CE/CS/EB/EC/EE/EI/IT/ ME/MRE/SE 301
ENGINEERING MATHEMATICS-III

Module I

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

Gamma and Beta functions, error functions - definitions and simple properties.

Module II

Special functions: Legendre polynomial, Rodrigue's formula - generation function, recurrence formula for Pn (x), orthogonality. Bessel function, Jn(x)- recurrence formula, general function, orthoganilty.

Module III

Partial differential equations: Solutions of equations of the form F(p, q) = 0, F(x,p,q)=0, F(y,p,q)=0, F(z,p,q)=0, $F_1(x,p) = F_2(y,q)$, Lagrange's form Pp+Qq = R.

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

Module IV

Probability and Statistics: Probability distributions: random variables (discrete & continuous), probability density, mathematical expectation, mean and variance of a probability distribution, binomial distribution, Poisson approximation to the binomial distribution, uniform distribution , normal distribution

Curve fitting: method of least squares, correlation and regression, lines of regression.

Module V

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

The estimation of variances :Hypotheses concerning one variance - Hypotheses oncerning two variances.

Note: Treatment of the topics under Modules IV, V should be oriented towards application of statistical techniques to problems in real life.

References:

1) Ervin Kreyszig : Advanced Engineering Mathematics, Wiley Eastern
2) Potter, Goldberg : Mathematical Methods, Prentice - Hall
3) Churchill R.V. : Fourier series and Boundary Value Problems - McGraw Hill
4) Irvrin Miller & Freind : Probability and statistics for Engineers , Prentice Hall of India.
5) Bowker and Lieberman : Engineering Statistics Prentice - Hall
6) Kirk - Patrick : Introductory statistics and probability for engineering science and technology , Prentice -Hall
7) Parzen E : Modern Probability Theory and its Applications, Wiley estern.

CS/EB/EC/EI/IT/ME/MRE302ELECTRICAL TECHNOLOGY

Module I

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

Module II

Basic principles of electrical machines: Concepts of motoring and generating action, DC machines- Main constructional features, principles of operation, types of ge nerators, emf equation, characteristics , applications, armature reaction and commutation, types of motors, torque, speed, and power, characteristics, applications, starting losses, and efficiency, speed control, testing, load test of dc machines.

Module III

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

Module IV

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

Module V

Generation, transmission & distribution of electrical energy:

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

References:

1) Electrical Machines : By F.S.Bimbra, Khanna publications.
2) Advanced Electrical Technology : By H.Cotton, Wheeler publications.
3) Electrical Machines : Nagarath & Kothari, (TMH)

EE / *EI 303 NETWORK ANALYSIS*

Module I

Review of basic circuit concepts –Classification of circuits, passive circuit elements, characteristics, sources, Kirchoff's laws, definition of graphs, outsets and loops, true, incidence matrix –Network Theorems –Substitution, Superposition, reciprocity – maximum power transfer, Thevonin's, Nortons

Module II

Review of node and mesh analysis by inspection: Application of graph theoretic methods to formulation of network equations –Two port networks –Characterisation in terms of hybrid and transmission parameters, Inter-connection of 2 ports – series, parallel and cascade.

Module III

Transients in linear circuits –initial conditions – Rise and decay of current in RL circuit – Time constant – RC circuits with –impressed DC voltage –RL and RC circuits with applied sinusoidal voltage –DC transients in RLC circuits –Damping.

Module IV

Signal representation and network response: Characteristics of signals –Unit step function, impulse and ramp functions, non sinusoidal signals –representation of a wave using Fourier series expansion – Frequency spectrum of periodic wave forms –Fourier integral and Fourier transforms, discrete and continuous frequency spectra.

Module V

Network transmission criteria: Signal distortion in transmission – relationship between bandwidth and rise time, delay time and network function – filters: analysis of constant K and M derived filters – Network synthesis Foster and Cauer forms.

References:

1) Evoritt And Annour, "Communication Engineering", McGraw Hill
2) Pottie & Fitch, "Theory of Network And Linear Systems", Asian Publishing House
3) Van Valkinburg, "Network Analysis", Indian Publishing House
4) Rider, "Network Lines And Fields"
5) C A Demoor And E J Kah, "Basic Circuit Theory"
6) Ruston And Burdogen, "Electronic Network, Functions, Filters, Analysis"
7) N C Gupta, J W Daylogi, "Circuit Analysis"
8) Sudhakar "Circuits & Networks Analysis & Synthesis", TMH

CS/EB/EC/EE/EI 304 DIGITAL ELECTRONICS

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

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

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

Memories – Static and Dynamic, ROM, RAM, EPROM, Flash Memmory, , Programmable logic array, devices - Basic ideas - PLD architecture - PAL and PLA

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

References :

1) Taub & Schilling, “Digital Integrated Electronics”, Mc Graw Hill
2) Samuel C Lee , ”Digital Circuits and Logic Design”, Prentice Hall
3) A P Malvino ,”Digital Computer Electronics”, Tata Mc Graw Hill
4) Morris & Miller, “Design with TTL Integrated Circuit”, Mc Graw Hill
5) Peatman , ”Digital Hardware Design”, Mc Graw Hill
6) Ronald J Tocci , “Digital Systems, Principles and Applications “, Prentice Hall

EB/EC/EE/EI 305 SOLID STATE ELECTRONICS & CIRCUITS

Band theory of solids - Conductors , semiconductors and insulators - energy band diagram. -Semi conductor materials and their properties: elemental semiconductors- the energy band model of semiconductors. valance band model of semiconductor equilibrium concentration of electrons and holes- the fermi level and energy distribution of carriers inside the bands- temperature dependence of carrier concentration inside the bands. - Carrier transport in semi conductors - drift of carriers in electric fields, carrier flow by diffusion - constancy of fermi level across junction , Excess carriers in semi conductors - injection of excess carriers - recombination of excess carriers - continuity equation - current flow equation.

PN junction- Abrupt PN junction - energy band diagram - barrier potential, biasing PN junction, excess carrier calculation - current components diffusion - drift - boundary conditions for long and short diodes - PN junction characteristics - calculation of diffusion – dep;etion layer capacitance - simple model - principle of zener and avalanche diodes - photodiodes -LDR - tunnel diode and PIN diode -varactor diode.

Bipolar junction transistors - NPN, PNP types , Basic structures - biasing - mechanism of carrier flow - current components in transistors boundary conditions in active region - solution for short base width - basewidth modulation - Transistor configurations - Characteristics - current amplification factors - relations between alpha & beta - comparison Ebbers - Moll model - Field effect transistors : JFET - basic structures - principle of operation - Characteristics and current equation - basic principles of phototransistors - UJT, characteristics.

MOSFET - semiconductor surfaces - C - V characteristics - the Si - SiO2 System - basic structures and operating principles - current equation - V-I characteristics - simple model - CMOS. Compound semiconductor - semiconductor heterojunctions - V-I characteristics - real heterojunctions - frequency limitation of transistor - transit time effect - heterojunction bipolar transistor.

DC power supplies - power transformers - rectification - half wave , full wave, bridge - expression for ripple factor, efficiency, comparison, diode ratings. filters - capacitor - inductor LC filters- use of bleeder resistor - voltage multipliers - dual power supplies - simple voltage regulator. Series regulators - IC regulators.

Text Books:-

1. Streetman , “Solid State Electronics Devices”, Pearson Education, (Module I to IV)
2. Ramanan,” Functional Electronics” (Module V)

References:

1) “Electronic Devices “, Learning Material Series, ISTE, NewDelhi 1997
2) Electronic Devices & Circuits, Millman & Halkias
3) Solid state electronics IV th edition, George B Rutkowski, Mc Graw Hill

EB/EC/EI 306 BASIC ELECTRONICS LABORATORY

1. Study of - Multimeter, Signal generators , CRO etc. and measurement of electrical quantities(V,I,FREQUENCY,PHASE)
2. Testing of Passive and Active components - Resistors , Capacitors, inductors , Transformers , diodes , Transistors, etc.
3. Characteristics of Active devices
   i) Forward and reverse characteristics of a diode - measurement of forward resistance
   ii) Common base characteristics of a transistor - measurement of current gain, input resistance and output resistance, maximum ratings of the transistor.
   iii) Common emitter characteristics of a transistor - measurement of current gain, input resistance and output resistance, relation between and study of the effect of leakage current, maximum ratings of the transistor.
   iv) Common source characteristics of a JFET - measurement of transconductance gm and drain to source resistance r_{ds} , use of FET as VVR.
4. Rectifying circuits
   i) HW rectifier
   ii) FW rectifier
   iii) FW Bridge rectifier
   iv) Filter circuits - Capacitor filter, inductor filter and Pi section filter
   (Measurement of ripple factor, maximum ratings of the devices)

5. Clipping and clamping circuits using diodes / transistors

CS/EB/EC/EI 307 ELECTRICAL LABORATORY.

Compulsory experiments

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

Optional Experiments

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

CE(A)/CS/EB/EC/EE /EI/IT/ME/SE401 ENGINEERING MATHEMATICS IV

Module I

Complex Analytic functions and conformal mapping : curves and regions in the complex plane, complex functions, limit, derivative, analytic function, Cauchy - Riemann equations, elementary complex functions such as powers, exponential function, logarithmic, trigonometric and hyperbolic functions.

