First year First Semester.

HUMANITIES-A

English - 2 Pds/week - 50 Marks
Sociology - 2 Pds/week - 50 Marks

HUMANITIES

1.Basic writing skills
2.Report, Covering Letter & Curriculum-Vitae writing
3.Reading and Comprehension
4.Selected Short Stories
Text Book: ENGLISH FOR ALL

SOCIOLOGY

1.Sociology: nature and scope of sociology - sociology and other social sciences - sociological perspectives and explanation of social issues
2. Society and technology: impact of technology on the society - a case study
3. Social stratification: systems of social stratification - determinants of social stratification - functionalist, conflict and elitist perspectives on social stratification
4.Work: meaning and experience of work: postindustrial society- post-fordism and the flexible firm
5.Development - conceptions of and approaches to development - the roles of state and the market in the development
6. Globalization: the concept of globalization - globalization and the nation state - development and globalization in post colonial times.
7. Industrial policy and technological change in india - the nature and role of the state in India
8. Technology transfer: the concept and types of technology transfer-dynamics of technology transfer
9. Technology assessment: the concept - steps involved in technology assessment
10. Environment: sociological perspectives on environment - environmental tradition and values in ancient india
11. The development of management: scientific management - organic organization - net work organization - post modern organization - debureaucratization - transformation of management
12. Technological problems and the modern society: selected case studies - electric power crisis, industrial and/or environmental disaster, or nuclear accident

PHYSICAL ELECTRONICS

Crystal structure: periodic arrays of atoms, fundamental type of lattices, crystal direction & planes.
Semiconductor statistics: distinguishable and indistinguishable particles, Maxwell-Boltzmann, Fermi- Dirac, & Bose -Einstein distribution.
Semiconductor physics: Schrödinger wave equation, infinite quantum well, finite quantum well, concept of nanostructures & nanomaterials. motion of electrons in a periodic structure, Bloch theorem, Kronig-penny model, energy bands, Brillouin zones,

reciprocal lattice vector, concept of effective mass, Fermi surface, density of states, carrier concentration in semiconductors, concept of holes, elemental and compound semiconductors, intrinsic & extrinsic semiconductors, degenerate & nondegenerate semiconductors, doping & compensation, traps, recombination & lifetime, surface states, surface recombination velocity.

Electron transport: lattice vibrations of monatomic lattices, lattice with two atoms per primitive cells, dispersion relations, quantization of lattice vibrations (phonons), scattering mechanisms & mobility of charge carriers, qualitative discussion on the phonon & impurity scattering mobilities, dependence of carrier mobility on lattice temperature & impurity concentration. Concept of field dependent mobility, diffusion, Einstein's relation, Poisson's eqn, continuity eqn.

Measurement of semiconductor parameters: cyclotron resonance experiment, hall experiment, Shockley Haynes experiment, four probe method.

MATHEMATICS – IG

Successive differentiation. Leibnitz theorem, Rolle's theorem (statement only), Mean value theorems, Taylor's and McClurin's theorem in finite and infinite form,
Indeterminate forms: Functions of two independent variables: their limits and continuities Partial derivatives, Euler's theorem: Partial derivatives of composite and implicit functions. Jacobians, Taylor's theorem (statement only). maxima and minima,
Lagrange's method.
Sequence and infinite series of positive terms: their convergence or divergence: Series of function, sequence of function, asymptote.

MATHEMATICS – IIG

Vector Calculus: Differentiation of a vector function, directional derivatives – gradient, divergence and curl, relations involving them, theorems of Green, Gauss and Stoke. 1D,2D,3D integral, Surface, line and volume integral.
Complex Analysis: Complex numbers, De Moivre's theorem, exponential values of sine and cosine, functions of a complex variable, limit continuity and differentiability,
Cauchy – Riemann conditions, complex integration, Cauchy's fundamental theorem,
Cauchy's integral formula, Taylor's theorem, Laurent's theorem, Singularity, poles and residues, contour integration, conformal mapping, Schwarz-Christoffel Transformation.

Integral Transform: Fourier Series, Fourier, Laplace and Z transform and their properties. Inverse Laplace transform, convolution theorem. Inverse Z transforms.

PHYSICS-IB

1. Use of vectors in particle mechanics, unit vectors in spherical and cylindrical polar coordinates, conservative vector fields and their potential functions - gravitational and electrostatic examples, gradient of a scalar field, equi-potentials, states of equilibrium, work and energy, conservation of energy, motion in a central field and conservation of angular momentum. homogeneous co-ordinate transformation.

2. Macroscopic and microscopic description, thermal equilibrium, zeroth law of thermodynamics, concept of international practical temperature scale, heat and work, first law of thermodynamics and some applications, reversible and irreversible processes, Carnot cycle, second law of thermodynamics, concept of entropy, thermodynamic relations.

3. Statistical description of a system of particles, phase space, microstates and Macrostates, Boltzmann formula for the entropy, canonical partition function, free energy and other thermodynamic quantities in terms of the partition function, classical ideal gas, equi-partition theorem and its applications.

4. introduction to rigid body dynamics: stability analysis of static and dynamic systems. formulation of dynamics systems, Lagrange–Euler equation, Newton-Euler equation, DeAlembert's model, rotational and translational motion of rigid body., concept of perspective projection , parameter estimation of perspective projection matrix.

COMPUTER PROGRAMMING AND NUMERICAL ANALYSIS

Computer programming

Introduction to digital computers, introduction to programming - variables, assignments, expressions, input/output, conditionals and branching, iteration, functions, recursion, arrays, introduction to pointers, structures, introduction to data-procedure encapsulation, dynamic allocation, linked structures, introduction to file handling, introduction to data structures – stacks, queues, linked list, trees and graphs, time and space requirements.

Numerical analysis

Introduction/error analysis: iterative methods, successive bisection, false position/Regula Falsi , Newton-Rhapson ,secant , successive Approximation
Solution of simultaneous algebraic Equations: Gauss elimination, Gauss-Seidel iteration, LU decomposition. Interpolation: Lagrange interpolation, spline interpolation, truncation error in interpolation. Approximation of functions: linear regression, polynomial regression, fitting exponential and trigonometric functions, series expansions (Taylor, Chebyshev). Differentiation and integration: numerical differentiation, trapezoidal rule, Simpson's one-third rule, Gaussian quadrature formula. Numerical solution of differential equations: Euler method, Taylor series method, Runge-Kutta methods, Predictor-corrector method

PHYSICS LABORATORY-1

(Selected Experiments from the following)
1. Determination of Galvanometer resistance by half - deflection method.
2. Determination of Galvanometer resistance by Thomson's method.
3. To find high resistance by Galvanometer deflection method.
4. To measure mechanical equivalent of heat, J by electrical method (Joule's) using copper calorimeter (radiation correction to be done).
5. To compare to low resistance by drop of potential method.

6. To determine resistance per unit length of wire by using Carey Foster bridge.
7. To estimate strength of a current by using copper voltmeter.
8. a) To compare the EMF's of two cells by using a potentiometer
b) To measure current by using a potentiometer
9. To measure the horizontal components of earth's magnetic field intensity using deflection and vibrating magnetometers.
10. Determination of co efficient of linear expansion by optical lever method.
11. Determination thermal conductivity of metal by Searle's method.
12. To determine co-efficient of viscosity by Capillary flow method.
13. Determination of Young's modulus by Flexure method.
14. To draw mutual and anode characteristics of triode and hence too fine Rp, μ, and gm
15. To draw the transistor characteristics (NPN/PNP) in the given configuration and hence to find hi, hf
16. Determination of refractive index of the material of the glass prism by prism spectrometer (for at least two ?s)
17. Study of collisions in one dimension using a linear air track
18. Use of an air track for obtaining potential energy curves for magnetic interactions.
19. Study of oscillations under potential wells of various shapes using an air track.
20. Experiments on diffraction in single slit, double slit and plane grating using He- Ne laser
a) To find the wavelength of a monochromatic light by single slit.
b) To find slit separation of a double slit.
c) To find number of rulings per cm of a plane grating
21. To find the wavelength of a monochromatic light by Newton rings.
22. Fabry-Perot interferometry: To find out separation of wavelength of sodium D1 & D2 lines.

BASIC ENGINEERING DRAWING

Drawing primitives: instruments, letters, lines, title block, geometric curves & shapes, scale and dimension. Projection: orthographic and isometric, sectional views.

WORKSHOP PRACTICE-VI

Introduction to types of Indian woods used for engineering purposes and carpenter’s tools; use of wood working machines; making of selected joinery. Introduction to fitter’s tools, gauges, measuring instruments etc., marking of jobs, fitter’s job involving chipping, filing, sawing, drilling; use of taps and dies, pipe fittings and plumbing.

PROGRAMMING LABORATORY

1. Programs to demonstrate the use of different control statements.
2. Programs using arrays and pointers.
3. Programs using files.
4. Programs involving functions and recursion
5. Program to demonstrate the use of structures.

6. Implementation of complex number as a user defined data type.
7. Implementation of stack and queues using both arrays and linked list.
8. Implementation of simple sorting and searching algorithms.
9. Implementation of a search on a tree.

First Year Second Semester

CIRCUIT THEORY

Graph theory: graph of a network, concepts of path, cycle and tree, spanning tree, independent loops, cut set – cut set matrix.
Circuit elements: passive circuit elements and their equilibrium equation, independent voltage and current sources, controlled sources, coupled circuits and their controlled source representations
Circuit equations: Kirchoff's laws, formation of node equations, formation of loop equation
Solution classification: solution using differential equation, concept of steady state and transient response
Laplace transforms and related topics: Fourier series, exponential Fourier series Fourier transform- limiting case of Fourier series, Laplace transform
Transient analysis : application of Laplace transform in the solution of circuit problems, concept of impedance function, poles and zeros, concept of impulse response ,convolution integral , convolution theorem and its application
Sinusoidal steady state analysis: frequency domain analysis, concept of phase and amplitude, vector representations, resonance
Network theorems: superposition and reciprocity theorem, Thevenin's and Norton's theorem ,maximum power transfer theorem, Tellegen's theorem
Passive two port network: different representation schemes, image impedance parameters, characteristic impedance and propagation constant, open circuit voltage transfer function

ELECTRON DEVICE

Metal-semiconductors Junction: band diagram, depletion region & capacitance, ohmic & rectifying contacts, Schottky diodes.

