P. Bhatkar - Distributed Computer Control for Industrial Automation - Marcel Dekker, INC, 1990.
3. B.G Liptak - Handbook of Process Control - 1996

## ROBOTICS (ELECTIVE - II)

**A805-1**

**Module1 Robot Organization**

Coordinate transformation – Kinematics and inverse kinematics – trajectory planning and remote manipulation.

**Module 2 Robot hardware**

Robot sensors – Proximity Sensors – Range Sensors – Tactile Sensors – Visual Sensors – Auditory Sensors. Robot Manipulators – Manipulator Dynamics – Manipulator Control –wrists – End effectors – Robot Grippers.

**Module 3 Robot and Artificial Intelligence**

Principles of all Basics of Learning – planning Movement – Basics of Knowledge Representation – Robot programming languages.

**Module 4 Robotic Vision Systems**

Principles of edge detection – Determining of optical flow and shape – image segmentation – Pattern recognition – model director sense analysis.

**Module 5 Robot control and Application**

Robot control using voice and infrared – overview of robot application – prosthetic devices – Robots in material handling, processing, assembly and storage.

**References**


1. Koren, "Robtics for Engineers", McGraw Hill Int. Co Tokyo 1985
2. Hall and Hall" Robotics – A User Friendly Introduction", Saunders Publishing Company, 1985
3. Vokobravotic "Introduction to Robotics", Springer 1988
4. Lee, Gonzalez aqnd Fu " Robotics (11 Ed)", IEEE Press, 1986
5. Charniakand, Mcdermott, "Roboty Technology ande Applications", Springer 1985
6. Charniac & Mcdermott, "Introduction to Artificial Intelligence", Mc Graw Hill, 1986
7. P Janaki Raman, "Robotics", Tata Mcgraw Hill




## VHDL (ELECTIVE - II)

**LA805-2** **3+1+0**

**Module 1**

Introduction: Hardware Abstraction- Basic Terminology- Entity Declaration- Architecture Body- Configuration Declaration- Package Declaration- Package Body- Model Analysis- Simulation- Basic Language Elements –Identifiers- Data Objects- Data Types- Operators.

**Module 2**

Behavioural Modelling: Entity Declaration- Architecture Body-Process Statement- Variable Assignment Statement- Signal Assignment Statement- Wait Statement- If Statement - Case Statement- Null Statement- Loop Statement- Exit Statement- Next Statement- Assertion Statement- Report Statement- Other Sequential Statements- Multiple Processes- Postponed Processes - Dataflow Modelling: Concurrent Signal Assignment Statement- Concurrent versus Sequential Signal Assignment- Delta Delay Revisited- Multiple Drivers- Conditional Signal Assignment Statement- Selected Signal Assignment

Statement- the UNAFFECTED Value- Block Statement- Concurrent Assertion Statement- Value of a Signal.

**Module 3**

Structural Modelling: Component Declaration- Component Instantiation- Resolving Signal Values - Generics and Configurations: Generics- Configurations- Configuration Specification- Configuration Declaration- Default Rules - Conversion Functions - Direct Instantiation- Incremental Binding.

**Module 4**

Subprograms and Overloading: Subprograms- Subprogram Overloading- Operator Overloading- Signatures- Default Values for Parameters - Packages and Libraries: Package Declaration- Package Body-Design File- Design Libraries- Order of Analysis- Implicit Visibility- Explicit Visibility.

**Module 5**

Advanced Features: Entity Statements- Generate Statements- Aliases- Qualified Expressions- Type Conversions- Guarded Signals- Attributes- Aggregate Targets- Shared Variables- Groups - Model Simulation: Simulation- Writing a Test Bench- Converting Real and Integer to Time- Dumping Results into a Text File- Reading Vectors from a Text File- A Test Bench Example- Initialising a Memory- Variable File Names- Hardware Modelling Examples: Modelling Entity interfaces- Modelling Simple Elements- - Different Styles of Modelling- Modelling Regular Structures- Modelling Delays- Modelling Conditional Operations- Modelling Synchronous Logic- State Machine Modelling- Interacting State Machines- Modelling a Moore FSM- Modelling a Mealy FSM- A Generic Priority Encoder- A Simplified Blackjack Program- A Clock Divider- A Generic Binary Multiplier- A Pulse Counter- A Barrel Shifter- Hierarchy in Design.

**Text Book**

1. VHDL Primer Third editions: J. Bhasker, Pearson Education Asia.

**Reference**

1. Introducing VHDL from simulation to synthesis: Sudhakar Yakmandhiri, Pearson Education Asia

## NEURAL NETWORKS (ELECTIVE - II)

**A805-3** **3+1+0**

**Module 1**

Introduction - Principles - artificial neuron - activation functions - Single layer & multi-layer networks - Training artificial neural networks - Perception - Representation - Linear separability - Learning - Training algorithms.