Conformal mapping: Linear fractional transformations, mapping by elementary functions like e^z, sin z, cos z, sin hz, and cos hz, Schwarz - Christoffel transformation.

Module II

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

Module III

Numerical Analysis : Errors in numerical computations, sources of errors, significant digits. *Numerical solution of algebraic and transcendental equations*: bisection method, regula falsi method, Newton - Raphson method, method of iteration, rates of convergence of these method,

Solution of linear system of algebraic equations: exact methods, Gauss elimination method, iteration methods, Gauss-Jacobi method.

Polynomial interpolation : Lagrange interpolation polynomial, divided differences, Newton's devided differences interpolation polynomial.

Module IV

Finite differences: Operators ?,?,?, and ?,Newton's forward and backward differences interpolation polynomials, central differences, Stirlings central differences interpolation polynomial.

Numerical differentiation: Formulae for derivatives in the case of equally spaced points.

Numerical integration: Trapezoidal and Simpson's rules, compounded rules, errors of interpolation and integration formulae. Gauss quadrature formulae (No derivation for 2 point and 3 point formulae)

Module V

Numerical solution of ordinary differential equations: Taylor series method, Euler's method, modified Euler's method, Runge-Kutta formulae 4^{th} order formula,

Solution of linear difference equations with constant co-efficients: Numerical solution of boundary value problems, methods of finite differences, finite differences methods for solving Laplace's equation in a rectangular region, finite differences methods for solving the wave equation and heat equation.

Reference:

1) Ervin Kreyszig : Advanced Engineering Mathematics, Wiley Eastern
2) S.S.Sastry : Introductory Method of Numerical Analysis, Prentice -Hall of India
3) Ralph G. Stanton : Numerical Methods for Science and Engg., Prentice - Hall of India
4) S.D.Conte and Carl de Boor : Elementary Numerical Analysis Analograthmic approach
5) McGraw Hill
6) M.K.Jani, S.R.K Iyengar and R.K. Jain : Numerical Methods for scientific and
7) Engineering Computations. Wiley Eastern.
8) P.Kandaswamy K.Thilagavathy : Numerical Mehtods , S.Chand & Co. K.Gunavathy
9) E.V.Krishnamurthy, S.K.Sen : Numerical Algorithms, Affiliated East West.

EB/EC/EE/EI 402 ELECTRONIC CIRCUITS

Small Signal amplifiers : Units of gain, low, frequency equivalent circuits - r-parameters , h-parameters - CE amplifier - Biasing techniques - stabilization of operating point - Methods of coupling - D.C coupled amplifier - CE RC coupled amplifier - concept of load lines- loading effect at the input and output - emitter follower as Buffer stage-Boot strapping - frequency response of RC coupled amplifier -- frequency analysis of R C coupled amplifier - lower cut-off frequency - upper cut-off frequency - 3 db bandwidth - Frequency response of DC coupled amplifier.

FET Amplifier : RC coupled common source amplifier - expression for gain - frequency response - comparison with BJT - FET as a voltage variable - resistor. Multistage Amplifier : Negative and positive feedback - Different types of negative feedback amplifier - voltage shunt- voltage series - current shunt - current series .

Power amplifier -classification - class A , class B, Class AB Class C and class D - Transformer coupled class Power amplifier - Transformerless class AB push-pull Power amplifier - complementary symmetry power amplifier - Harmonic distortion in Power amplifiers - Transistor rating -Heat sinks Oscillators - Principle of sinusoidal oscillators - Bark Hausen criteria - RC oscillators - phase shift wienbridge - LC oscillators - Hartley , Colpitts -clapp oscillator -

Pulse circuits - pulse characteristics - Pulse shaping using RC circuits - Differentiating and integrating circuits - clipping and clamping circuits using diodes and transistors - Transistor as a switch sweep circuits - Transistor sweep circuits - voltage and current sweep - Miller sweep circuit - Bootstrap sweep circuit - UJT relaxation oscillator. Multivibrators using transistors - astable - monostable and bistable operation

High frequency amplifier - Tuned amplifier - coupled circuit, unilateralisation of transistor, Q-factor, single tuned, double tuned and stagger tuned amplifier (analysis not required) - Wide band amplifier : Gain-bandwidth trade off . Wide band transistor configuration cascade emitter coupled - broad banding, bandwidth trade-off, wide band transistor configuration with negative feed back, frequency compensation - low frequency RC compensation, High fequency compensation (analysis not required)

Reference :

1) Millman & Halkias , "Electronic Devices & Circuits"
2) Bapat K N , "Electronic Devices & Circuits"
3) Ramanan," Functional Electronics"
4) Millman & Taub, "Pulse Digital and Switching Waveforms"
5) Allan Mottorshed, " Electronic Devices & Circuits"
6) Millman & Halkias , "Integrated Electronics"
7) Boylestead & Neshelsky ,"Electronic Devices & Circuits
8) Schilling & Belove "Electronic Circuits ,Discrete & Integrated" TMH

EI 403 MICROELECRONICS AND INTEGRATED CIRCUITS

Module I

Introduction to microelectronics: monolithic and hybrid integrated circuits – bipolar and MOS technology – fabrication of active and passive components, bonding packaging, concept of SSI, LSI, VLSI.

Module II

Introduction to thick film and thin film technology – resistors, capacitors, comparison – optical integrated circuits. DC amplifier –problems with straight DC amplifier – difference amplifier. Common mode and difference mode operation –CMRR –merits and demerits – use of constant current source, drift and offset problems –current mirror and its uses.

Module III

Operational amplifier: internal structure – block diagram – characteristics of ideal op-amps – linear circuits using op-amp –DC & AC analysis –inverting amplifier, non-inverting amplifier instrumentation amplifier, adder, subtractor, log and antilog amplifier, integrator, differentiator, peak detector, precision rectifier – Non-ideal effect of op-amp – offset, drift, finite gain-band width product, finite CMRR, finite Ri, non zero Ro, slew rate, effect of finite gain on inverting and noninverting amplifiers, offset compensation, frequency compensation.

Module IV

Nonlinear circuits using op-amp- comparators, multivibrators, function generators – voltage regulators – using op-amp, functional diagram of 723 voltage regulator-Ic-short circuit protection-Active filters-general transfer functions-Advantages – Design of second order Chebychev & butter worth filters – low pass, high pass, band pass, band stop filter – Gyrator –negative impedance converter, filter using simulated inductance, Universal active filter (KHN): All pass filters.

Module V

Sample and hold circuits, Introduction to different types of ADC's and DAC's – VCO: functional diagram –applications –PLL: principle of operation – applications. Analogue multiplier: Various types and applications.

References:

1) Boylestead And Nashelesky, "Electronic Devices And Circuits", PHI
2) Gayakwad, "Op-Amp And Integrated Circuit"
3) Clayton, " Operational Amplifiers"
4) " Operational Amplifiers" IHRDE Publication
5) "High Frequency Electronics", Learning Material Series, ISTE, New Delhi, 1997
6) Sergio Franco "Design With Op-Amps & Analog Integrated Circuits" MH International

EE/EI 404 COMPUTER ARCHITECTURE & ORGANISATION

Module I

Basic structure of computer hardware and software – Addressing methods and machine programme sequencing –Computer arithmetic – logic design and fast adders – multiplication –Booth's algorithm –fast multiplication –integer division –floating point numbers –control unit –instruction execution cycle – sequencing of control signals –hardwired control –PLAs –microprogrammed control –control signals – microinstructions – microprogram sequencing –Branch address modification –Prefetching of microinstructions –emulation – Bit-slice processors.

Module II

Memory organization –semiconductor RAM memories –internal organization –Bipolar and MOS devices –dynamic memories – multiple memory modules and interleaving –cache memories –mapping functions –replacement algorithms –virtual memory –address translations –page tables memory management units –Secondary memory –disk drivers –organization and operations –different standards.

Module III

Input-output organizations –accessing I/O devices –direct memory access (DMA) –interrupts –interrupt handling – handling multiple devices –device identification –vectored interrupts – interrupt nesting – Daisy chaining – I/O interfaces –serial and parallel standards –buses –scheduling –bus arbitration – computer peripherals –printers –plotters –VDUs.

Module IV

Introduction to microprocessors – Architecture of typical 8 bit microprocessor –Intel 8085 microprocessor –study of functional units –function of various control signals –design of CPU section with buffers and latches. Interrupt structure of 8085

Module V

Instruction set of 8085 microprocessor –Addressing modes –programming –examples –instruction timing. Memory design –Design of memory using standard chips –Address decoding – I/O addressing schemes – I/O mapped I/O, and memory mapped I/O techniques.