Semiconductor-semiconductor junction: basic device technologies for fabrication of a p-n jn., homojunction & heterojunctions; equilibrium band diagram, charge, field & potential profiles in p-n junctions, depletion region, depletion capacitance, biased p-n junctions, diode eq. & diode characteristics, diffusion capacitance, circuit models of p-n junction diode. **Breakdown mechanisms in p-n junctions:** avalanche & zener processes & their dependence upon temperature & doping zener diode, varactor diode.

Degenerate p-n junctions: band model under large doping condition, tunnel diode, i-v characteristics, equivalent circuit, applications, backward diode.

Bipolar transistors: band diagram, the transistor action, current components in a BJT, current amplification factors, early effect & its consequences, different modes of operation, input & output characteristics, load line & amplifier operation**.**

Junction field effect transistor (JFET): principle of operation, output and transfer characteristics, JFET parameters. common source amplifier.

Insulated gate field effect transistor (IGFET) : construction & principle of operation of p- & n-channel enhancement & depletion mode MOSFETS, drain & transfer characteristics, threshold voltage & its control, psg & soi systems, CMOS inverter, speed of operation, V-MOS construction.

Operation & characteristics, CCD: construction & principle of operation.

Power semiconductor devices: semiconductor controlled rectifier, construction & operation, forward & reverse characteristics, triggering methods, SCR specifications, SCR control, Shockley diodes,

Diac, Triac: operation & characteristics; unijunction transistors (UJT), UJT control of SCR, programmable UJT; V-MOS construction, operation & characteristics; IGBT characteristics. **Switching characteristics of devices:** switching phenomenon in diodes, BJT, MOS & CMOS, switching times, switching speeds, speed up capacitor.

Basic optoelectronic devices: light emitting diode, liquid crystal display, solar cell, photodiode, phototransistor, seven segment display, alpha-numeric display, opto-coupler.

MATHEMATICS – IIIG

Abstract Algebra: sets and set operations: D'Morgan's Laws, cartesian product of sets; binary relations: equivalence relations, partial ordering relation, lattice, boolean algebra, linear space, linear dependence and independence. basis, dimension, normal linear space, inner product space.

Introduction to probability theory:
addition, multiplication, marginal and conditional probability, joint probability, Baye's theorem, random variables, probability mass function, probability distribution function, moments and moments generation function, binomial distribution, Poisson distribution, exponential distribution, Gaussian /normal distribution, gamma distribution, Chebyshev's inequality, Schwartz inequality, q function, random process, autocorrelation, auto covariance function, stationary process, Erlang process, ergodic random process, Markov chain and transitional probability, order of Markov chain, Chapman-Kolmogorov equation, irreducible state, absorbing state, ergodoic chain, birth and death process, Markovian queuing models

MATHEMATICS – IVG

Linear transformations and matrices: conformability of matrix sum and product, types of matrices, matrix polynomial, matrix differentiation, partitioning, rank of a matrix, condition for the existence of solutions of a system of linear equations and their

uniqueness, characteristic equation of a matrix, Cayley Hamilton theorem, Eigenvector and Eigen value of a matrix (linear transformation).
Comparison test, D'alembert's ratio test and Cauchy's root test.
Exact equation of first order, 1st order linear equation solution of ordinary second and higher order linear differential equation of with constant coefficients, ordinary point and regular singular point of equations with variable coefficients. Method of Frobenius, Bessel and Legendre functions. Solution of system of ordinary linear differential equations, method of phase plane, critical point and stability. Solution of difference equation. Solution of difference equation.

PHYSICS-IIB

1. Measurement of film thickness and wavelength, diffraction of light waves, Huygens's construction, Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction due to single slit and plane diffraction grating, approximate rectilinear propagation of light, zone plate, polarization of light waves, polarization by reflection, Brewster's law, double diffraction-ordinary extraordinary rays, polaroid, optical activity.

2. Energy levels of the hydrogen atom and the Bohr atom model, X-ray spectra, X-ray diffraction, Bragg's law, Compton Effect. De-Broglie waves, particle diffraction, uncertainty principle and its application

3. Wave-particle duality and uncertainty principle, two-slit experiment, concept of wave function, physical interpretation of wave function, probability density, current, equation of continuity, time independent Schrödinger equation for a free particle and a particle in a potential, stationary states, postulates of quantum mechanics, expectation values of physical observables, energy Eigenvalues for particle in a box, square well potential, reflection and transmission coefficient in potential barriers, linear harmonic oscillator, block potential function , particle in a central potential, orbital angular momentum, hydrogen atom- energy levels, degeneracy.

ENGINEERING MECHANICS

Statics:
introduction, idealizations of mechanics, fundamentals of vector algebra, application of vectors in mechanics, equiv system, equilibrium, fbd concept, fundamentals of friction, properties of surface, centroid, moment of inertia

Dynamics:
intro to vector calculus, definition of vectors in dynamics, rectilinear motion, curvilinear motion of particle and description of different coordinate systems, kinetics, Newton's Law and D' Alembert's principle and application to rectilinear and curvilinear motion, constrained motion, energy and momentum methods.

CIRCUIT THEORY LAB –I

1. Study on the transient response characteristics of an RC series network.
2. Study on the transient response characteristics of an RC parallel network.
3. Study on series resonance circuit
4. Study on parallel resonance characteristics
5. Frequency response characteristics of passive RC networks.
6. Study on Thevenin's theorem.
7. Study on maximum power transfer theorem
8. Determination of two port parameters of a resistive two port.
9. Familiarity with controlled sources
10. Application of voltage controlled current sources – Gyrator
11. Determination of Thevenin's equivalent circuit of a network containing controlled source.
12. Study on Reciprocity theorem.
13. Study on Superposition theorem.
14. Study on Tellegen's theorem.

NUMERICAL ANALYSIS LAB

List of Experiments/Programs

1. Find the root(s) of an equation using different iterative methods, namely successive bisection, Regula Falsi, Newton-Raphson, secant and successive Approximation
2. Solution of simultaneous algebraic equations using Gauss elimination and Gauss-Seidel iteration
3. Use of Lagrange's forward and backward interpolation formulae and spline interpolation
4. Problems on linear and higher order polynomial regression and fitting of exponential trigonometric functions
5. Taylor and Chebyshev series expansions of a function
6. Problems on numerical integration using various techniques like trapezoidal rule, Simpson's rule and Gaussian Quadrature
7. Solution of differential equation using different numerical techniques like Euler method, Taylor series method, Runge-Kutta method and predictor-corrector method

WORKSHOP PRACTICE-XII

Introduction to machine tools - lathes, drilling machines, shaping machines, planning machines, slotting machines, milling machines, grinding machines; machine shop work involving different operations by using the above mentioned machines through making of jobs. Experiments on: Study of the speed structure of a lathe, study of apron mechanism and calibration of feeds in a lathe. Study and grinding of various cutting tools.

ELECTRON DEVICE LAB

1. Identification of electronic components.
2. Verification of Ohm's law and meter handling.
3. I-V characteristics of semiconductor diode.
4. I-V characteristics of zener diode.
5. Input and output characteristics of BJT in CE configuration.
6. Output and transfer characteristics of JFET in CS configuration.
7. Transfer characteristics of CMOS inverter.
8. I-V characteristics of UJT.
9. I-V characteristics of LED.
10. Illumination – forward current characteristics of LED.
11. Characteristics of 7-segment display.
12. LDR characteristics

Second Year First Semester

ELECTROMAGNETIC THEORY

physical interpretation of differential vector operations, green's theorem, divergence & Stroke's theorem, electrostatics, Gauss law, electric potential, Laplace's & Poisson's equation, boundary value problems, method of images, energy storage in electric field. Magnetostatics, Faraday's law, Ampere's law, dielectric & magnetic media, magnetic vector potential, relationship between ES& MS fields. Equation of continuity for steady & time varying currents, Maxwell's law, displacement current & displacement current density, wave equation, phasor concept for time harmonic fields, plane waves in simple media & lossy media, homogeneity, isotropy and anisotropy. Polarization, reflection, refraction, diffraction and scattering at different interfaces, Brewster's' angle, total internal reflection. Poynting theorem- general & complex, power & power density, magnetic current concept, Hertz potentials, equivalence of electric & magnetic sources. Lorentz reciprocity theorem

NETWORK SYNTHESIS

Positive Real (PR) function : definition, properties of pr function, testing of pr function, Hurwitz polynomial., driving point functions of a passive one port
Passive one port: derivation of properties for lc driving point functions, synthesis procedures – Foster & Cauer, derivation of properties for rc one port, synthesis procedures – Foster & Cauer
Transfer function synthesis: Properties of transfer function, Zeros of transmission, Synthesis of Z_{21} and Y_{21} with 1 ohm termination.
LC Filter Design: different types of constant-k filters, m-derived filters. Composite filters, filter design problem and approximation techniques. Magnitude and frequency normalization. Frequency transformation, controlled source representation of operational amplifier, active filter concepts, Salankey network, quad, biquad, gyrator, nullator.

SIGNAL THEORY & NOISE

Introduction, Signal definition, different type of signals: analog & discrete. time domain and frequency domain representation, periodic and aperiodic signals, energy and power signal, deterministic and non-deterministic signal, signals and vector analogy, othogonality of signal functions, some useful signal operations,
Basis function and concept of generalized Fourier series: different forms, Fourier series of some useful functions, Fourier transform, inverse Fourier transforms, transform of some useful functions, convolution and correlation in time domain and frequency domain. Some properties of Fourier transform. Perseval's theorem, energy spectral density, essential bandwidth of a signal, energy of the modulated signal, time autocorrelation function and the energy spectral density, power spectral density, time autocorrelation function of power signals, Input and output power spectral densities, psd of modulated signals.
Sampling theorem, Sampling and re-construction of signals, practical difficulties in signal reconstruction, Aliasing, different types of sampling, some applications of the sampling theorem.

Sources of noise: atmospheric noise, solar noise, cosmic noise, industrial noise, thermal noise, shot noise, transit-time noise, flicker noise. **Noise calculations:** resistor noise, multiple-resistor noise sources, noise in reactive circuits, signal-to-noise ratio, noise figure, noise temperature, calculation of noise due to several amplifiers in cascade, calculation of noise figure and equivalent noise temperature of a cascade. **Some statistical terms:** random variable, random process, ensemble, sample function, time average, ensemble average, stationary and ergodic process, correlation between two random variables. **Mathematical representation of noise:** frequency domain representation of noise, spectral components of noise, superposition of noise, mixing of noise, effect of a filter on the power spectral density of noise, linear filtering-rc low-pass filter, rectangular low-pass filter, rectangular band-pass filter, differentiating filter, integrator, noise bandwidth, quadrature components of noise, power spectral density calculation of quadrature components, concept of additive white Gaussian noise channel.
Familiarization with MATLAB tools for signal analysis.