**Module 2**

Back Propagation - Training algorithm - Applications - network configurations - Network paralysis - Local minima - temporal instability.

**Module 3**

Counter Propagation networks: Kebenon layer - Training the cohenen layer - Pre initializing the wright vectors - statistical properties - Training the Grosbery layer - Full counter propagation network - Application.

**Module 4**

Statistical methods- Boltzmann's Training - Cauche training - Artificial specific heat methods - Applications to general non-linear optimization problems.

**Module 5**

Hopfield nets - Recurrent networks - stability - Associative memory - applications - Thermo dynamic systems - Statistical Hopfield networks – Bi-directional associative memories - Continuous BAM - Adaptive resonance theory - Architecture classification - Implementation.

**Text Book**

1. Neural Computing Theory & Practice - Philip D. Wasserman.

**References**

1. Neural Networks - Simon Haykins
2. Adaptive Pattern Recognition & Neural Networks - Pay Y.H.
3. An Introduction to neural computing - Chapman & Hall
4. Artificial Neural Networks - Robert J. Schalkoff, McGraw Hill
5. Artificial Neural Networks - B.Yegnanarayana, PHI



## ADVANCED MICRO-CONTROLLERS (ELECTIVE – II)

**LA805-4** **3+1+0**

**Module 1**

Low pin count controllers – Atmel AVR family – ATTiny15L controller - architecture – pin descriptions – features – addressing modes – I/O space – reset and interrupt handling – reset sources - Tunable internal oscillator.

**Module 2**

Timers – Watch dog timer – EEPROM – preventing data corruption – Analog comparator – A/D converter – conversion timing – ADC noise reduction – PortB – alternate functions – memory programming – fuse bits – high voltage serial programming – algorithm.

**Module 3**

National semiconductor COP8 family - COP8CBR9 processor – features – electrical characteristics – pin descriptions – memory organization –EEPROM - security – brownout reset – in system programming – boot ROM. Idle timer – Timer1, Timer2, Timer3 -operating modes – PWM mode – event capture mode

**Module 4**

Power saving modes – Dual clock operation – Multi input wake up – USART – framing formats – baud rate generation – A/D conversion – operating modes – prescaler – Interrupts – interrupt vector table – Watch dog – service window – Micro-wire interface – waveforms.

**Module 5**

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.

**References**


1. Design with PIC micro-controllers: John B Peatman, Pearson Education.
2. DS101374: National Semiconductor reference manual.
3. National semiconductor web site – www.national.com
4. 1187D: Atmel semiconductor reference manual.
5. Atmel semiconductor web site – www.atmel.com
6. DS30292B: Microchip reference manual.
7. Microchip semiconductor web site – www.microchip.com


## E-COMMERCE (ELECTIVE - II)

**LA 805-5** **3-1-0**

**Module1**

Introduction to Electronic Commerce - E-Commerce Framework- Anatomy of E-Commerce Applications - E-Commerce Consumer & Organization Applications- E- Commerce and World Wide Web - Internet Service Providers - Architectural Framework for Electronic Commerce - WWW as the Architecture- Hypertext publishing.

**Module 2**

Network Security - Client-Server Network Security - CS Security Threats – Firewalls - Data & Message Security - Encrypted Documents - Security on the Web.

**Module 3**

Electronic Payment Systems - Types of Electronic Payment Systems - Digital Token Based Electronic Payment System - Smart Cards - Credit Cards - Risk in Electronic Payment Systems - Designing Electronic Payment Systems.

**Module 4**

Electronic Data Interchange - EDI Application in Business- EDI-Legal - Security and Privacy Issues - EDI standardization - EDI Envelope for Message Transport - Internet based EDI - Internal Information System- Work-flow Automation and Coordination- Supply Chain Management- Document Library- Types of Digital Documents- Corporate Data Warehouses.

**Module 5**

Recent Trends in E-Commerce - Multimedia in E-Commerce - Video Conferencing with Digital Videos - Broad Band Telecommunication- Frame & Cell Relays - Switched Multimegabit Data Service (SMDS) - Asynchronous Transfer Mode - Mobile Computing and Wireless Computing.