Text Books:

1. Hamacher C V, "Computer Organization –3rd Edition", Mcgrawhill, New York, 1990

References:

1) Pal Chaudhary P, "Computer Organization And Design ", Prentice Hall, New Delhi, 1995
2) Bartee T C, "Digital Computer Fundamentals", McGraw-Hill, New York, 1997
3) Hayes J P, "Computer Organization And Architecture-2nd Edition", McGraw-Hill, New York
4) Tanenbaum A S, "Structured Computer Organization- 3rd Edition", Prentice Hall, New Jersey
5) Goankar, "Microprocessors Architecture Programming And Applications", John Wiley
6) Douglas V Hall, "Microprocessors & Interfacing To 8085 Introduction To", Tata Mcgrawhill
7) Ghose Sridhar, "Microprocessors For Engineers And Scientists"
8) Lance A Leventhal, "Introduction To Microprocessors" Prentice Hall

EI-405 INSTRUMENTATION ENGINEERING-I

Module I

Generalised Measurement system – Block diagram. Functional Description of Measuring System. Desired, Modifying, Interfering Inputs, Methods of eliminating Modifying and Interferring Inputs.
Generalised performance characteristics – Static characteristics error and error analysis.
Dynamic characteristics, ramp and impulse, step response of Zero order, 1^{st} order, 2^{nd} order Measurement systems.

Module II

Variable Resistance Transducers – Types, Potentiometric Transducers – Loading Error, Sensitivity and Linearity.
Strain Gauges – types, Gauge Factor – Strain gauge bridge circuits, Tempcompensation. Semi-conductor Strain gauge, Calibration ofStrain gauge, Termister, R.T.D.
Variable capacitance Transudcers: Principles, types, Sensitivity and Linearity for variable airgap & Variable Permitivity Types. Capacitance Transducers bridge circuits.

Module III

Variable Inductive Transducers: Various types, L.V.D.T. – Principle and characteristics, Block diagram approach for a typical L.V.D.T. set up used for displacement Measurement.
Magneto striction – Materials – Magneto striction Transducers.

Module IV

Piezo Electric Transducers: Piezo Electric, Element and their properties. Piezo Electric coefficients. Equivalent circuit and frequency response of P.E. Transducers.
Hall Effect transducers inductive transducers, digital transducers. Phito electric transducers, pyroelectric transducers and fibre optic sensors.
Elastic Transducers: Springs, Bellows, Diaphram, Bourdon Tubes – Their important features.
Ionization Transducers: Geiger Muller and Scintillation counters.

Module V

TEMPERATURE: Temperature Scales, Mechanical temperature sensors, Resistance type temperature sensors, Platinum resistance thermometers, Thermisters, Thermocouples, Solid state sensors, Quartz thermometer, Radiation methods, Optical Pyrometer, Callibration of thermometers.
PRESSURE: Diaphragms, other elastic elements, Transduction methods, Force balance transducers, Solid state devices, Piezo-Electric transducers, Vibrating element pressure sensors, Pressure calibration using dead weight tester.

References:

Instrumentation transducers - Newbert
Measurement systems, application & design Doeblin
Instrumentation in scientific research Lion
Engineering measurements Collet & Hope
Electrical and electronic measurements A K Sawhney
Instrumentation for process measurement and control Norman & Anderson
Engg. Measurement & inst'n Adams. I F
Principles of industrial instrumentation D Patranabid
Industrial process measuring instruments G C Carrol

CS/EB/EC/EE/EI 406 DIGITAL ELECTRONICS LABORATORY

Transfer characteristics and specifications of TTL and MOS gate

Design of half adder and full adder using NAND gates.

Set up R-S & JK flip flops using NAND Gates

Code conveters - Binary to Gray and gray to Binary using mode control.

Asynchronous UP / DOWN counter using JK Flip flops

Design and realisation of sequence generators.

Study of shift registers and design of Johnson and Ring counter using it.

Binary addition and subtraction (a) 1's complement (b) 2's complement

Study of IC counters 7490, 7492, 7493 and 74192.

Astable and monostable multi-vibrators circuit using 555

ADC at least one method.

Study of MUX & DeMUX Circuits and ICs

EB/EC/EI 407 ELECTRONICS CIRCUITS LABORATORY 1

I Study of RC and RLC circuits - Frequency responses, pulse response, Filter characteristics,

II Differentiating circuit and integrating circuit Biasing of Active devices
i) Voltage biasing, current biasing and Feedback biasing of BJT
ii) Biasing of JFET

III Amplifying circuits
(i) Simple common emitter amplifier configuration - gain and bandwidth.
(ii) Common source amplifier
Functions of each component, gain measurement, frequency responses

IV Feedback amplifier circuits - Current series and voltage shunt - gain and bandwidth..

V Oscillators - RC phase shift. Wein Bridge

VI Multivibrators - Astable ,Bistable,monostable.

VII Sweep circuits - Simple transistor sweep,bootstrap sweep.

VIII Series Voltage Regulator using transistors.

EC/EE/EI 501 ELECTROMAGNETIC THEORY.

Module I

Introduction: Overview of vector analysis. orthogonal co-ordinate systems- rectangular, cylindrical, spherical transformations, Flux, circulation open and closed surface Divergence, gradient, curl, stokes theorem Static Electric Field : Coulomb's law, superposition, scalar potential, moment method, gradient, electric field, electric flux, Gauss's law for electric flux, capacitance of sphere, concentric sphere, coaxial cable and two wire transmission line. Energy stored in a charged capacitor.

Module II

Static Electric Field - Dielectric homogeneity, linearity, isotropy, permittivity, electric dipole, polarization, boundary relations, divergence of the flux density, Laplacian Field Mapping Laplace equation, uniqueness theorem, Poisson's equation .Static Magnetic Field - Ferromagnetic Materials, magnetic dipole, permeability, hysteresis, The Static Magnetic Field of Steady Electric Currents, magnetic flux, Biot-Savart law, Ampere's law, Gauss's law for magnetic flux, boundary conditions, inductance of a coaxial cable , two wire transmission line , energy stored in a magnetic field- Magnetic vector potential .

Module III

Time varying Electric and Magnetic Fields - Faraday's law, Stokes's theorem, self and mutual inductance, eddy current, displacement current. Maxwell's Equations integral & differential form - General solution of wave equation in free space - uniform plane waves - TEM waves -relation between electric and magnetic fields, phase velocity and group velocity - Plane waves in a lossy medium. Skin depth ,propagation constants and intrinsic impendence - Time harmonic fields - solutions of wave equations.

Module IV

Poynting theorem – real and complex Poynting vector – interpretation - application of pointing theorem - power flow in transmission lines, uniform plane waves. Wave polarization, Reflection of plane waves at plane boundaries - normal and oblique incidence – refraction - transmission -snells law -critical angle -Brewster angle -total internal reflection - evanescent wave concept. Guided waves –TE,TM,TEM waves, Velocity of propagation ,attenuation-wave impedance.

Module V

Transmission lines: analogy between circuit theory & EM theory. Uniform transmission line - V I solution - characteristic impedance. Terminated uniform transmission line- VSWR -impendence matching quarter wave and half wave length transformer, stub matching -single stub matching, double stub matching and tuning - pulses on a transmission line- smith chart –Impedance matching using Smith Chart. Transmission line transformers.. Waveguides: rectangular wave guide- modes of wave propagation- TE_{mn}, TM_{mn} waves, cut off wavelengths, derivation - dominant modes - Cylindrical Wave guides.

Texts:

Field & Waves Cheng, Pearson Education (LPE)
Electromagnetic waves and fields " , Jordan and Balmain PHI

References:

1) W. H. Hayt ,"Engineering Electromagnetic", Mc Graw Hill
2) J. D. Kraus ,"Ele ctromagnetics",McGraw Hill
3) Electromagnetism ParmaniK PHI
4) Fundamentals Electromagnetism Guru Thomson
5) K. P. Harrington ,"Introduction to Electromagnetic Engineering",McGraw Hill
6) Edminister, "Electromagnetics", Schaum series
7) Elements of Electromagnetics Saddique ,Oxford
8) S Ramo ,W Whignary "Fields and Waves in Communication " Wiely

ME/SE/EI/EE 502 INDUSTRIAL ORGANISATION AND MANAGEMENT

Module I

Organization: Concept of organization, Characteristics of organization, Elements of organization, organizational structure organization charts, types of organization, formal line, Military or Scalar organization, functional organization, line and staff organization, project organization, matrix organization, authority and responsibility, span of control, delegation of authority.

Management: Concept of management and administration, difference and relationship between management, administration, and organisation, evolution of management theory, principles of scientific management, levels in management, introduction to project management and MIS.

Industrial ownership: Types of ownership –single ownership, partnership, joint stock company, co-operative society, public sector, private sector, scientific management –review of different schools of thoughts.

Module II

Personal Management: Recruitment and training, labour turnover, operator trainee, suggestion system.

Industrial safety: working conditions, environmental factors, psychological attitude to work and working conditions, fatigue, accidents and hazards.

Wages and incentives: feature of wages, time and piece rate, different incentive plans, profit sharing, job evaluation and merit rating, factors of comparison and point rating.

Industrial relations: Industrial disputes, collective bargaining, trade unions, worker's participation in management, labour welfare.

Module III

Marketing management: Concept of marketing VS Sales approach, consumer behavior and demand concept, buying motives, influence of income level, product design, new product distribution, pricing decision, major price policy considerations, pricing methods and tools, break even analysis and marginal costing in pricing, sales promotion, marketing research, test marketing, marketing of services, advertising management-types of advertising, choices of media, economic and psychological factors in advertising.

Module IV

Finance Management: Tasks, evolution of co-operative management, long term management, equity, preference and debenture capitals, term loans, dividends and share valuation, legal aspects of dividends, short term financing, working capital influencing factors, cash budgeting, terms of liquidity, management of receivable and inventories, budgets and budgetary control-objectives of budgeting, classification, ratio analysis.