DIGITAL LOGIC CIRCUITS

Number systems: decimal, binary, octal and hexadecimal systems, conversion from one base to another. **Codes**: BCD, excess- 3, gray reflected ASCII, EBCDIC. **Algebra for logic circuits**: logic variables, logic constants; Logic functions- NOT, AND, OR, NAND, NOR, Ex-OR, boolean algebra (including Shannon's expansion theorem and consensus theorem), canonical representations-minterm, maxterm, Karnaugh map simplification, Quin-Maclusky minimization. **Combinational circuits**: analysis and synthesis of combinational circuits, multiplexer, de-multiplexer, encoder, decoder, code-converter, adder, subtractor, comparator, parity generator/checker, priority encoder. **Sequential Circuits**: **flip-flops**- SR, JK, D and T. **Registers**- buffer registers, shift registers etc.. **Counters**- asynchronous and synchronous counters. **Interface circuits**: digital to analog converter (DAC) - weighted resistor method, R-2R ladder method; Analog to Digital

converter (ADC) - parallel comparator method, counter method, successive approximation method, dual-slope method.

ELECTRICAL MACHINES

PART I

Single-phase transformer construction and basic principle of operation, core type and shell type. Materials used for core. winding and insulation,(e.m.f. equivalent circuit;) equivalent circuit referred to primary -- phasor diagram, polarity test, o.c and s.c. test regulation. efficiency. all ,day efficiency, parallel operation. induction motor three phase balanced excitation system. development of rotating magnetic field. frequency of the induced emf and relationship to number of poles. construction and basic principle of operation of 3 phase induction motor, slip, slip speed and slip frequency, per-phase equivalent circuit, phasor diagram, types of windings, squirrel cage and slip-ring motor construction, equations for torque, torque-speed characteristics, effect of change in rotor resistance in slip-ring machine, methods of starting and speed control.

PART II

D.C.. machines construction and operating principle, function of commutator and brush system, armature reaction and their effects, MMF distribution, commutation, interlopes. D.C. generators EMF equation characteristics with different excitation systems, voltage relation. parallel operation. D.C. motors equation for torque, characteristics with different excitation systems. Method of starting. Speed control, speed-torque characteristics. synchronous machines alternator: construction, EMF equation, armature reaction with different power factor of loads, phasor diagram, methods of determination of voltage regulation. Parallel operation of alternators and synchronization. Synchronous motors principle of operation, hunting, starting method. Introduction to stepper motor.

ANALOG CIRCUITS-I

Diode circuits

Basics, Ideal and piecewise linear models, graphical analysis, different rectifier circuits, ripple factor, efficiency, TUF, PIV, power supply filters, voltage doubler, clipper and clamper circuits

BJT circuits

Biasing and stability analysis: fixed bias, emitter bias, voltage divider bias, DC bias with voltage negative feedback, transistor as a switch

AC analysis: modeling (re, hybrid equivalent, and hybrid π models), expressions for input impedance, output impedance, voltage gain, current gain for different configurations including emitter follower with different biasing circuits, DC bias with voltage negative feedback, effects of source and load resistance, two-port system approach- combination networks: Darlington pair, cascade and cascode configurations, current mirror circuits.

Frequency response: Low frequency and high frequency response, Miller effect, brief overview on multistage amplifier, frequency effects and square wave testing

Regulated Power Supply

Voltage regulation, regulation factor, filter circuits discrete transistor voltage regulation (series and shunt), IC regulator

FET circuits

Biasing: fixed bias, self bias, voltage divider bias, common drain, common gate configurations AC analysis: Modeling (small signal model), expressions for input impedance, output impedance, voltage gain for different configurations like fixed bias, self bias, voltage divider bias, common drain, common gate configurations

Frequency response: low frequency and high frequency response, Miller effect

Note: discussions mostly restricted to JFET and depletion-type MOSFET

OPAMP circuits

Basics, differential amplifier circuit, concept of open loop and closed loop gain, DC-offset and frequency parameters, slew rate, differential and common mode operation , applications: inverting and non-inverting amplifier, adder, buffer, controlled sources, differentiator and integrator, active filters, Equation solver, Schmitt trigger and multivibrators

Feedback amplifier circuits

Feedback concepts, connection types, practical circuits, phase and frequency considerations

ANALOG CIRCUIT LAB-I

List of Experiments

1. On rectification using diodes
2. On clipping using diodes
3. On clamping using diodes
4. On voltage regulation using transistors
5. On frequency response of transistor amplifiers
6. Basic OPAMP applications – inverting and non-inverting amplifiers, adder, buffer
7. Medium-level OPAMP applications – differentiator and integrator
8. Advanced OPAMP applications – Schmitt Trigger and multi-vibrators.
9. Measurement of Slew rate and open loop gain of OPAMP.

DIGITAL CIRCUIT LAB-I

1. Familiarization with the experimental board and IC tester.
2. Truth table verification of SSI gates.
3. Logic function realization using SSI gates.
4. On multiplexers.
5. On demultiplexers / decoders.
6. On comparators.
7. On parity checkers/generators.
8. On flip-flops.
9. On registers.
10. On counters.
11. Experiments on DAC, ADC.

CIRCUIT DESIGN LAB

1. Design of transistor biasing circuits using different schemes and to study their relative advantages.
2. Design of an RC coupled CE amplifier.
    a. Measurement of frequency characteristics
    b. Measurement of input and output impedances.
3. Design of emitter follower.
    a. Determination of gain and impedance characteristics.
    b. Modification of the circuit using different biasing techniques to improve its impedance characteristics.
4. Cascading of CC and CE amplifier to realize high input impedance voltage amplifier.
5. Realization of following circuits using OP-AMPS.
    a. Inverter
    b. Positive gain amplifier
    c. Differential amplifier
    d. Integrator
    e. Differentiator
6. Filter design using op-amps.

ELECTRICAL MACHINES LAB

1. EMF Induced In DC Machine
2. External Characteristics of DC shunt/compound Motor- study relations between speed, field current and armature voltage.
3. Brake test of a DC series motor.
4. Coil connection of a single phase transformer.
5. OC and SC of a single phase transformer and determination of loss, efficiency and regulation.
6. Starting and load characteristics of a 3-phase Induction Motor.

Second Year Second Semester

ANALOG CIRCUITS-II

1. Enhancement Mode MOSFET circuits (drain feedback, voltage divider configuration). 2. Multistage amplifiers cascaded BJT and FET amplifiers, frequency response of R-C coupled multistage amplifier. 3. Power amplifiers Analysis and design of class A, class B, class AB, class C, class D amplifiers, design of heat sink, IC power amplifiers. 4. Tuned amplifiers bandwidth consideration of tuned amplifiers, analysis of single and double tuned amplifiers, stagger tuning, Butterworth and Chebyshev response. 5. Linear wave shaping circuits RC high and low pass filter response for non sinusoidal signals, compensated attenuator, ringing circuit, measurement of L and C through circuit step response. 6. Waveform generator, oscillation criteria and oscillator circuits. Blocking oscillator, relaxation oscillator, 555 timer as variable duty cycle square wave generator,

variable frequency LC and RC sine wave oscillators, crystal oscillators. Linear time base circuits, PLL-architecture and applications, VCO architecture and applications, synchronization and frequency division circuits. Bandwidth improvement with current feedback due to absence of Miller effect, the current mirror, current copier and current differentiating amplifier and their applications, Widler circuits. 7. Voltage regulator switching regulators, switch mode power supply.

DIGITAL CIRCUITS & SYSTEMS

Analysis and synthesis of sequential circuits: Basic models of sequential M/C, analysis of asynchronous and synchronous circuits, synthesis of completely and incompletely specified synchronous sequential M/Cs.

Fault detection and location in combinational circuits: Fault detection and location, classical methods, path sensitizing method, equivalent-normal-Form method, two level-circuit fault detection, multi-level-circuit fault detection, boolean difference method, SPOOF method. **Digital system design:** Hardware programming language (HPL), application of HPL in designing data unit and control unit of a digital system.

Timing circuits: Timing circuits using gates, 74121 mono shot, re-triggerable mono shot- 74122, 74123.

Arithmetic circuits: Fixed-point and floating-point representation of data, serial and parallel Addition(CLA), subtraction, multiplication and division algorithms (add & shift & Booths' algorithm) and their circuit implementation and division for fixed-point signed magnitude data, fixed-point binary data in signed 2's complement representation, floating-point binary data and binary coded decimal (BCD) data.

Semiconductor Memory: Read Only Memory (ROM) - PROM, EPROM, EEPROM, random access memory (RAM)-static, dynamic, memory characteristics, memory organization and applications. digital system design using FPGA & CPLD.

ANALOG COMMUNICATION SYSTEMS

Introduction to basic elements of communication systems

Signal transmission through linear systems: condition for distortion less transmission of signals through networks. Different types of distortion and their effect on the quality of output signals, transmission of transient signals, distortion analysis.

Amplitude modulation: Modulation principle and definitions, sideband and carrier power, generation of AM signal, demodulation of AM signal. Different type of modulator circuits, square law modulator, balanced modulator, etc.. Demodulator basic principle of coherent detections, square law detectors, average envelope and peak envelope detectors. quadrature amplitude modulation (QAM), amplitude modulation: single sideband (SSB), generation of SSB signals, selective filtering method, phase shift method, demodulation of SSB-SC signals, envelop detection of SSB signals with a carrier (SSB+C), amplitude modulation: vestigial sideband (VSB), envelop detection of VSB+C signals, noise in AM receivers using envelope detection, concept of SNR.

Frequency and phase modulation: principles and definitions, relationship between frequency and phase modulations. phase and frequency deviations, spectrum of FM signal, bandwidth considerations. Effect of modulation index on bandwidth, narrow band and sideband FM and PM principles, circuit for realization of FM and PM.

Demodulation Principle of demodulation: different type of demodulator, discriminator, use of PLL etc. Radio transmitter: Basic block diagram of radio transmitter (AM and FM), Analysis of a practical circuit diagram used for medium power transmitter.

Radio receiver Basic block diagram of TRF, superhetrodyne principle, its advantages, Mixer principle and circuit, AVC, Radio receiver measurement.