**Text Book**

1. Frontiers of Electronic Commerce: Ravi Kalakota & Andrew B Whinston.

**References**

1. Global Electronic Commerce: J Christopher Westland & Theodore H K Clark.
2. E- Commerce The cutting edge of Business: Kamlesh K Bajaj & Debjani Nag.
3. E-Commerce: Strategy Technologies and Applications, TMH

## ADVANCED DIGITAL SIGNAL PROCESSING (ELECTIVE - III)

**LA806-1** **3+1+0**

**Module 1**

Introduction to Multi-rate Digital Signal Processing – Sample rate reduction - decimation by integer factors- sampling rate increase – interpolation by integer facto - Design of practical sampling rate converters: Filter Specification- filter requirement for individual stages - Determining the number of stages and decimation factors - Sampling rate conversion using poly-phase filter structure – poly-phase implementation of interpolators.

**Module 2**

Adaptive Signal Processing – Adaptive filters – Concepts- Adaptive filter as a Noise Canceller - Other configurations of the adaptive filter - Main components of the adaptive filter – Basic Wiener filter theory – The basic LMS adaptive algorithm – Practical limitations of the basic LMS algorithm - Recursive Least Square Algorithm – Limitations - Factorization Algorithm.

**Module 3**

Introduction to two dimensional signal and systems - 2D – DFT Transforms - Properties and applications - Discrete Hilbert Transform and Discrete Cosine Transform – Properties and Applications - Short term Fourier Transform - Gabor Transform - Properties and Applications.

**Module 4**

Wavelets – Wavelet Analysis – The Continuous Wavelet Transform - scaling - shifting - scale and frequency - The Discrete Wavelet Transform - One Stage filtering - Approximation and Details - Filter bank analysis – Multilevel Decomposition – Number of levels – Wavelet reconstruction – Reconstruction filter- Reconstructing Approximations and details- Multilevel Reconstruction - Wavelet packet synthesis- Typical Applications.

**Module 5**

General and special purpose DSP Processors - Computer Architecture for signal processing – Havard Architecture - Pipelining - Hardware Multiply and Accumulate – Special Instructions - Replication - On-chip Memory Cache - Extended Parallelism - SIMD – VLIW and static super-scalar Processing - Brief study of TMS320C4X and ADSP 2106 processors.

**References**


1. Digital Signal Processing: Emmanuel C Ifeachor, Barrie W Jrevis, Pearson Education.
2. Theory and Applications of DSP: L.R Rabiner and B gold
3. Electronic filter Desig Hand Book: A .B Williams and FT Taylor, McGraw Hill
4. Wavelets and Subband Coding: Valterli & Kovaceric, PHI.
5. Analog Devices & Texas Instruments Users Manuel of TMS320C4X and ADSP 2106x.


## MULTIMEDIA SYSTEMS (ELECTIVE - III)

**LA806-2** **3+1+0**

**Module 1 Introduction**

Definition of multimedia, multimedia, hardware, software applications and software environments, - Media Types - Analog and digital video, digital audio, music and animation - Analog & Digital video - Memory storage - Basic tools - Authoring tools.

**Module 2 Building Blocks**

Text - Hyper text - Sound - Sound cards - Standards - Image - Image types - Image compression, RLE, JPEG, MPEG - Fractal and Wavelet Compressions - Image file types - Animation - Capture and Playback techniques. (basic ideas only)

**Module 3 Multimedia Environments**

The Compact Disc family, CD-interactive, Digital Video Interactive, QuickTime, Multimedia PC and Microsoft Multimedia Extensions.

**Module 4 Multimedia Programming**

Framework: Overview, Media classes, Transform classes, Format classes and Component classes - Problems related to programming - Composition, Synchronisation, Interaction, Database integration.

**Module 5 Advanced Multimedia**

Moving pictures - Techniques realistic image synthesis, Virtual Reality - Full motion digital video - Video capture techniques - multimedia networks - Desktop video conferencing - Future multimedia.

**References**


1. Multimedia Programming Objects, Environments & Framework - (Addison-Wesley Publishing Co.)
2. Multimedia- Making it work - Tay Van Ghan – Osborne Tata Mcgraw Hill
3. Authoring Interactive multimedia - Arch C Luther
4. Optimizing your Multimedia PC- L.J. Skibbe, Susan Lafe Meister- Comdex
5. Multimedia Bible - Winn L. Rosch, Sams
6. Multimedia Producers Bible - Ron Goldberg, Comdex
7. Multimedia Power Tools - Peter Jellam, Random house Electronic Pub.
8. Multimedia Computing - Mathew E. Hodger & Russel M. Sasnett, Addison wesley
9. Integrated Multimedia Systems Overview- Palikom, The communication Wall


## SYSTEM SOFTWARE (ELECTIVE - III)

**LA806-3** **3+1+0**

**Module1 Introduction**

Concept of system software, classification of system s/w. Assemblers: over view of assembly process, elementary ideas of macros & macro processors. Compilers: Overview of compilation process, Parsing- top down & bottom-up parsing, storage allocation. Interpreters: basic ideas only.