Module V

Management Accountting: Fundamental of book keeping, journalizing, ledger accounts, sub division of journal, cash book, banking transactions, trial balance, preparation of trading, profit and lose account and balance sheet, adjustments.

References

1) Industrial organization and management :Bethel etal, McGraw Hill
2) Principles of industrial management :Kootnz & Donnel
3) Financial Management :Prasanna Chandra, Tata McGraw Hill
4) Operation Management :Fabricky etal, Tata McGraw Hill
5) Hand book of MBO :Reddin & Ryan, Tata McGraw Hill
6) Industrial Finance of India :S.K.Basu
7) First steps in book keeping :J.B.Batliboi
8) Management Accounting :Hingrani & Bemnath

EE/EI 503 Microprocessor System Design

Module I

Interfacing of peripheral chips with 8085:-Programmable peripheral interface (Intel 8255)-programmable communication interface (Intel 8255)-programmable interval timer (Intel 8253 & 8254).Programmable keyboard/Display controller (Intel 8279)-Programmable interrupt controller (8259)-DMA Controller (Intel 8257)-Block Diagram, Interfacing, initialization program and its applications. Serial and parallel bus standards-RS 232 C, IEEE 488, Centronics.

Module II

Architecture of typical 16-bit microprocessors (Intel 8086) - memory address space and data organization-segment registers and memory segmentation-I/O address space-addressing modes-comparison of 8086 and 8088-basic 8086/8088 configuration-minimum mode-maximum mode-system timing-bus interface. Interrupts and interrupt priority management.

Module III

Instruction set, assemblers, assembly level programming and programming examples in 8086. Introduction to IBM PC Architecture, peripherals and interface buses.

Module IV

Introduction to 80386, 80486 and Pentium family processors - interrupts and exception management of tasks-real, protected and virtual mode-super scalar architecture, intelligent branch prediction and pipelining, Introduction to Pentium and Pentium pro architectures. Introduction to RISC & CISC Architecture.

Module V

Introduction to micro controllers-comparison with microprocessors-study of micro controller (MCS 51 family)-Architecture, instruction set, addressing modes and programming, typical applications.

References

1) Microprocessor System, Architecture, Programming and Design : YU- Cheng Liu & Glenn A Gibson
2) Microprocessors and Interfacing : Douglas V Hall TMH
3) IBM PC/8088 Assembly language Programming : Avtar Singh
4) Upgrading and Repairing IBM PCs : Scott Muller
5) Advanced 80386 Programming techniques: James L Hardey
6) Intel users manual for 8086,80386 & 80486,Pentium and Pentium Pro Microprocessor Systems, Learning Material Series, ISTE, New Delhi, 1997

EI 504 INSTRUMENTATION ENGINEERING II

Module I

DC and AC Bridges: DC bridges for measurement of low-, medium-, and high- resistance–Kelvin's double bridge, Wheatstone bridge, Guarded Wheatstone bridge–Shunt calibration method; AC bridges and their application–Maxwell bridge, Hay bridge, Schering bridge, Wien bridge

Signal Generators: Sine-wave generator, sweep-frequency generator, pulse and square-wave generators, function generator, audio frequency signal generation

Electronic Measurement of Basic Parameters: Electronic multimeter, digital voltmeter, simple frequency counter

Module II

Length measurement – line- and end- standards, vernier instruments, micrometer instruments, slip gauge, dial indicator, Measurement of straightness and flatness – straight edge, flatness comparators, optical flats, straightness error

Angular measurement – sine bar and slip-gauge, clinometers: vernier, micrometer, pendulum, and optical types, auto-collimator

Roundness measurement – eccentricity tester

Module III

Flow measurement – flow meters: classification, rotameter, electromagnetic flow meter, mechanical flow meters, anemometer, ultrasonic flow meter, vortex-shedding flow meter, mass flow meter

Force measurement – dynamic response of elastic force transducers, digital force transducer, force-balance device, hydraulic load cell, electronic weighing systems, vibrating-wire force transducer; Torque measurement

Module IV

Vibration measurement – characteristics of vibration, vibration sensing devices, analysis, accelerometers: piezoelectric type and servo-type, calibration of acceleration pickups, jerk pickup

Velocity measurement: calibration, proximity pickup, stroboscopic flash, moving-coil and moving magnet pickups, DC tachometer generator, eddy-current drag-cup tachometer, seismic velocity pickup

Module V

Oscilloscopes: Block diagram, CRT circuits, vertical deflection system, delay line, multiple trace, horizontal deflection system, probes, techniques, special oscilloscopes [block-level treatment]

Waveform analysis: Spectrum Analyzer

Recording and Display instruments: Strip-chart recorder, X-Y recorders, Seven-segment display, Dot matrix display

Reference

1) Helfrick, Cooper *Modern Electronic Instrumentation and Measurement Systems* PHI
2) Rangan, Samra, Mani *Instrumentation Devices and Systems* TMH
3) Doebelin *Measurement Systems Application and Design* Mc-Graw Hill
4) Patranabis *Principles of Industrial Instruementation* TMH
5) Prasad *Metrology and Instrumentation*

EB/EC/EE/ EI 505 INDUSTRIAL AND POWER ELECTRONICS

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

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

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

Static switches - Timer circuits - Flasher circuits . Switching regulators - Basic concepts and analysis and design of Buck, Boost, Buck-Boost and derived converters . UPS - Characteristics - Configuration - application - battery selection, charging circuits. Thyristor protection - over current, over voltage , di/dt , dv / dt, gate protection , RFI minimization, Thyristor mounting and heat transfer.

Principle, characteristics and application of induction heating and dielectric heating - Ultrasonic - characteristics - application in non-destructive testing - application of power electronics in welding.

References:

1) Power Electronics Rashid ,Pearson Education /PHI
2) Modern Power Electronics And AC Drives B K Bose ,Pearson Education
3) Introduction to Power Electronics D W Hart ,Pearson Education.
4) Mohan Undeland Robbins," Power Electronics", - Converters application and design" , WE
5) "Power Electronics J Michanel Javob Vikas Thomsan Pub
6) P C Sen, " Power Electronics", Tata Mc Graw Hill
7) Singh & Khanchandani "Power Electronics" Tata Mc Graw Hill.
8) "Power Electronics Asghar M syed PHI
9) Power Electronics N Mohan John Wiely
10) The art of Electronics Hays Cambridge

CS/ EB/ EC/ EE/ EI 506 MICROPROCESSOR LAB

Part A (Compulsory)

Study of a typical microprocessor trainer kit and its operation
Simple programming examples using 8085 instruction set. To understand the use of various instructions and addressing modes - Monitor routines.
Interfacing and programming of 8255.(eg: traffic light control, burglar alarm, stop watch)
Interfacing and programming of 8253/ 8254.
Interfacing and programming of 8279.

Part B*

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

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

EI 507(P) : INSTRUMENTATION LAB-I

PART –A *
Measurement of Inductance by Maxwell's Bridge and Hay's Bridge
Measurement of Capacitance by Schering Bridge
Measurement of low resistance by Kelvin Double Bridge
Measurement of resistanc e by Wheatstone's Bridge
Study of Inductance Pick up Module
Study of Capacitance Pick up Module

* Atleast three topics from part A has to be covered.

PART –B *

I. Circuits using OP-AMPs
Instrumentation Amplifier.
Measurement of Off-set Voltage and its compensation.
Precision rectifiers
Second order active RC filters-Low pass, High pass, Band pass and Band elimination
Filters using simulation inductance
Universal active filter
Double integration Oscillator
* Atleast four topics from part B has to be covered.

PART –C (Compulsory)
II. Voltage regulator using 723 with short circuit protection
III. Voltage controlled oscillator – Use as frequency modulator
IV. Familiarisation with DAC and ADC chips

CS/EE/EI 601 DIGITAL SIGNAL PROCESSING

Module I

Introduction to discrete time signals & system-Discrete time signals and systems-Properties of discrete systems- linearity-time invariance-causality-stability. Convolution-difference equation representation of discrete systems-he Z transforms –properties of Z transform-the inverse Z transform-System function.

Module II

Discrete Fourier Transform & Fast Fourier Transform. Discrete Fourier series-properties-discrete Fourier transform-properties-block convolution-decimation in-time FFT algorithms-decimation in-frequency FFT algorithms-FFT algorithms for N a composite number.

Module III

FIR Digital Filters Realization-direct-cascade-lattice forms-hardware implementation-FIR filter design using Fourier series-use of window functions-frequency sampling design.

Module IV

IIR Digital Filters Realization-Direct-Cascade-Parallel forms-hardware implementation-Analog filter approximations-Butterworth and chebychev approximations-The method of mapping of differentials-impulse invariant transformation-Bilinear transformation-Matched Z transform technique.

Module V

Finite word length effects in digital filters-Fixed point arithmetic-Floating point arithmetic-Block floating point arithmetic –Truncation-Rounding-Quantization error in analog to digital conversion-finite register length effects in IIR & FIR filters Limit cycles. Digital signal processing applications (Only brief description required) Software implementation of digital filters-Architecture of typical DSP processor.