System noise calculation Signal to noise ratio of SSB, DSB, AM for coherent and envelope and square law detection, threshold effect. Signal to noise calculation for FM and threshold.

TRANSMISSION LINES AND WAVEGUIDES

Circuit representation of transmission lines, transients in a transmission line, sinusoidal excitation of transmission lines, distinction between distributed and lumped constant systems, discussions on line parameters, characteristic impedance. complex propagation constant, distortions in transmission lines, terminated transmission line, coaxial line, the impedance transformation, smith chart, impedance matching and two-port network analysis. Introduction to scattering matrix in transmission line analysis.

Theory of guided waves parallel plate waveguide, NRD guide, rectangular waveguides. solutions of wave equations in rectangular coordinates. TE and TM modes in rectangular waveguide. Power transmission and losses in rectangular waveguide. excitation of modes in rectangular waveguide, characteristics of standard rectangular waveguide. Circular waveguide, solutions of wave equations in cylindrical coordinates. TE and TM modes in circular waveguides, power transmission and losses in circular waveguide, excitation of modes in circular waveguide, characteristics of standard circular waveguide.

Introduction to different planar transmission lines, microstrip line, strip line, characteristics of microstrip line, modes in Microstrip line. CPW line.

ELECTRICAL MEASUREMENTS

Electrical measuring instruments - their classifications, damping and balancing. principles of moving coil, moving iron and dynamometer type of ammeters and voltmeters, shunt multipliers for dc and ac instrument, measurements of low medium and high resistance. ac and dc potentiometers, conventional moving -coil instruments. ballistic and. vibration galvanometers, principles of thermal and induction type of indicating instruments, frequency meters, dynamometer wattmeter, power factor meter. ac energy meters instrument transformers, general theory of ac bridge circuits and simple ac bridge. magnetic measurements, principles of high voltage measurements.

Principle of Cathode Ray tube (C.R.O.).

ANALOG CIRCUIT LAB-II

1. Two stage RC Coupled BJT Amplifier
2. Monostable timer circuit using 555 IC
3. Astable timer circuits using transistors, ICs
4. Wien Bridge oscillator using 741 IC
5. Phase Shift oscillator using 741 IC
6. Schmidt Trigger using741 IC
7. VCO using both transistor and 555 IC
8. Sinusoidal VCO.
9. VCO /PLL using 565 / 566 IC
10. Relaxation oscillator using 741 IC

DIGITAL CIRCUITS LAB

Experiment on Moore and Mealy Machine.

1. Experiment on sequence detectors (overlapping and non-overlapping modes).
2. Experiment on fault detection experiment in digital circuits.
3. Experiment on fault location determination experiments (single level and multiple-level fault).
4. Experiment on decoders (BCD to decimal using IC 7447).
5. Experiment on adder and subtractor.
6. Experiment on two's complements binary adder/subtractor.
7. Experiment on 64 bit read/write memory using IC74189.
8. Experiment on multivibrators using universal gates.
9. Experiment on monostable multivibrator using ic 74121.
10. Experiment on astable multivibrator using IC 74123.
11. Experiment on clock generation using nand gates and crystals.
12. Experiment on generation of square wave using IC 7414.

ANALOG COMMUNICATION LAB

1. Study of pulse amplitude modulation and demodulation
2. Study of IF tuned amplifier
3. Study of class B push pull power amplifier
4. Study of transistor mixer

5. Study of amplitude modulation and demodulation
6. Study of frequency modulation and demodulation
7. Study of synthesis of Fourier series for wave form generations
8. Study of different types of sampling
9. Study of effect of noise on signals
10. Study of PLL and frequency synthesis

ELECTRICAL MEASUREMENTS LAB

1. Measurement of low resistance by Kelvin double bridge.
2. Measurement of high resistance.
3. Calibration of ammeter and voltmeter with D.C. Potentiometer.
4. Measurement of inductance by Owen's Bridge.
5. Measurement of capacitance by Schering Bridge.
6. Calibration of wattmeter by D.C. potentiometer.
7. Test of P.T. by absolute technique.

Third Year First Semester

MICRO PROCESSORS AND MICROCONTROLLERS

Evolution of Microprocessors: introduction to 8-bit Intel 8085 microprocessor architecture, interrupt and DMA Processes

Introduction to 8085 Assembly Language Programming (ALP)

Intel 8085 interfacing techniques with: memory and I/O devices, 8255 PPI (Programmable Peripheral Interface), 8279 keyboard/display controller, data converters (ADC/DAC), 8253/8254 programmable interval timer, 8259 programmable interrupt controller, 8237 DMA controller, 8251 serial communication interface.

Applications of microprocessors in: basic sequencing / data acquisition / process control systems

Important features of 16-bit microprocessors: Intel 8088/8086, memory segmentation, parallel processing, queuing, co-processor, design features of 32-bit microprocessors and characteristics of Intel 80386, 80486 and Pentium processors, RISC Processors

Evolution & introduction to 8-bit Single-chip microcontrollers, features of Intel MCS-51 Family, overview of Intel 8051 architecture and instruction set, introduction to Texas Instruments 16-bit microcontroller : TI MSP 430 Microcontroller

CONTROL ENGINEERING

Introduction to control systems, concept of feedback. Typical servo components and transducers: electrical servo motors, hydraulic actuator, pneumatic controller, potentiometer, synchros, tachogenerator, gears, LVDT, pressure transducers, accelerometer, gyroscope, resolver, amplidyne, operational amplifier. Mathematical models of typical components, systems and subsystems in frequency domain and time domain, state variable representations, controllability and observability. Time domain and frequency domain analysis and associated mathematical tools, control system performance specifications: transient and steady state, stability of systems. Routh Hurwitz, Lyapunov functions. Controller design: state feedback, compensators. Typical case studies identification and control of oven, hydraulic position control in rolling mills. AC servo voltage stabilizer design and analysis of control systems using MATLAB and SIMULINK.

DIGITAL COMMUNICATION SYSTEMS

Signal detection:

Model of digital communication system, geometric interpretation of signals, Schwarz's inequality, concepts of orthogonality and orthonormality, Gram-Schmidt orthogonalization process, roles of multipliers and correlators, bank of correlators in noisy environment, channel characterization, likelihood functions, memory less channel, signal detection in presence of noise, maximum-likelihood detector, observation space, decision regions, conditional probability of symbol error, error function, complementary error function, correlation receiver, matched filter receiver, maximization of signal to noise ratio, properties of matched filter.

Formatting in base band transmission techniques:

Basic block diagram of formatter, concepts of sampling in transmitting multiple band limited signals, channel bandwidth of PAM signal, crosstalk, concepts of signal reconstruction, quantization of signals, quantization error, PCM system, uniform and non-uniform quantization, companding, μ-law and A-law compressions, input-output characteristics, DPCM, DM, start-up, hunting, slope-overload error, ADM, algorithms for varying step size, $\sum$ - Δ modulator, signaling formats – unipolar, bipolar, NRZ, RZ, Manchester and Gray with emphasis on power spectra, ISI, eye pattern, concept of equalization, linear transversal equalizer.

Digital modulation techniques:

Digital modulation formats, coherent systems – BPSK, BFSK, QPSK & MSK: signal constellation, average probability of symbol error, derivation of transmitter and receiver, non-coherent systems – BFSK & DPSK: derivation of transmitter and receiver, comparison of binary and quaternary modulation systems, introductory idea of GMSK, QAM & OFDM.

Information theory and coding:

Concept of uncertainty, discrete messages, amount of information, probability of occurrence, concept of binit, unit of information, Entropy, properties of

entropy, information rate, source coding theorem, Shanon-Fano algorithm, Shanon's theorem, channel capacity, Gaussian channel, bandwidth-SNR trade off, Shannon's limit, introductory idea of linear block code, generator and parity-check matrices, encoder, error detection and correction, syndrome decoding, decoder.

ANTENNAS & PROPAGATION

Antenna

Brief history of antenna, sources of radiation, radiation mechanism, Helmohlz wave equation, vector magnetic potential, Hertzian Dipole, different field components, E and H plane concept, different characteristics of antenna, power radiation, Poynting theorem, antenna equivalent circuit, impedance and bandwidth of antenna system, concept of antenna polarization, linear, circular and elliptic polarization. Friis transmission formula, antenna effective aperture

Monopole and dipole antennas, radiation properties, effect of ground, antenna array concepts, antenna synthesis using Chebychev analysis, binomial array, parasitic array-Yagi-Uda array, Concept of frequency independent antenna, spiral and log periodic antenna, analysis.

Concept of broadband antenna : helical antenna, design principle, microwave antennas-horn, slot, parabolodial reflector, examples of antenna applications, antennas for wireless applications, duality principle, concept of aperture antenna

Propagation

Effect of link on EM wave propagation in different frequency ranges. ground wave propagation, free space propagation, reflection from ground, surface waves, diffraction model for propagation, interference effects of ground, antennas located over flat & spherical earth, coverage diagram, tropospheric propagation, tropospheric scatter, ducts & non-standard refraction, surface wave propagation,
basic physics of ionosphere, ionospheric propagation, including effects of the earths' magnetic fields, virtual height, MUF, oblique propagation,
wireless and mobile environment: NOLS propagation, scattering, frequency and time spreading, multipath fading, brightness & antenna temperature- their role in link calculation, power budget calculation in propagation.
Indoor and outdoor propagation model. Leaky feeder system, model for non line of sight communication.

IC TECHNOLOGY

Review of crystal structure: crystal structure and X-ray diffraction, crystal defects, solid solution.
Crystal growth techniques and wafer preparation: Czochralski method, zone melting and zone refining, wafers.

Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaning processes, dry and wet chemical etching techniques.

Oxidation: Kinetics of silicon dioxide growth both for thick, thin and ultra thin films. Oxidation technologies in VLSI and ULSI, characterization of oxide films, high k and low k dielectrics for ULSI.

Impurity incorporation: Solid State diffusion modeling and technology, ion implantation modeling, technology and damage annealing; characterization of impurity profiles.

Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, mask generation.

Chemical Vapour Deposition techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films, epitaxial growth of silicon; modeling and technology.

Metal film deposition: Evaporation and sputtering techniques. Failure mechanisms in metal interconnects, multi-level metallization schemes.

Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques, RTP techniques for annealing, growth and deposition of various films for use in ULSI.Process integration for NMOS, CMOS and Bipolar circuits, advanced MOS technologies.