**Module 2 Operating Systems**

Types of OS, batch processing, multiprogramming, timesharing, real time OS. OS services UNIX OS –shells, Bourne Shell, C shell- visual editor.

**Module 3 Information Management**

File system- directory structure, basic file system calls, file protection, allocation methods disk blocks and inodes in UNIX. Device management.

**Module 4 Processor Management**

CPU scheduling- scheduling algorithms, Multiprocessor scheduling, Process management in UNIX, concurrent process- critical section, semaphores, synchronization, concurrent languages.

**Module 5 Memory Management**

Swapping, partitions, paging, segmentation, virtual memory concepts, page replacement, dynamic linking, caching of secondary storage, memory management in UNIX, Deadlocks: cause, detection, prevention, avoidance, recovery, combined approach to deadlock handling.

**References**


1. System programming and Operating Systems – D M Dhamdhere
2. System Software – an introduction to system Programming – Leland L Beck, 3ed.
3. Operating System – Peterson & Silberschatz, Addison Wesley
4. Operating Systems – Dietal H M
5. Design of UNIX Operating System – Maurice J Bach
6. UNIX System Programming – Stevens.

## EMBEDDED SYSTEMS (ELECTIVE - III)

**LA806-4** **3+1+0**

**Module1 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.

**Module2 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 3 Embedded Communication System**

Serial Communication, PC-to-PC Communication, Serial Communication with the 8051 Family of Micro-controllers, Protocol Converter, Voice-over-IP, Embedded Applications over Mobile Network example MP3 Sound Player.

**Module 4 Real Time & Database Applications**

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

**Module 5 Java Applications & Future Trends in Embedded Systems**

Networked Java-Enabled Information Appliances, Embedded Process Control System, Mobile Java Applications, Appliance Control using Jini, System on a Chip (SOC), Smart Cards and the Cashless Society, Security in Embedded Systems.

**Text Book**

1. Programming for Embedded Systems- Dreamtech Software Team, Wiley Dreamtech

**Reference**

1. Fundamentals of Embedded Software where C and Assembly Meet – Daniel W Lewis.

## PROJECT & SEMINAR

**A808** **0+0+3**

Each student is expected to prepare a report on the project work done by him/her and present a paper highlighting the work done by him/her in a seminar. The student is expected to complete the project work assigned to him/her and submit the project report by the end of semester.

## VIVA – VOCE

**A809** **0+0+0**

The students should prepare for an oral examination on Basic Circuit theory, Digital systems, Instrumentations, Computer Communication, Microprocessors, Industrial Electronics, Signal Processing etc.

(50 marks University exam)

Viva-Voce examination may be made based on Seminar, Projects, Industrial Visits, Industrial training and overall performance.

**References**


1. Global Electronic Commerce – J Christopher Westland & Theodore H K Clark
2. E- Commerce The cutting edge of Business - Kamlesh K Bajaj & Debjani Nag / Pearson Education


## ARTIFICIAL INTELLIGENCE

**RT 804** **3+1+0**

**Module 1**

Introduction – Definitions – AI application areas – Example problems- Problems and problem spaces - Problem characteristics – Problem solving by searching. Searching strategies – Breadth first search, Uniform cost search, DFS, Depth – Limited search, Bi-directional search – Constraint satisfaction search.

**Module 2**

Informed search, A* algorithm, Heuristic functions – Inventing Heuristic functions - Heuristic for constraint satisfaction problem – Iterative deepening – Hill climbing – Simulated Annealing.

**Module 3**

Game playing and knowledge structures – Games as search problem – Imperfect decisions – Evaluation functions – Alpha – Beta pruning – state of art game programs. Introduction to frames and semantic nets.

**Module 4**

Knowledge and Reasoning – Review of representation and reasoning with Logic – Inference in first order logic, Inference rules involving quantifiers, modus ponens, Unification, forward and backward chaining – Resolution.

**Module 5**

Introduction to Prolog – Representing facts – Recursive search – Abstract data types – Alternative search strategies – Meta predicates, Matching and evaluation, meta interpreters – semantic nets & frames in prolog.

**Text Books**

**Module 1,2,3,4**


1. Artificial Intelligence – A modern approach - Stuart Russell – Peter Narang, Pearson Education Asia
2. Artificial Intelligence - Rich E. - McGraw Hill Booq Company


**Module 5**


3. Artificial Intelligence - George F Luger, Pearson Education Asia


**Reference**


1. An Introduction to Artificial Intelligence – Eugene Charniak & Drew McDermot, Pearson Education Asia