References:

1) Oppenheim & Ronald W Schafer, Digital Signal Processing", Prentice Hall, India
2) Andreas Antoniou, "Digital Filters Analysis & Design", Prentice Hall, India
3) R Rabiner & B Gold, "Theory & Applications of Digital Signal Processing", Prentice Hall, India
4) Andreas Antoniou, Digital Signal Processing, Prentice Hall, India
5) John G Proakis & Dimitris G Manolakis: Digital Signal Processing, Prentice Hall, India
6) Sanjit K Mithra, "Digital Signal Processing, Tata Mc Graw Hill
7) Douglas K Lindner, " Introduction to signals & Systems", Mc Graw hill.

EI 602 PROCESS INSTRUMENTATION

Module I

Level measurement – Simple methods. Visual indicators, float actuators, electrical resistance and static pressure type. Principle of operation. Level switches – Linearisation techniques for level sensors. Ultrasonic and capacitor type level measurement. Measurement of level of solids – Paddle wheel type. Level measurements using pressure sensors – diaphragm.

Measurement of humidity – Hygrometer various types – Dew cells – Measurement of moister – Conductance type – Capacitance type –Spectral type.

Module II

Viscometry – different types of viscosity meters –consistency measurement – Pneumatic and electrical signal conditioning control of viscosity and consistency. PH meters – hydrogen, Ion concentration – Definition of PH value – Acidity - Alkalinity – PH measurement – calomel electrodes – PH measurement and electronic PH meter – Digital PH meters

Module III

Analysers – Gas analyser – Biochemical absorptions – Biothermal conductivity – Bio chemical reactors – Heat of reactors by magnetic property and gas chromatography calorimetry – Infrared and Ultra violet method of analysis – Mass spectrometer – Instrumentation Symbols and diagrams.

Module IV

Analytical Instruments – Radiant energy types – X-ray detecting method and proportional counters – Geiger Muller Counter – Scintillation counters - spectrometers. Industrial Weighing – Pneumatic and electrical weighing – on line weighing and control Automatic bagging and bottling.

Module V

Pumps – Different types other than vacuum pumps construction – Characteristics – Efficiency specifications and typical applications with calculation – Control of centrifugal, rotary, reciprocating pumps – Throttling and on-off control.

Effluent and water treatment – Chemical methods – Oxidation, reduction and neutralization – Biological methods of control.

Control schemes for compressors with special reference to surge control

References:

1) Principles of Industrial Instrumentation – D PTRANABIS
2) Industrial Process measuring instruments – G.C. CARROL
3) Transducers and Display Systems – Dr. B S SONDE
4) Measurement Systems – D.O. DOEBELIN

EE/EI 603 COMMUNICATION ENGINEERING

Introduction to various communication systems – Modulation – Different types of modulation – AM- Expression –modulation index –bandwidth – AM Modulator (Block level treatment)- Introduction to DSBSC, AM Balanced Modulator (Block level treatment) SSB, VSB – FM – Expression- Modulation Index –Bandwidth – Carson's rule – FM Modulator (Block Level treatment) – Phase Modulation – Comparison between FM and PM – Armstrong Modulator (Block level treatment)

Transmitters (Block level treatment) AM Transmitter – Low level – High Level –FM Transmitter- FM Stereo Transmitter – Receivers – (Block level treatment only) – AM receivers – TRF- Super – Heterodyne receiver – Image frequency –Envelope detector –FM receiver – FM Stereo receiver – Pulse Modulation Systems – PAM – PWM – PPM.

Radiation and propagation of waves: (analysis not required) –Electro magnetic Radiation – Waves in free space – polarization – Reception – Effects of Environment – Propagation of waves: Ground waves – Sky – Way propagation –Space Waves – Antennas – Basic consideration – Wire radiator in space – Common terms and definitions – Effects of Ground on Antennas – Directional High frequency Antennas – UHF – Microwave antennas – Wide band and Special purpose antennas.

Micro wave techniques (analysis not required) – Microwaves in perspective – Transmission lines –Wave guides – Cavity resonators – Microwave semiconductors – Microwave tubes – Microwave antennas - Satellite Communications: Satellite orbits – Satellite communication Systems- -Satellite sub systems – Earth stations.

Fiber optic communication Light – light wave communication systems – Fiber optic cable – Optical Transmitters and Receivers
Modern communication Applications: Facsimile- Cellular Radio Systems – Radar –Television.

References:

For Modules I, II, & III
Electronic Communications : Dennis Roddy and John Coolen, Prentice Hall ,India
Electronic Communication Systems : Kennedy & Davis –Fourth Edition – Tata McGraw Hill Publishing Company Ltd.
Communication Electronics : Frenzel , Mc Graw Hill , International Editions
For Modules IV & V
Communication Electronics : Frenzel , MGH.

EI 604 INDUSTRIAL INSTRUMENTATION

Module I

Measurement of Pressure:-Introduction-Units and definitions-Standards of pressure-pressure and vacuum. Pressure measuring elements-Bourden gauge-Mcleod gauge-Float type pressure gauges-Knudsen gauge-Momentum transfer gauges-thermal conductivity gauge-pirani gauge. Dynamic effect of volumes and connecting tubing – dynamic testing of pressure measuring systems. Pressure measuring strain gauges. Differential pressure elements-U tube manometer – Inclined manometer – Ring balance type manometer-Bellows-principle of operation, theory and construction-Pressure transducers-differential pressure transducers-pneumatic and electrical pressure transmitter-Pressure switches-very high pressure measurement (70 kPa) transducer-Pressure regulation and control-Pressure signal multiplexing.

Module II

Differential pressure meters:-Orifice plates-venturi tube-dall tube-flow nozzles-laminar flow-turbulent flow-pitot tube-installation procedures measuring units-manometers-flow registering instruments-wet and dry type. Recording mechanism-automatic indication-square root compensation-pressure transmission between detecting elements and measuring units-selecting position and installation of units-purge system Shunt flow meters for liquids and gases-principle of operation and construction-variable area meters-theory-principles of operation and construction.

Module III

Density measurement, different methods of applications-continuous weight measurement in conveyor belts-strain gauge load cell melthod Pneumatic, Hydraulic, load cells – Different methods of weight measurement-float principles – Air pressure balance method – Gamma rays method – Future trends, measurement of turbidity-Principles, different methods, and applications.

Liquid vapour equilibrium – Standard vapour pressure pshychometry and use of psychometric charts. Humidity measurement Air hygrometer Dew point method-wet and dry bulb hygrometer-electrical method of measuring humidity.

Module IV

Power plant instrumentation:-Scheme of a typical power plant. Pressure, temperature, flow and level. Vibration and expansion. Analyzers-flue gas analysis. Nuclear power plant instrumentation-safety measures pneumatic instrumentation. Thermal power plant instrumentation.

Module V

Control valves: final control operation-electrical and pneumatic Signal conversion-actuators-different types of automatic control valves. Butterfly valves-ball valves-v ball valves, glob valves-plug valves, gate valves (brief study)

Positioner and advantages of using positioner. Solenoid valves.

References:

1) MeasurementSystem application & design Earnest O-Deobelin-Mc Graw Hill
2) Industrial Instrumentation-Donald P.Eckman-Vilky Eastern Ltd
3) Mechanical & Industrial measurements-R K Kain-Khanna Publishers
4) Principles of Industrial Instrumentation-D.Patranabis-Tata Mc Graw Hill
5) Measurement and control of temperature in industry-Yoyd R Constable
6) Pyrometry-Wood J P and Cooler. J M Tata Mc Graw Hill
7) Measurement System application and design-Earnest.O.Doeblin Tata Mc. Graw Hill
8) Process control instrumentation technology-Austin D Johnson-John Wiley & Sons
9) Instrument engineers handbook-third edition-Process control-Bela-G.Lpitak-Butterworth Heinemann-Distribution Asian books New Delhi
10) Process control-Donald P Eckman
11) Instrument engineers handbook-third edition-Process measurement and analysis-Bela-G.Liptak-Butterworth Heinemann-Distribution Asian books New Delhi.

CS/ EB/EC/EI 605 CONTROL SYSTEM ENGINEERING

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

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

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

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

State variable methods : introduction to state variable concepts - state variable description of linear dynamic systems - representation in matrix forms - block diagram and signal flow graph representation of state equations - Transfer matrix from state equations - transition matrix - general solution for linear time invariant state equations. Control system components :- Error detectors , servomotor, tachogenerator, servo amplifier, magnetic amplifier, rotating amplifier - Basic principles of adaptive control systems.

References:

1) Ogata K, " Modern Control Engineering", Prentice Hall/Pearson
2) Dorf Morden Communication Systems ,Pearson Education
3) Franklin Feed back Control Systems, Pearson Education
4) Kuo B. C , "Automatic Control System", Prentice Hall
5) Nagoor Kani :Control Systems, R B P
6) Ogata Discrete Time Control Systems ,Pearson Education
7) Nagarath & Gopal, " Control System Engineering", Wiley Eastern
8) Control Engineerng Ramkayan Vikas Pub
9) Control Theory M N Bandyopadhyaya ,PHI
10) Control Theory Glad , Vikas Thomson Pub

EI 606 : INSTRUMENTATION LAB -II

PART –A (Compulsory)

. 1. PLL Measurement of Capture range, Lock range, Use as FM discriminator and frequency synthesizer
2. Familiarisation with Analog multiplier IC, use as AM modulator and frequency doubler.