COMPUTER ORGANIZATION AND ARCHITECTURE

Introduction: brief history of computers, economic trends, underlying technologies, general organization of a digital computer, computer functions, interconnection structure, bus, bus interconnection. arithmetic logic unit: arithmetic and logic operations, arithmetic and logic operands, construction of arithmetic and logic unit, bit/time slice, IEEE standards for floating point number representation, truncation techniques. processor organization, register organization, the instruction cycle, instruction pipelining, instruction representation format, micro-operations, control of the processor, instruction sequencing, formats and its interpretation, microprogram concepts, control unit design, CPU design: hardwired and microprogrammed approaches. semiconductor, magnetic and optical memories (primary, secondary and tertiary storage), memory organization, virtual memory, cache memory and interleaved memory, CDROM ,static and dynamic ram interrupt, interrupt generation, interrupt handling and interrupt service routine, exception, concepts of i/o organization, data transfer methods, programmed i/o, DMA, interrupt based transfer, i/o channels, i/o processors,

Serial transmission and synchronization. multiprogramming and time sharing, architecture classification, parallel computers-classification various terms associated with pipelining, pipelined data paths, pipelined control, pipeline hazards, pipeline implementations, instruction-level parallelism, Amdahl's law, multiprocessors, array processors, vector processors.

IC TECHNOLOGY LAB

1. Cleaning of wafer.
2. Oxidation
3. Metallization.
4. Photolithography.
5. Diffusion.
6. Schottky diode fabrication.
7. Study of crystal structure.
8. Study of p-n junction.
9. Study of Hall Effect.
10. Measurement of resistivity of semiconductor by four probe method.

DIGITAL COMMUNICATION LAB

1. Generation of maximal length PN sequences
2. Details study of properties of PN sequences with mathematical background
3. Study of pulse code modulation and demodulation
4. Study of delta modulation and demodulation
5. Study of adaptive delta modulation and demodulation
6. Study of ASK modulation and demodulation
7. Study of PSK modulation and demodulation
8. Study of FSK modulation and demodulation
9. Study of DPSK modulation and demodulation
10. Study of Auto correlation of PN sequences
11. Study of cross correlation of PN sequences
12. Study of constellation, Eye diagram, error vector spectrum and symbol error table for BPSK and QPSK modulations using vector signal generator and vector signal analyzer software

MICRO PROCESSORS LAB

List of Experiments

1. Kit awareness and a simple assembly language program
2. On array processing
3. On arithmetic operations
4. On logical operations
5. On delay processing
6. On stack

7. On interrupts
8. On port interfacing
9. TI MSP 430 Microcontroller based Experiments

CONTROL ENGINEERING LAB

1. Synchro in AC position control
2. DC position control system
3. Amplidyne in DC position control
4. DC motor study
5. Temperature control system
6. Controller design using MATLAB
7. SCR as a control element

Third Year Second Semester

IC DESIGN

Introduction Discrete and Integrated Circuit: TTL, DTL, IIL, ECL, MOS and CMOS IC. introduction to analog design, symbols, MOSFET as switch, derivation of I/V characteristics, second order effects, MOS device layout, MOS small signal model, SPICE simulation models. Single-stage amplifiers, different common-source stages, source follower, common-gate stage, cascode stage. Differential amplifiers, active diode resistors and switched capacitor resistors; current sinks and sources, current mirrors and amplifiers, voltage and current references, cascade amplifiers; operational amplifiers; design of two-state and cascade op Amp. **Analogue circuits**: comparators, switched capacitor amplifiers, integrators, filters; DAC and ADC circuits. **MOS inverters:** definition and properties, MOS and CMOS inverter, VTC characteristics, BI CMOS circuit technique BI CMOS device and technology.

VHDL and VERILOG Basic language elements: data objects, classes and data types, operators, overloading, logical operators, VHDL representation of digital design entity, entity and architectural declarations, introduction to behavioral, dataflow and structural models.

FPGA Design and Architecture: Introduction and fundamental concepts, the origin of FPGA, FPGA architecture and design Flows.

COMMUNICATION SWITCHING SYSTEMS

Introduction to voice & data communication system. voice switching: circuit switching, stronger and limitation system concentrator and expander, analog matrix switching. Contention free 3 stage matrix switching, stored programme control concept. Analog sampled switch with virtual path: sampling theorem PAMTDM system, resonant transfer method. T1 format, common channel signaling. Time slot interchange technique limitation. Digital space switching limitation, time space time switch. Distributed switching network and exchange hierarchical numbering system, EPABX.

Traffic engineering: definition of traffic load, grade of service and other parameters, definition of Markov chain, probability distribution of arrival service and termination process, B-D process. Modeling of switching system, LCC, LCD delay systems. Erlang's formula.
Data Network concepts: introduction to message and packet switching, advantage of packet switching, design consideration, topology, media, routing, access techniques basics, examples of data networks. Multiple access technique methodology: FDMA, TDMA, ALOHA, Slotted ALOHA, CSMA, persistent CSMA/CD, Token ring, Special access technique for mobile radio network. Spread spectrum basics, PN and FH sequence, CDMA techniques. Network protocols, 7 layers OSI architecture, Physical layer example RS232 line coding, data link layer ARQ techniques, integrated services digital network. SS-7 architecture.

DIGITAL SIGNAL PROCESSING

Signals and Systems: Introduction to continuous time & discrete-time signals & systems, discrete-time sinusoidal properties.
Sequences: classification based on length, symmetry, periodicity, energy, power, generation of sequences, special sequences, arithmetic operations on sequences.
LTI Systems: Convolution, graphical & analytical techniques, overlap & add method, sliding tape method, numerical problems on LTI systems, properties of convolution and interconnection of LTI systems, de-convolution, stability of systems, casual systems, recursive and non-recursive systems, difference equation, implementation of systems, direct Form I and II structures, concepts of IIR & FIR systems, moving average system.
Discrete Fourier Transform: DFT and IDFT relationship, Twiddle factors, linear transformations, basic properties, , multiplication of DFTs, circular convolution, linear filtering using DFT, filtering of long data sequences, overlap and save method, overlap and method.
Fast Fourier Transform: Efficient computation of DFT, FFT algorithms, Radix-2 algorithm, decimation in-time and decimation-in-frequency algorithms, signal flow graph, butterflies, computation in one place, bit reversal, DFT computations using DIT & DIF algorithms.
Typical DSP Hardware: Texas Instruments family of DSP Processors, study of TMS320C5416 Processor’s architecture, extensive parallel operations, MAC operations, different addressing techniques, common instructions used for extensive DSP applications , familiarity with Code Composer Studio.

DIGITAL CONTROL SYSTEMS

Benefits of digital control: representation of discrete systems: Z-transforms, pulse transfer function, sampling process and its frequency domain interpretation, aliasing. Mapping S domain to Z domain, bilinear transformation and frequency prewarping, discretization of continuous system, hold circuits, state variable representation. Time and frequency domain analysis: controller specification, stability of sampled data systems, Jury's test and Liapunov's stability criterion design of discrete controller: state feed back, observers, linear quadratic controller, and compensator design in W-domain.

Implementation of digital controllers: effect of finite bits, quantization error and overflow. Series, parallel and cascade realization of digital controllers, word length requirements of ADC and CPU for a given controller function and prescribed noise figure case studies: position control of an antenna dish, read write head of computer hard drive, and twin rotor multi input multi output system design and analysis of control systems using MATLAB and SIMULINK

SYSTEMS SOFTWARE

Assemblers: Basic functions of assemblers, design of one-pass and multi-pass assemblers, cross-assemblers, MASM. **Macroprocessor**: Design of one-pass and two-pass macroprocessors, **Loaders and linkers**: Absolute loaders, subroutine-linkage, relocating loaders, direct linking loaders, binders, linking loaders, overlays, dynamic binders. **Compliers**: Different phases - lexical analysis, syntax analysis, intermediate code generation, introduction to code generation and optimization, interpreters, compiler-compilers-YACC. **Operating systems**: Extended M/C view of an operating system, operating system as an user interface, Operating system as a resource manager, features of processor management module, memory management module, device management module and information management module, **Introduction to Text-editors and Debuggers**.

INSTRUMENTATION AND MEASUREMENTS

characteristics of measurement systems; errors in measurements, classification of transducers: variable resistive, inductive, capacitive, photo electric and piezoelectric electric transducers; thermocouple; smart / intelligent sensors.
Digital instruments: digital frequency meter - frequency measurements, errors and reciprocal counting technique; time and ratio measurements; digital voltmeter System (DVM), digital measurement of current, resistance and AC quantities; digital multimeter, digital LCR measurements.
Display Systems: CRO, measurement of voltage, frequency and phase, pulse measurement, oscilloscope probes, dual trace CRO, analog and digital storage oscilloscope.
Graphic recording instruments: Strip Chart Recorder, XY recorder and memory recorder
Signal analyzers: Distortion analyzer; spectrum analyzer, Q meter

IC DESIGN LAB

SPICE based experiments

1. Schematic design of MOS inverter with different loads.
2. Schematic and lay-out of two input NAND gate.
3. Schematic and lay-out of two input NOR gate.
4. V.I characteristics of CMOS inverter charging the value of channel width (w) and channel length (L).

VHDL/Verilog based experiments

1. Design a 4:1 MUX with four inputs, two select inputs, one enable input and one output
2. Design of a full adder and full subtractor circuit.
3. Design of a three input majority and minority circuit.
4. Design a priority encoder using 4-bit inputs and two outputs, where both input and outputs are active high.
5. Design a 2 to 4 line decoder circuit.
6. Design a 2-bit digital magnitude comparator circuit.
7. Design the following Flip-Flop

i) J-K Flip-Flop ii) D - type' Flip-Flop and iii) T - Flip-Flop.

8. Design and simulate a 4 bit UP/DOWN counter.

COMMUNICATION SWITCHING LAB

1. To study the principle connection establishment in a real time analog circuit switch.
2. To study the principle of operation of analog matrix switch.
3. To study the principle of a PAM-TDM exchange.
4. To study the operation of a Time-space-time switch
5. Characterization of a hybrid transformer
6. To study the telephone hand set including Ringer circuit

DIGITAL SIGNAL PROCESSING LAB

MATLAB applications: Sequence generation, convolution, impulse response, DFT & IDFT computations, computation of rational Z-transform, circular convolution, relationship between linear and circular convolutions, linear filtering and study of Butterworth and Chebyshev filters, FIR filter design.