PART –B*

Measurement of viscosity
Measurement of temperature
Measurement of pH.
Measurement of pressure
Dynamic response of first order system
Dynamic response of second order system
Pressure to current & Current to pressure converter
Use of L.D.R. for measurement of physical variation
Measurement of strain /force
Measurement of speed

* Atleast five topics from part B has to be covered.

PART –C*

SCR characteristics
SCR triggering circuits
Phase controlled rectifiers
Dc motor speed control
Chopper circuits
Power transistor characteristics
Power MOSFET characteristics
Simple inverter circuits
Microprocessor based motor control

* Atleast five topics from part C has to be covered.

EI 607 MINOR PROJECT

EB//EE/EI 701 Computer Communication and Networks

Module 1

Introduction to computer networks - need for networking - various topologies and configurations Concept of Internet -Internet services - concept of layering - peer processes - ISO - OSI - & layer standard - functions of each layer.

Module 2

Transmission media - description and characteristics - base band and broad band transmission - synchronous and asynchronous transmission - full duplex and half-duplex links - MODEMS serial communication standards - X-21 digital interface - need for data link layer - stop and wait sliding window protocol - HDLC protocols terminal handling - polling, multiplexing and concentration.

Module 3

Virtual circuits and data grams - routing - different types congestion control - LAN - base band and broad band LANs - carrier sense networks - CSMA/CD - ring networks - shared memory systems - IEEE 802 standard - introduction to X-25 standards.

Module 4

Transport layer - design issues - connection management - connection establishment flow control and buffering - multiplexing - crash recovery - a simple transport protocol on top of X-25 standard . Session layer - design issue - data exchange – dialogue management - synchronisation - remote procedure call - client server model

Module 5

Presentation layer - data representation - data compression - network security and privacy - cryptography - presentation layer in ARPANET application layer - virtual terminal and file transfer protocols - electronic mail - introduction to distributed system.

References:

- A S Tannenbaum, " Computer Networks
- Hausly, " Data Communication"
- UYLESS BALACK, " Computer Networks, Protocols Standards & Interfaces"
- Stalling , "Local Area Networks"
- Communication networks, 2nd Edition By Jean Walrand

EI 702 DIGITAL SYSTEM DESIGN

Module I

Introduction to combinational modules and modular networks: Standard combinational modules design of arithmetic modules. Implementation of combinational systems with ROM's and PLA's Comparison with other approaches. Implementation of multimodule combinational systems. Decoder networks, Mux trees, demux network ,encoder network shifter and barrel shifters

Module II

Introduction to digital systems. Synchronous and asynchronous-state diagram, state names, mili and moor machines binary description. Time behavior of sync. sequential systems. Minimization of no. of states Specification of various types of sequential system.

Module III

Canonical implementation-analysis and synthesis of networks in the canonical implementation. Flip flop modules and networks. Modular sequential networks

Module IV

Standard sequential modules- Registers-shift register-counters-RAM-content addressable memories and programmable sequential arrays (PSA)-Design of sequential systems with small number of standard modules-state register and combinational networks-use of ROMs in sequential networks-Counter and combinational networks-RAM and combinational networks-SR and combinational networks.

Module V

Multimode implementation of sequential systems. Multimodule registers-Shift registers and RAMs- Multimodule counters-Sequential arrays-Introduction to hardware / Firmware algorithms

Reference

1. Milos D Ercegovac, Tomas Lang, "Digital systems and hardware/firmware algorithm", John Wiley
2. William I Fletcher, "An engineering approach to Digital design", Prentice Hall
3. Hayes, " Digital System Design and Microprocessor", Mc Graw Hill
4. John B Peatman, " Digital Hard Ware Design", Mc Graw Hill

EI 703 AUTOMATIC PROCESS CONTROL

Module I

An overview of process control ,controller principles - process characteristics - control system parameters - controller modes - discontinuous controller modes - composite controller modes (on-off ,integral ,derivative) process loop tuning - open loop transient response method - Ziegler-Nichols method

Module II

RLC elements in pressure, flow, temperature systems. Use of RLC concept in analysis of pressure, flow, temperature systems.
Basic feed back control – negative feed back, dead time, capacity. Analysis of common feed back loops for flow control, temperature control, pressure regulation, liquid level, mixing process.

Module III

Computer control of process: Concepts of basic process control computers, direct digital control, sample data control systems – Block diagram PID control algorithms, Alarm Annuciators.
Programmable Logic Controllers (PLC) functional features – Input/output subsections of PLC, specifications. PLC program scan. PLC program for motor control – Distributed Control System (DCS) – architecture – features of operator's station in DCS comparison between DCS and Centralised Computer System, Supervisory Computer Control and Data acquisition (SCADA).

Module IV

Multiple loop system- Cascade control, ratio control, feed forward control, adaptive control system. Concepts of multivariable processes control.
Applications – Boiler control, Distillation control, PH control, Heat exchangers.

Module V

Instrumentation and control in blast furnaces Stone combustion control, gas and water control in BCF furnaces sand casting mould level control.
Instrumentation and control in paper stock chest basis weight control, consistency control thickness control(paper industry).
PH control systems
Instrumentation and control in cement kilns.

References:

1. Automatic Process Control - DECKMAN
2. Process Control Systems – SHINSKEY
3. Automatic Control Systems – B.C. KUO
4. Principles of Process Control m- D. PATRANIBS
5. Instrumentation in the Processing Industries – B G LIPTAK
6. Applied Instrumentation process industries – Vol. 1, 2, 3 – W G ANDREW & N B WILLIAMS
7. Process Control Systems, Application, Design and Tuning 3rd edition- F GREGG.

EI 704/ EE705 D DIGITAL COMMUNICATION

Module I

Digital modulation schemes: BPSK-DPSK-DEPSK-QPSK M-ary PSK-QASK-BFSK-BPSK-M-ary FSK-MSK

Module II

Digital communication: A/D and D/A converters-uniform and non-uniform quantization-PCM-DPCM-delta modulation. Entropy encoding and data compression.

Module III

Digital transmission and reception: Timing-symbol and frame synchronization-codes of synchronization in Modulators and demodulators-ASK-FSK-PSK-Digital multiplexing-modems-probability of error-matched filters-probability of error in matched filters.

Module IV

Digital switching systems-circuit switching message switching-packet switching. ISDN introduction-network and protocol architecture-transmission channels-user network interfaces-signaling-numbering and addressing-ISDN standards. Network access control-centralised - distributed- decentralised.

Module V

Design of digital communication systems: Digital design trade off-paging systems- cellular telephone-global positioning satellite-facsimile-videotext-Video conferencing.

References:

1) Taub and Schilling, "Principles of communication systems", Tata Mc Graw Hill
2) Martin's Roden, "Analog and digital communication system"
3) Martin's Roden, " Digital communication systems"
4) Bruce Carlson, " Communication systems"
5) Tannenbaum, " Computer Networks"
6) John Freer, " Computer communication Networks"
7) Thiagarajan Viswanth, " Telecommunication switching systems and networks', Prentice Hall
8) William C Y Lee " Mobile cellular telecommunications", Tata Mc-Graw Hill
9) John G Proakis " Digital Communications", Mc Graw Hill International

EI 705 A - FUZZY LOGIC & NEURAL NETWORKS

Module I

Introduction to artificial neural networks - biological neurons - Mc Culloch and Pitts modals of neuron - types of activation function - network architectures - knowledge representation - learning process - error-correction learning - supervised learning - unsupervised learning - single unit mappings and the perceptron - perceptron convergence theorem (with out proof) - method of steepest descent - least mean square algorithms - adaline/medaline units - multilayer perceptrons - derivation of the back-propagation algorithm

Module II

Radial basis and recurrent neural networks - RBF network structure - covers theorem and the separability of patterns - RBF learning strategies - K-means and LMS algorithms - comparison of RBF and MLP networks - recurrent networks - Hopfield networks - energy function - spurious states - error performance

Module III

simulated annealing - the Boltzman machine - Boltzman learning rule - the mean field theory machine - MFT learning algorithm - applications of neural network - the XOR problem - traveling salesman problem - image compression using MLPs - character retrieval using Hopfield networks

Module IV

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets - fuzzy relations - operations on fuzzy relations - the extension principle - fuzzy measures - membership functions - fuzzification and defuzzification methods -

Fuzzy controllers - Mamdani and Sugeno types - design parameters - choice of membership functions - fuzzification and defuzzification methods - applications

Module V

Introduction to genetic algorithm and hybrid systems - genetic algorithms - natural evolution - properties - classification - GA features - coding - selection - reproduction - cross over and mutation operators basic GA and structure

Introduction to Hybrid systems - concept of neuro-fuzzy and neuro-genetic systems

Reference books

1. Simon Haykins, *"Neural Network a - Comprehensive Foundation"*, Macmillan College, Proc, Con, Inc
2. Zurada J.M., *"Introduction to Artificial Neural Systems*, Jaico publishers
3. Driankov D., Hellendoorn H. & Reinfrank M., *"An Introduction to Fuzzy Control"*, Norosa Publishing House
4. Thimothy J. Ross, *"Fuzzy Logic with Engineering Applications"*, McGraw Hill
5. Bart Kosko. *"Neural Network and Fuzzy Systems"*, Prentice Hall, Inc., Englewood Cliffs
6. David E. Goldberg, *"Genetic Algorithms in Search Optimisation and Machine Learning"*, Addison Wesley
7. Suran Goonatilake & Sukhdev Khebbal (Eds.), *"Intelligent Hybrid Systems"*, John Wiley & Sons

EB/EC/EI 705B EMBEDDED SYSTEMS

Module I

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

Module II

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

Module III

8Bit microcontrollers – Architecture on chip peripherals instruction set/programming of Intel MCS51 family (8 bit) microcontroller,Inter facing of 8051 with LCD,ADC,sensors,stepper motor,key board, DAC,memory

Module IV

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

Module V

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

Text :

1.Programming for Embedded Systems- Dreamtech Software Team, Wiley Dreamtech
2. The 8051 micro controllers , M A Mazidi& Mazidi, Pearson Education

3. Design with PIC micro-controllers: John B Peatman, Pearson Education

References

1) Fundamentals of Embedded Software where C and Assembly Meet – Daniel W Lewis.
2) DS101374: National Semiconductor reference manual.
3) Embedded / RealTime systems: Concepts, Design and programming, Dreamtech Software Team, Wiley Dreamtech
4) 1187D: Atmel semiconductor reference manual.
5) Atmel semiconductor web site – www.atmel.com
6) DS30292B: Microchip reference manual.
7) Microchip semiconductor web site – www.microchip.com
8) National semiconductor web site – www.national.com

CS/EB/EC/EI/IT 705 C ARTIFICIAL NEURAL NETWORKS

Module I

Fundamentals of ANN – Biological prototype – Neural Network Concepts, Definitions - Activation. Functions – single layer and multilayer networks. Training ANNs – perceptrons – Exclusive OR problem – Linear seperability – storage efficiency – perceptron learning - perceptron training algorithms – Hebbian learning rule - Delta rule – Kohonen learning law – problem with the perceptron training algorithm.

Module II

The back propagation Neural network – Architecture of the back propagation Network – Training algorithm – network configurations – Back propagation error surfaces – Back propagation learning laws – Network paralysis _ Local minima – temporal instability

Module III

Counter propagation Networks – Architecture of the counter propagation network – Kohonen layer – Training the Kohonen layer – pre-processing the input vectors – initialising the weight vectors – Statistical properties. Training the Grossberg layer- Feed forward counter propagation Neural Networks – Applications.

Module IV

Statistical methods – simulated annealing – Bloltzman Training – Cauchy training -artificial specific heat methods. Application to general non-linear optimisation problems – back propagation and Cauchy training.

Module V

Hopfield net – stability – Associative memory – statistical Hopfield networks – Applications – ART NETWORKS – GENETIC ALGORITHMS –Bi-directional Associative memories- retrieving stored information . Encoding the association – continuous BAMS

References

1) Linus Fe, *Neural Network in Computer Intelligence* , McGrawHill
2) Philip D.Wasserman, *Neural Computing(Theory and Practice)*
3) Robert Hecht-Nilson, *Neuro Computing*
4) James A.Anderson, *An Introduction to Neural Networks*
5) Jack M. Zureda, *Introduction to Artificial Neural Systems*

EC 704/EI 705 D ELECTRONIC PRODUCT DESIGN

I **From Requirement to Product**

Definitions of Science, Engineering, and Technology- Engineering design as real life problem solving- Requirement analysis of Electronic products- Formulation of product requirement specifications and target specifications. The design process- Computer Aided Design- Product conceptualization- Product architecture- Product synthesis- Design analysis- Portable Electronic Design Factors. Product Life Cycle, Representation of development tasks using standard tools showing timing and dependencies.

II **Electronic Product Design**

Various dimensions of Electronic Product Design- Industrial design and Engineering design- DFx methodologies in product design- Quality by design analysis- Sketches and Engineering drawing of Electronic products. Aesthetics and Ergonomics- Inputs, control and display interface. Electronic interconnection and Packaging of components, Integrated circuits, Printed circuits and Functional products- Cables and connectors- Design Engineering and Test Documentation – Component Specification/ Bill of materials.

III **Thermal Design of Electronic Equipment**

Heat generation and modes of heat transfer in Electronic products- Selection of Power Semiconductor Devices based on thermal considerations- Selection/Design of Heat Sinks- Factors affecting the design of heat sinks and its cooling effectiveness- Assembly of components on heat sinks- Electrical analogue of thermal circuits- Enclosure design of Electronic Equipments and thermal considerations- Design guidelines for Ventilations- Forced cooling- Heat pipes for electronic cooling applications- Cooling of power intensive IC chips- Thermal Considerations in PCB design.

IV **Electromagnetic Interference and Design for Electromagnetic Compatibility**

Electric Field Interference, Magnetic Field Interference, Conducted noise etc. in Electronic Equipment- Sources of EMI, inter and intra system EMI- Noise performance of passive components- Cabling, Shielding and Grounding - Cables, Connectors, components and equipments for interference suppression/minimization- Intrinsic noise sources and their management- EMI standards and Regulations- PCB design guidelines for EM compatibility.

V **Electronic Design Automation Tools**

PCB design process- Design rules for analog, digital, high-frequency, power-electronic and MW PCBs. Introduction to PC based Electronic Design Automation Tools: Schematic Capture, Circuit Simulation, Layout Design etc. Features of such packages with reference to popular EDA tools such as Orcad- Designing PCBs for manufacturability- Design considerations for power efficiency. Introduction to SPICE simulation of circuits- Circuit description- Modeling ofactiveand passive circuit elements. Circuit analysis- DC, AC, Transient and Parametric analysis. (For this module tutorial sessions on an EDA tool is recommended)

References

1. Product Design & Development- Karl T. Ulrich & Steven D. Eppinger, MGH.
2. Product Design & Manufacturing- John R. Lindberg, PHI.
3. Thermal Design of Electronic Equipment- Monogram by CEDT, IISc. Bangalore.
4. PCB Design & Technology- Waller C. Bosshart, TMH
5. Noise Reduction Techniques in electronic systems- Henry W. Ott.
6. Electronic Product Design for Automated Manufacturing- Richard Stillwell, Marcel Dekker Pub.
7. Spice for circuits & Electronics using Pspice- Mohammed H. Rasheed, PHI

8. Printed Circuits Handbook- Clyde F. Coombs, Jr., MGH
9. Product Design and Manufacturing- A.K. Chitale & R.C. Gupta
10. Portable Electronics Product Design and Development – Bert Haskell, MGH

EI 706 : DIGITAL SIGNAL PROCESSING LAB

Part A (Experiments on a Digital Signal Processor kit)

1. Programms for the familiarization of Important Instructions
2. Programms for Arithmetic Operations
3. Programms for Different types of Wave generation
4. Programms for Linear Convolution
5. Programms for Circular Convolution
6. Programms for FIR Filter Design
7. Programms for IIR Filter Design
8. Programms for FFT
9. Programms for DFT
10. Programms for Step response of Difference Equation

Part B (Experiments Using MATLAB)

1. Simple operations on Sequences (Signal Smoothing, Generation of Waveforms etc.)
2. Simulation of Discrete-Time Systems (The Moving Average, Linear, Non Linear, Time Variant, Time Invariant, Stable etc.)
3. Convolution and Circular Convolution
4. DTFT Computation

5. DFT and IDFT computations
6. Sampling Process in Time –Domain and Frequency –Domains
7. Analog Low Pass Filter
8. Realization of FIR and IIR Transfer Functions
9. FIR and IIR Filter Design
10. Simulation of FIR and IIR Digital Filters
11. Generation and Quantization of Binary Numbers
12. Coefficient Quantization effects
13. A/D Conversion Noise Analysis
14. Analysis of Arithmetic Round-off Errors
15. Limit Cycles

EI (707) PROCESS CONTROL LAB

I Study Of Different Types Of Process Stations.
1. Temperature Process Control trainer.
2. Level Process Control trainer.
3. Pressure Process Control trainer.
4. Flow Process Control trainer.

II. Study Of Various Types Of Linear Controllers.
1. Characteristics of ON-OFF Control.
2. Characteristics of 'P' Control.
3. Characteristics of 'I' Control.
4. Characteristics of 'D' Control.
5. Characteristics of 'P+I' Control.
6. Characteristics of 'P+D' Control.
7. Characteristics of 'P+I+D' Control.

III. Studies of cascade control

IV. Studies of feed forward control

V. Characteristics of Control Valve.

VI. Use of Programmable logic controller and DCS

VII. Characteristics OF Devices Connected With Process Control Systems/Plants.

a. Characteristics of Thermocouple.
b. Characteristics of Signal Conditioner.
c. Characteristics of RF Capacitance type Level Sensor.
d. Characteristics I/P and P/I Converters.

e. Characteristics IR type Flow sensor.

VIII. Studies of Ratio control

IX. Supervisory control-SCADA package

X. Non-linear plant control-pH &conductivity

EI 708 – SEMINAR

Each student shall individually prepare and submit a seminar report on a topic of current relevance on stipulated time. Few panels consisting of three teachers (internal) each should evaluate the seminar report and the presentation. Marks should be distributed considering report writing, presentation, technical content, depth of knowledge, brevity and references and their participation in seminar. The time allotted for presentation is 30 minutes.