Simulink applications: verification of sampling theorem, filter design, familiarity with signal processing block set

Digital signal processor: Detail study of the architecture of TMS320C5416 processor, writing of programs in Assembly Language for DSP applications, study of various aspects of Code Composer Studio.

Experimental verification of sampling theorem using 8013 Multiplier chip.

DIGITAL CONTROL LAB

1. motion control of a BOE-BOT robot
2. Leg movement control of 6-legged robots
3. Digital controller design using MATLAB
4. Digital sun-tracking system: study of locking and tracking
5. Using microcomputer as a controller in a digital control system
6. Multi-robot motion planning simulator

7. Multi-robot coordination in box-pushing

Fourth Year First Semester

COMPUTER COMMUNICATION NETWORKS

Introduction of computer networks and data communication services. roles of network hardware and structured network software. The reference models: OSI, TCP/IP. mention of physical layers and significance of circuit switching, packet switching, message switching. ATM and transmission in ATM network, design of data link layer, data link protocol, framing, error and flow control. Error detection and correction, example of data link protocol. The multi-access channel, multiple access protocols, wireless LAN protocols, IEEE standards, network layers, its internal organization, routing algorithms, hierarchical routing, routing for mobile hosts, congestion control algorithms. Network layer in internet, the IP protocol/addresses/header. Network layer in ATM networks. Transport layer services, Internet transport protocols, ATM AAL layer protocols, protocols for Gigabit networks. Network security and authentication concepts. The electronic mail, Email gateways, the World Wide Web, Multimedia concepts.

OPERATING SYSTEMS

Hierarchical and extended machine view. **Processor management**: State model, job scheduling, process scheduling, multi-processor scheduling, process synchronization, deadlock problem. **Memory management**: Single contiguous allocation, partitioned allocation, paging, segmentation, demand paged memory management. **Device management**: Dedicated, shared and virtual devices, channels and I/O control units, device allocation, I/O traffic controller, I/O scheduler. **Information management**: File systems, allocation, strategy, recovery of files**. Introduction to the distributed operating systems**. **Case study**: DOS, UNIX, LINUX WINDOWS etc.

VLSI DESIGN

CMOS circuit design:

Basic structure of p-well CMOS Inverter, circuit operation, voltage transfer characteristics, calculation of critical points and their physical significance, noise margins, design of symmetric inverter, power dissipation issues, inverter capacitances, transmission gates and perfect signal steering, capacitance loads driven by transmission gates, NAND and NOR logic gates, stick diagrams, comparison of performances, derivation of combinational networks from canonic forms, AND-OR-INVERT gate, complex gates, Sutton's method of network synthesis, combinational networks using Shannon's expansion theorem, two-input and two-variable universal logic modules, pre-charge and evaluation phases, pseudo-NMOS, Domino and NORA circuits, λ- based design rules.

Arithmetic subsystem:

Concept of pipelined multiplier, systolic array, gated full adder, 4-bit X 4-bit systolic array multiplier, expandability of basic circuit,
2-D systolic array, basic cell, 3 X 3 matrix multiplication, wave front array processors, barrel shifter-NMOS implementation with shift control, concept of wraparound feature, lay out of 8 X 4 barrel shifter.

MICROWAVE ENGINEERING

Basic microwave concepts, frequency bands, transmission line analogy of waveguides, general approach to microwave circuit analysis, losses & discontinuities in rectangular waveguides. Waveguide resonators, waveguide matching components, inductive, capacitive & resonant windows, screws, posts. magic tee, hybrid ring, corners, bends & twists, phase-shifters, directional couplers, multi-hole, single-hole coupler characterization of ferrites, ferrite devices e.g. circulator, isolator etc.,

Microwave Sources: Different Types. Limitations of conventional sources in microwave frequency range. Klystron- 2 cavity & multicavity, Reflex Klystron, Magnetrons, periodic structures, Floquets' Theorem, helix TWT. Transfer Electron Devices, GUNN oscillators, IMPATT devices, microwave transistors & FET, PIN diode single stage microwave amplifier design.

Microwave Measurement frequency, impedance and power measurement, noise figure measurement, antenna measurements, time domain reflectrometry, principle of operation of network analyzer.

ELECTIVE-I (from common elective pool)

COMPUTER ARCHITECTURE AND SYSTEM SOFTWARE LABORATORY

Computer architecture lab

1. Design and realize binary multiplier circuits (signed and unsigned) and verify functionality.
2. Design and implementation of binary divider circuits and verify functionality.
3. Design a 4-bit ALU and verify its functionality.
4. Design an 8-bit ALU by cascading two 4-bit ALU chip and verify functionality.
5. Design a simple control unit with four inputs and two outputs which encode the four inputs into two bit output code.

System software lab

1. Specify a prototype HLL and design a lexical analyzer for the same.
2. Design of a recursive descent parser.
3. Design of a predictive parser.
4. Design of an assembler.
5. Design of a macroprocessor.

MICROWAVE LABORATORY

1. Study of Klystron tubes.
2. V-I Characterictics of GUNN diode and study of tuning of GUNN oscillator.
3. Study of standing wave ratio and frequency by slotted waveguide.
4. Study of radiation pattern of horn antenna
5. Study of characteristics of different antennas.
6. Determination of coupling coefficient and directivity of directional coupler.
7. Measurement of impedance and transmission characteristics of a slotted line.
8. Study of network analyzer.

COMMUNICATION NETWORKS LAB

1. To develop a Ethernet LAN and study of a layer 2 switch functionality.
2. To configure IP addresses of client machines and switches and study of layer 3 switch functionality including routing.
3. To study the ICMP protocols on Internet
4. To configure a network and study using simulation software.
5. Software implementation of simple protocols

PROJECTS

Fourth Year Second Semester

INDUSTRIAL MANAGEMENT

Growth of industries, management thoughts and scientific management, taylorism; factory system of production, introduction to management problems, types of manufacture, planning analysis and control aspects in industries. Types of business ownership, means of finance and business combinations, organization structures, committee organization, authority and responsibility, duty and span of control. Plant location, factory buildings and physical facilities, plant layout, tools and techniques of plant layout, materials - handling arrangements. Product development, standardization, simplification and diversification. Functions of production, planning and control, production forecasting, production scheduling and network techniques, Gantt chart, CPM, pert etc. work study, job evaluation and merit rating; purchase system and inventory control. inspection and quality control of systems, statistical quality control, maintenance and replacement policies for machine and equipments; decision making theories, breakeven analysis cost benefit analysis, evaluation of financial and managerial efficiencies. Introduction to operational research techniques. Application of fuzzy logic in modern management concepts. Human relations in industry and labour compensation. personnel management, provision of industrial legislations in India. Wage and salary

administrations. Welfare and safety provisions, trade union acts. Study of environmental impacts and environmental laws.

WIRELESS COMMUNICATION SYSTEMS

History of wireless communication, concept of mobile and personal communication, wireless cellular platform, the design fundamentals of cellular networks, frequency reuse, spectrum capacity enhancement techniques, co-channel and adjacent channel interference, location management, handoff management. Concept of mobile IP for mobility management issues.
Propagation models for wireless networks, two-ray ground reflection model, a micro-cell propagation model, a macro-cell propagation model, shadowing model, large scale path loss and shadowing, multi path effects in mobile communication, linear time variant channel model, concept of coherent bandwidth, coherent time, Doppler Shift - Effect of velocity of the mobile, models for multi path reception, mobile communication antennas.
Evolution of modern mobile wireless communication systems: personal area networks: PAN, Public wide-area wireless networks, wireless Local Area Networks.
Multiple access techniques in wireless communications**:** frequency division multiple access technology (FDMA), time division multiple access (TDMA), space division multiple access (SDMA), code division multiple access (CDMA), spectral efficiency of different wireless access technologies: spectral efficiency in FDMA system, spectral efficiency in TDMA system, spectral efficiency for DS-CDMA system.
Second Generation Mobile Networks-GSM: architecture and protocols, access technology, call set up procedure, 2.5 G networks: evolution to GPRS, concept of data communication on GPRS, session management and PDP Context, data transfer through GPRS network and routing. Brief introduction to 3G – The universal mobile telecommunication system (UMTS)

Basic idea of satellite mobile communication systems

OPTICAL FIBER COMMUNICATION

Propagation of signals in optical fiber: loss and bandwidth windows, intermodal dispersion, waveguide properties, fiber modes, polarization modes and dispersion, chromatic dispersion, nonlinear effects, Raman scattering, self phase modulation, cross phase modulation, four-wave mixing, solitons.
Components: couplers, isolators and circulators, , multiplexers and filters, Bragg and fiber gratings, Fabry –Perot filters, multilayer dielectric thin film filters, Mach-Zehnder interferometers, arrayed waveguide grating, acousto-optic tunable filter.
Optical amplifiers: stimulated emission, spontaneous emission, Erbium-doped fiber amplifiers, Raman amplifiers, semiconductor optical amplifiers.
Transmitters: lasers, light emitting diodes, tunable lasers, direct and external modulation, pump sources for Raman amplifiers.
Detectors: photo-detectors, front end amplifiers. Optical switch fabric: crossbar, Closs, Spanke, Benes, Spanke-Benes, optical switch technologies, bulk mechanical switches,

MEMs switches, liquid crystal switches, electro-optic and thermo-optic switches, SOA switches.
Wavelength converters: optoelectronic approach, optical gating, interferometric techniques.
Modulation: subcarrier modulation and multiplexing, clipping and intermodulation products, spectral efficiency, optical duobinary modulation, optical single sideband modulation, multilevel modulation.
Demodulation: Ideal receiver, direct detection receiver, front end amplifier noise, APD noise, optical preamplifiers, bit error rates, coherent detection, timing recovery, equalization, error detection and correction.
Transmission system engineering: system model, power penalty, crosstalk, overall design considerations.

EMBEDDED SYSTEMS

Introduction: Terms and Scopes, application areas ,specifications.
Embedded system hardware: input devices, output devices, inter process communication mechanisms, processing units : DSP processors, microcontrollers and re-configurable logic, CPU performance and power consumption.
embedded operating systems, middleware and scheduling, evaluating the performance of operating system: analysis and optimization of execution time, power, energy and program size
Implementation of embedded systems: hardware / software co-design, program validation and testing

ELECTIVE-II (from coomon elective pool)

MOBILE COMMUNICATION LAB

1. VoIP operation over wireless media
2. Study of QoS parameters for VoIP
3. Determination of path loss exponent under wireless environment
4. Understanding the GSM operations on a GSM Tx-Rx system
5. Learning of OPNET for wired and wireless network
6. Learning of QualNet for wireless Networks

PROJECT

SEMINAR

Electives (Elective I and II)

ADVANCED ELECTRON DEVICE

Optoelectronic and Display Devices: avalanche photodiode, photo-Darlington and photo FET, **Dynamic scattering and field-effect LCD:** operation & electrical characteristics, Gas discharge displays, Laser diodes, optoelectronic couplers.

High Frequency Devices : Metal semiconductor field effect transistor (MESFET).

Miscellaneous Devices: Thermistor, VVC diodes, Lambda diodes.

Quantum devices: Concept of quantum well and quantum confinement, quantum wires and quantum dots, wave function modulator, band gap engineering, heterostructures, superlattice, high electron mobility transistor (HEMT), heterojunction bipolar transistor (HBT), resonant tunneling diode (RTD).

Basic concepts : Single electron transistor, spintronic devices, carbon nanotubes.

ELECTRONIC DESIGN AUTOMATION

MOSFET small signal model, MOSFET parasitic capacitance value and modification in model. Scaling of MOS structure. SPICE level -1, level-2 and level 3 model. BSIM and CSIM models. Comparison between models.

Layout generation, design checking rules. Lamda, beta rule, routing: auto routing. Device floor planning basics.

Advance programming using VHDL. Component level programming. Library files, type declaration and usage, parameter types and overloading, types and type related issues, predefined and user-defined attributes, package declaration and usage.
Delta delay modeling, insertion and transport delay. Use of signal drivers. Multiple processes.

Introduction to CADENCE. Use of CADENCE. Basic modeling using CADENCE. Layout generation using CADENCE.

Introduction to low power IC design using CAD tools. Case study of a low power OPAMP design and layout generation.

AUDIO/VIDEO ELECTRONICS & BROADCASTING

Audio fundamentals, acoustical system and its electrical equivalent circuits, loudspeakers, microphones, studio acoustics, sound recording and reproduction, high fidelity stereophonic systems, multi channel audio, digital audio, analog-to-digital conversion, audio compact disc. IC chips for audio applications, video fundamentals, picture elements, black and white pictures. BW consideration, scanning, synchronization, composite video signal camera tubes and picture tubes, fundamentals of color TV , color camera, color picture tubes, chromatic circuits, am transmitter, master oscillator, buffer frequency multiplier, low and high level modulation systems, feeder lines. FM

transmitter-block diagrams & elementary principles. TV transmitters programme control room, video switches master control room vestigial sideband transmission, transmitting antenna, details of TV receiver stages, video amplification- methods of compensation, D.C. restoration. Receiving antenna, digital recording, digital multimedia, data compression, audio/video compact disc.

SOFTWARE ENGINEERING

Introduction, software life-cycle models; software requirements analysis and specification, data-flow-oriented design, data-structure-oriented design and object-oriented design, coding, unit testing, integration, validation and system testing, software project planning, monitoring, maintenance and quality control. software reliability and fault tolerance. computer aided software engineering (CASE).

PRINCIPLES OF ELECTROMAGNETIC COMPATIBILITY

Introduction, Causes of EMI, EMI effects, EMC practices, EMI standards, biological effects.

Sources of conducted interference and its characteristics, non-functional sources: commutators, heater circuits. Fluorescent lamps, static power devices, automatic sources.

Functional sources. The conducted spectrum.

Characteristics of Interference

Bandwidth, narrowband interference, broadband interference, amplitude behavior, thermal noise, impulsive noise, design practice for minimizing conducted interference, noise source treatment, modes of operation, tube design, arc discharge, sensitive device treatment.

Sources of radiated interference and its characteristics, nature of sources of radiated interference. non-functional sources, functional sources.

Interference coupling by conduction and radiation, coupling via conductive patches.

Resistive transfer, inductive and capacitive transfer. grounding bonding, shielding and filtering, .materials and special devices

Mathematical models for sources coupling and susceptors

NEURO-FUZZY CONTROL

basics of fuzzy sets: classical set to fuzzy set, operations on fuzzy set, membership functions, extension principle, fuzzy arithmetic, fuzzy logic and approximate reasoning,

Fuzzy logic based control system: its relationship to conventional control systems, Fuzzifier, fuzzy rule base, Defuzzifier, inference engine, Mamdani and Sugeno scheme.

design methodology of fuzzy control systems, stability analysis and applications.

Introduction to neural nets, common types of neural nets, feed forward, Hoffield

Learning of neural nets: supervised and unsupervised learning, back- propagation learning.

Adaptive controller using neural nets, neuro-fuzzy adaptive control.

ROBOTICS AND COMPUTER VISION

(A) Robotics

Fundamentals: Components, degrees of freedom, joints, reference frames, characteristics

Kinematics: Transformations and their representation using matrix, forward and inverse kinematic equations, Denavit- Hartenberg representation, degeneracy and dexterity

Differential motions and velocities:

Jacobian, differential motions of a frame, Jacobian and the differential operator

Trajectory Planning: Joint-space and cartesian-space trajectories

(B) Computer Vision

Fundamentals: Relationships to other fields, image geometry, definitions, levels of computation

Binary image processing: Geometric processing, binary algorithms (e.g., component labeling, distance transforms, medial axis)

Image filtering: Histograms, linear systems, mean and median filters, Gaussian smoothing

Edge detection: Gradients, first and second derivative operators

Regions and segmentations: Thresholding, region representation, split-and-merge

Hough Transform: Theory and applications

INDUSTRIAL ELECTRONICS

Behavior of circuit with flywheel diode. regulated power supply, SMPS

Silicon Controlled rectifier: single phase, polyphase; triggering circuits. UJT, DIAC, Relaxation oscillator, application in DC motor control, PLC; TRIAC. Power FET, Inverters using SCRs,UPS

Industrial timer circuits; Resistance welding and its control, Induction and Dielectric heating. magnetic amplifier and transconductors. Introduction to inverter, application of inverter. sine wave inverter.

BIOMEDICAL ELECTRONICS

Bioelectric Signals and Electrodes : Sources of biomedical signals, basic medical instrumentation system, PC based medical instruments, general constraints in design of medical instrumentation systems, origin of bioelectric signals, Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG). Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes. Electrocardiograph-block diagram, ECG leads, effects of artifacts, multi-channel, ECG machine, vector cardiograph, phonocardiograph-origin of heart sounds, microphones and amplifiers for PCG

Pacemakers & Defibrillator: Need for cardiac pacemaker, external pacemaker, implantable pacemakers-types, ventricular synchronous demand pacemaker,

programmable pacemaker, power sources for implantable pacemakers. Need for defibrillator, DC defibrillator, automatic external defibrillator, implantable defibrillators

Blood Flow & Cardiac Output Measurement :

Electromagnetic blood flowmeter- principle, square wave electromagnetic flowmeter, Doppler shift ultrasonic flowmeter

Advanced Diagnostic & Therapeutic Instruments : Principle of surgical diathermy & surgical diathermy machine, Electrodiagnosis-Electrotherapy-functional block diagram and working, interferential current therapy. Artificial kidney-Principle and haemodialysis machine.

Biosensors

Electrochemical transducers, Electrode potential and reference electrodes, potentiometric sensors, amperometric sensors, electrochemical gas sensors, chemical transducers of acoustic and thermal principles. Biosensors – Enzyme based biosensors, immunosensors, and microbial sensors. Continuous measurement of chemical quantities

HUMAN-COMPUTER INTERFACE

1. **Input interface:** Digital camera, optical scanner, microphone, joystick, light pen, touch screen, wearable devices and other mode of input interface.
2. **Output Interface:** High resolution bit mapped screen, speakers, peripheral attachments like robotic arms and wheeled robots.
3. **Interface Design:** Signal/Image pre-processing; recognition; control signal/command generation.
4. **Emotion Recognition:** Recognition of users' emotion from facial expression, voice and bio-potential signals, including EEG, ECG, pulse rate, and body temperature.
5. **Controlling emotion of Users:** Control of emotion using selective audio-visual information; controller design; Fuzzy realization of controller.
6. **Brain-Computer Interface:** Frequency domain features of EEG signals; Pre-processing and filtering of EEG; time-frequency information and Wavelet transform; power spectral density; data preparation for motor imagery classification; Classifier design; LDA, QDA and support vector machine classifier.
7. **Case Study-I:** *Design of a hand-tremor controller for people suffering from neuro-motor instability:* Kalman filter; extended Kalman filter for tremor prediction from EMG and accelerometer signals, Polarity inversion of predicted tremor signal; Actuator design; Realization of the complete system on a micro-controller.
8. **Case Study-II:** *Design of an artificial limb as neuro-motor rehabilitation aids:* Experiment design; EEG data recording; feature extraction, classification of arm movement from motor imagery, and their execution by robotic control.

PATTERN ANALYSIS AND MACHINE INTELLIGENCE

1. **Statistical Pattern Classification:** Linear discriminant analysis, Bayesian classification, model-free technique including the K-nearest neighbors method.

2. **Neural Classifiers:** Perceptron, Multi-layered perceptrons and back-propagation algorithm, support vector machine classifier.
3. **Clustering Techniques:** K-means, Fuzzy C-means, SOFM Neural net, Hopfield neural net.
4. **Feature Minimization Techniques:** Principal component analysis, iIndependent component analysis.
5. **Intelligent Search:** Problem solving by search, Heuristic search.
6. **Machine Learning Techniques:** Decision tree learning; analogy based learning, inductive learning, Q-learning.
7. **Reasoning Using Logic:** Propositional and predicate logic, unification and resolution principle, deductive and abductive reasoning, fuzzy reasoning.
8. **Perception:** Visual and linguistic perception.

COMMUNICATION NETWORK MANAGEMENT

Network management systems (NMS), network management functions- framework, network management standards, network management model: organization Model, Information model and its structure (ASN-I).
Simple network management (SNMP-version I) SNMP communication model, access policy & protocol, SNMP-Macro, SNMP operations.
The information model: management information base (MIB) module, example. The IP Group, IP routing and forwarding; ICMP and TCP groups, SNMP MIB group.
The SNMP-version-2, SNMP management: remote monitoring (RMON) RMON
Broad band multimedia service: ATM SONET;HFC;ADSL WAN, mobile & broadband access service, principle of broadband network management, CMIP, CORBA, layer services and interfacing,
TMN-Model & its relationship to data & Telecom Networks: TMN- standards, services, functions & architecture.
Performance and fault management. Network management tools: For trouble shooting of problems; bit error rate , protocol analyzer, traffic load monitor etc.
Global view of network, network management applications. Web-based network management.
Network survivability: Protection in SONET/SDH, point to point links, self healing rings, unidirectional path switched rings, bidirectional line switched rings, ring interconnection and dual homing. Protection in the client layer, protection in resilient packet rings, protection in Ethernet, protection in IP, protection in MPLS.

OPTICAL NETWORKS

Optical layers: SONET/SDH - multiplexing, virtual tributaries, virtual concatenation, link capacity adjustment scheme, sub layers, frame structure, physical layer. Optical transport network- hierarchy, frame structure and overheads, multiplexing. Generic framing procedure- frame, common and client specific aspects. Ethernet- LAN, VLAN, spanning tree, link aggregation control protocol, Gigabit and 10Gigabit Ethernet physical layer, carrier transport, provider backbone bridges for VLAN, IP over WDM, routing and forwarding, multiprotocol label switching, resilient packet ring, storage area networks.

Wavelength division multiplexing: optical line terminals, optical add drop multiplexers, reconfigurable architectures, optical cross connects.
Control and management: network management functions- framework, element management system, information models and protocols, MIB and SNMP, CMIP, CORBA, layer services and interfacing, layers within optical layer, interoperability. Performance and fault management, BER measurement, optical trace, alarm management, DCN and signalling, policing, client layers. Configuration management, equipment and connection management, adaptation management. Optical safety.

Network survivability: Protection in SONET/SDH, point to point links, self healing rings, unidirectional path switched rings, bidirectional line switched rings, ring interconnection and dual homing. Protection in the client layer, protection in resilient packet rings, protection in Ethernet, protection in IP, protection in MPLS. Optical layer protection schemes.
WDM network design: cost trade-offs. Light-path topology design, routing and wavelength assignment, dimensioning wavelength-routing networks, statistical dimensioning models and maximum load dimensioning models.
Access Networks: network architecture overview, enhanced hybrid fiber coax, fiber to the curb.
Photonic packet switching: optical time division multiplexing, bit and packet interleaving, optical AND gates, nonlinear optical loop mirror, soliton trapping AND gate, synchronization, tunable delays, optical PLLs. Header processing, buffering, deflection routing, delay, optical burst switching
Optical network design considerations

ADVANCED MOBILE COMMUNICATIONS

Introduction

Modulation techniques in wireless communications : GMSK, QAM, OFDM, direct sequence spread spectrum, frequency hopping spread spectrum

Protocol architecture of GSM, authentication/encryption, GPRS data services, 3G UMTS, LTE

Wireless LAN: overview, advantages/disadvantages, IEEE802.11, protocol/architecture, roaming, WiMAX standard

Mobile IP: Goals, entities and terminology in MIP, IP Packet delivery, agent advertisement and discovery, registration, tunneling, encapsulation, reverse tunneling, routing, MIPv6

Internetworking between different wireless access networks, loose coupling, tight coupling, GPRS/3G-WLAN internetworking, AAA protocols

MONOLITHIC MICROWAVE INTEGRATED CIRCUITS

Introduction to MMIC, processing, MMIC performance, MMIC status, GaAs MMIC reliability, yield cost, future developments, MMIC applications: military, commercial and consumer applications.
Device Modeling: Single-Gate FET, Basic operation, device performance analysis, characterization, equivalent circuits and parameter extraction, device modeling, design considerations and applications, noise modeling. dual-Gate FET, DC characterization and basic device operation, high frequency lumped element equivalent circuit, applications of dual gate FETs.
Planer resistors, transmission lines, microstrip and coplanar lines for MMICs line discontinuities, planer lumped elements, planer capacitors, coupling structures, Lange couplers, passive baluns, Marchand baluns, spiral transformers. Wilkinson divider with high pass and low pass sections, active power splitter and combiners, active baluns.

MMIC Design considerations and amplifier design, design consideration for MMICs, chip size, thermal design and wafer thickness, low-inductance grounds and crossovers, propagation modes and other design considerations.
Microwave amplifier design, design considerations, procedure for general design of an amplifier, low-noise amplifier design, circuit performance, combining techniques for power amplifiers.
On-chip tuning, tuning techniques using addition of elements. airbridge removal technique.
Mixer design: diode mixers, single ended diode mixers and its planar implementation, doubled balanced diode mixer, active FET mixers, single ended FET mixers, single balanced FET mixers, double balanced FET mixers, resistive FET mixers, distributed FET mixers.
Phase shifter design: analogue phase shifters, single stage refection type phase shifters, cascaded match reflection type phase shifters, digital implementations, switched line phase shifters, loaded line phase shifters, intrinsic phase shifters.
Switch and attenuators: microwave switches, PIN diode switches, FET MMIC switches, switched FET equivalent circuit, attenuators, variable attenuator, switched attenuators, analogue attenuators.
MMIC CAD tools and simulation techniques.

DISTRIBUTED SYSTEMS

Concept of Distributed Systems: definition, Enslow's model, motivation and objectives, application areas.
Inter Process Communication: building blocks, client server communication, case studies.
Remote Procedure Call (RPC) : Design Issues and Implementation, Case Studies – SUN, ANSA, Asynchronous RPC.
Distributed Operating System: Kernel definition of process and threads, naming and protection, communication and invocation, file server, SNS Name service model.
Timing and coordination: synchronization, physical clocks, concept of logical time and logical clocks, distributed coordination.

Replication: Basic Architectural Model, consistency and request ordering, gossip architecture, process group and ISIS.
Shared Data Transaction: Conversation between Client and Server, Simple Distributed Transaction and Nested Transactions, Automatic Commit Protocol, Concurrency Control, Distributed Deadlocks, Transactions with replicated data.
Recovery and Fault Tolerance : transaction recovery, hierarchical and group masking of faults, security issues.

COMPILER DESIGN

The structure of a compiler, **Lexical Analyzer**: regular expression, finite automata, NFA, DFA, minimizing the number of states of a DFA, implementation issues, introduction to LEX. **Syntactic specification** of a programming language, context-free grammar, derivation and parse trees, ambiguity. basic **Parsing Techniques**: shift reduce parsing, operator-precedence parsing. **Top Down parsing**, LL(1) parsers. **Bottom up Parsing**, LR parsers, LR(0) items, construction of SLR parsing table. Introduction canonical LR parsing, LALR parsing table. Use of ambiguous grammars for LR parser implementation. Introduction to YACC. **Syntax Directed Translation** , **Intermediate code**, postfix notation, three address codes – quadruples and triples. Translation of assignment statement, Boolean expressions, control structures, arrays. Run-time **Storage Administration** and symbol table management, data-flow analysis, **Code Optimizations** .

RADAR & NAVIGATION

Radar

Basic radar, radar equation, monostatic, biastatic radar, threshold detection, integration of radar pulses, system losses, effects of RCS fluctuation, internal and external noise. MTI and pulse Doppler radars, range and speed ambiguities, Doppler Filter Banks, Digital MTI Processing, MTD, Limitations to MTI performance.

Tracking Radars: Conical Scan and Monopulse, ADT. matched filter receiver, detection criteria, automatic detection, detectors & integrators, CFAR. radar clutter and reduction.

Target recognition: SAR & ISAR.

Navigation

Guidance and navigation, categories of navigation. navigation equations, co-ordinate frame, dead reckoning computations, positioning, terrain matching navigation, course computation, navigation errors.

Inertial Navigation: Instruments, Platforms, Mechanization Equations, Error Analysis & Fundamental Limits.

Satellite Navigation: Ranging Equations, Range Rate Equations and Clock Errors, NAVSTAR GPS: Principles, coverage, configuration, Control & Signal Structure, DGPS, GPS Accuracy; GLONASS, GAGAN, combined GPS/GLONASS.

DESIGN AND ANALYSIS OF ALGORITHMS

Data Structures
Stacks, queue, linked lists revisited, trees and graphs, hash tables and hash functions, Binary search tree
Complexity Analysis
Analyzing and designing algorithms, asymptotic notation, recurrences, time and space complexity
Sorting and Searching
Insertion sort**,** Bubble sort**,** Quicksort, Counting sort, Radix sort, Bucket sort, Linear search, binary search
Advanced Design and Analysis Techniques
Dynamic programming, greedy algorithms, examples
Graph Algorithms
Breadth-first search, depth-first search, minimum spanning tree (Kruskal and Prim's algorithms), single source shortest paths (Bellman-Ford and Dijkstra's algorithms), Max-flow min-cut (Ford-Fulkerson's algorithm)
NP-completeness
Polynomial time, NP-completeness and reducibility, examples

DATABASE MANAGEMENT SYSTEM

Introduction - Evolution of database systems, overview of database management systems

Entity-relationship model - Basic Concepts, Constraints, Keys, Design Issues, Entity-Relationship Diagrams, The Unified Modeling Language (UML), Class Diagrams

Relational Model - Structures of relational databases, integrity constraints, logical database design – ER to relational, relational algebra, relational calculus, functional dependencies, multi-valued dependencies, normal forms, decompositions into normalized relations

Details of Relational Algebra – Basic operators, extended operators, constraints

SQL – Simple queries, queries with more than one relation, subqueries, full-relation operations, Database modifications, View definitions

Issues in Physical Database Design – physical data storage, raid disk organization technique, file structures – sequential file organization, indices, b-trees, hash tables

Query Execution – Basic analysis of one-pass algorithms and nested-loop joins

DIGITAL IMAGE PROCESSING

Fundamentals – Steps in digital image processing, sampling and quantization, relationship between pixels, imaging geometry

Image Transforms – Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, Discrete Cosine Transform, Walsh Transform, Hadamard Transform, Hotelling Transform

Image Enhancement – Point processing, spatial filtering (smoothing and sharpening filters), enhancement in frequency domain

Image Compression – Coding, interpixel and psychovisual redundancy, image compression models, error-free compression (variable-length coding, bit-plane coding, lossless predictive coding), lossy compression (lossy predictive coding, Transform coding)

Image Segmentation – Detection of discontinuities, boundary detection, thresholding techniques, region-based segmentation, use of motion in segmentation

Image Morphology – Dilation and erosion, opening and closing, hit-or-miss transform, some basic morphological algorithms

Image descriptors – Moments, topological descriptors, textures, Fourier descriptors