EC/EE804 D /EI 801 BIO MEDICAL INSTRUMENTATION

Module I

Source of bio electric potential – resting and action potential – propagation of action potential – The bio electric potential – Electrodes for ECG ,EEG and EMG- Micro electrodes

Module II

Bio medical recorders- electro cardio gram –lead systems – block diagram of ECG – EEG – EMG (Block diagram level treatment only)- Ink jet recorders- UV recorders

Module III

Theraputic equipments – Cardiac Pacemakers – External and Implantable pacemakers – power sources for Implantable pace makers leads and electrodes – Cardiac defibrillators – Implantable Defibrillators – electro surgical machines – Ultra sonic therapy unit.

Module IV

Imaging Systems – Basics of X-ray machines – Computed Tomography – MRI Systems – basic NMR components –Thermographic Equipment – Real time ultra sonic Imaging systems.

Module V

Bio telemetry – Inntroductuion –components – implantable units –single channel telemetry systems – multichannel wireless telemetry systems – transmission of analog physiological Signals over telephone lines.

References:

1. Bio medical Instrumentation and Measurements , Leslie Cromwell

2. Hand book of bio medical instrumentation R.S. Khandpur
3. Principles of Bio medical Instrumentation , Richard Aston .

EI 802 VLSI SYSTEM DESIGN

Module I

Review of solid-state device concepts – Semiconductor materials –Crystal structure, Crystal axes & planes, orientation effect, pn junction – built in voltage –current equations. Progress & impacts of Integral circuit technology, Ultra fast VLSI systems –submicron CMOS, GaAs technology–GaAs crystal structure. The MOS device – (n-channel & p-channel) – capacitance of MOS structure –accumulation, depletion and inversion, threshold voltage, current equations – characteristics, channel pinch-off. Second order MOS device effects –short channel effect – narrow width effect – sub threshold current –device saturation characteristics.

Module II

The basic inverter using MOS – circuit –current –equations –pull up pull down ratios –Alternate forms of pull up – Basic circuit concepts –sheet resistance, area capacitance, inverter delays – effect of loading –basic NAND, NOR circuit –super buffers –pull up and pull down characteristics. The CMOS invertor characteristics –NAND –NOR circuits using CMOS.

Module III

VLSI process integration – fundamental considerations in IC processing –NMOS IC technology –CMOS IC technology – BiCMOS IC technology –GaAs technology –Ion implementation in IC fabrication –range theory – implantation equipment –annealong –shallow junction – High energy –implantation and future trends.

Module IV

Layout design of static MOS circuits – Layout rules – general principles &steps of lay-out design – use of stick diagrams – design rules – effects of scaling down – general considerations in subsystem design –Layout examples of NAND, NOR, registers –pass –transistors in implementing a circuit. Assembly techniques and packaging of VLSI devices –package types –package design consideration package – fabrication technologies –Yield statistics.

Module V

Logic design of MOS networks –combinational circuits –clocked sequential circuit – drivers for bus lines dynamic RAM –Forming arrays of RAM, ROMs in logic design and task realization algorithms –PLAs and variations, field programmable array logic, examples pf applications, introduction to design automation & Verification –CAD tools in VLSI design – Graphical entry layout –Design rule checkers –Circuit extractors & simulators.

Text Book

Douglas A Pucknell, Kamran Eshraghian, "Basic VLSI Design", P H

References: -

1) Mead & Conway, "Introduction To VLSI System Design "
2) Fabricius, "Introduction To VLSI System Design"
3) Geiger, Allen Et Al, "VLSI Technique For Analog Digital Circuits", McGraw-Hill
4) S M Sze, "VLSI Technology"
5) Thomas E Dillinger, "VLSI Engineering ", P H Interscience
6) S K Gandhi, "VLSI Fabrication Principles" (McGraw-Hill)
7) Sung-Mo Kang, "CMOS Digital Integrated Circuits Analysis And Design", McGraw-Hill

EI 803: OPTICAL INSTRUMENTATION

Module 1

Interferometers - Fabry-Perot and Michelson interferometers - Mach-Zehnder interferometer - interference filters - interferometer methods in metrology and testing of optical components - optical spectrum analyzer - modulation of light - electro-optic effect - Kerr modulators - magneto-optic devices - acoustic optic modulators - display devices - light emitting diode - plasma displays - liquid crystal displays - pin diodes - photo detectors –thermal detectors – photon devices- optocouplers.

Module II

Optical materials and coating - moire fringes - photo elasticity - lasers - principles of operation - Einstein relations - population inversion - optical feed back - laser modes - classes of lasers - solid state, gas and liquid dye lasers - semiconductors lasers - properties of laser light.

Module III

Optical resonators – Rectangular cavity – Open planer resonator – Quality factor – Ultimate line width – Mode selection – Transverse & longitudinal – Q Switching – Mode Locking – Confocal resonator, Planar resonator – Spherical resonator

Optical Modulators: Electrooptic, Accousto optic, and Mechanooptic modulators – Theory, Principle of Operation, Construction and applications

Module IV

Applications of lasers - laser gyro - Laser Doppler Anemometry (LDA) - holographic interferometry - distance measurement - holography - principles and applications - optical fibres - light guidance through fibres - step index and graded index fibres - multimode and single mode fibres - fibre fabrication

Module V

Measurement of fiber characteristics - attenuation, dispersion and refractive index profile measurement - OTDR - fiber optic components , Fibre losses, Fibre materials, Integrated Optics -- couplers, splicers and connectors - applications of optical fibers - optical fiber communication - fiber optic sensors - recent trends

Reference books

1. Meyer-Arendt J.R., “Introduction to Classical and Modern Optics”, PHI
2. Wilson J. & Hawkes J.F.B, "Optoelectronics: An Introduction", Prentice Hall of India
3. Thygarajan K. & Ghatak A. K., "Lasers - Theory and Applications" Plenum Press
4. Guimaraes W.O.N. & Mooradian A., “Lasers and Applications”, Springer Verlag.
5. Cock W.E., “Engg Applications of Lasers and Holography”, Plenum Press.
6. Cheo P.K., “Fibre Optics-Devices and Laser Systems”, PHI.
7. Jain R.K., “Engineering Metrology”, Khanna Publishers.

EB/**EC/EI 804A DIGITAL IMAGE PROCESSING (Elective)**

Module I

Digital image fundamentals: representation - elements of visual perception - simple image formation model - Image sampling and quantization - basic relationships between pixels - imaging geometry.

Review of matrix theory results: Row and column ordering - Toeplitz, Circulant and Block matrices.

Review of Image transforms: 2D-DFT, FFT, Walsh , Hadamard , Haar, DCT and Wavelet transforms.

Module II

Image enhancement: Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging; Spatial filtering- smoothing filters, sharpening filters. Frequency domain methods: low pass filtering, high pass filtering, homomorphic filtering. Generation of spatial masks from frequency domain specifications.

Module III

Image restoration: Degradation model - Diagonalization of circulant and Block circulant matrices - Algebraic approaches - Inverse filtering - Wiener filter - Constrained Least squares restoration - Interactive restoration - Geometric transformations. Fundamentals of Colour image processing: colour models - RGB, CMY, YIQ, HIS - Pseudo color image processing - intensity slicing, gray level to color transformation.

Module IV

Image compression: fundamentals- redundancy: coding, inter pixel, psychovisual, fidelity criteria, Models, Elements of information theory, Error free compression- variable length, bit plane, lossless predictive, Lossy compression- lossy predictive, transform coding. Fundamentals of JPEG, MPEG, Fractals.

Module V

Image segmentation: Detection of discontinuities - point, line and edge and combined detection ; Edge linking and boundary description - local and global processing using Hough transform – Thresholding - Region oriented segmentation - basic formulation, region growing by pixel aggregation, region splitting and merging - Use of motion in segmentation. Fundamentals of Representation and Description.

References:

1) Gonzalez and Woods, “Digital Image Processing”, 2 Ed, Pearson Education, 2002.
2) Anil K. Jain “Fundamentals of Digital Image Processing”, Pearson Education, 2003.
3) Mark Nelson, Jean-Loup Gailly “The Data compression Book” 2 Ed, bpb Publications.
4) Pratt William K.,”Digital Image Processing”, John Wiley & sons
5) Chanda & Majumdar, “Digital Image Processing and Analysis” , PHI.
6) M.Sonka,V. Hlavac, R. Boyle, “Image Processing, Analysis and Machine Vision”, Vikas Publishing House

EC/EI 804B ASIC DESIGN

Module I

Introduction to ASICs: - Types of ASICs - Design flow - CMOS logic: CMOS transistors CMOS Design rules - Combinational Logic Cell - Sequential logic cell - Data path logic cell – I/O cells - ASIC library design: Transistors as Resistors - Transistor Parasitic Capacitance-Logical effort.

Module II

Programmable ASICs: - Anti fuse - static RAM - EPROM and EEPROM technology – practical issues - Programmable ASIC logic cells : Actel ACT - Xilinx LCA - Altera FLEX - Altera MAX. Programmable ASIC I/O cells : DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

Module III

Programmable ASIC interconnect: Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX. Programmable ASIC design software : Design systems - Logic Synthesis - Half gate ASIC. Low level design entry : Schematic entry - Low level design language - PLA tools - EDIF- CFI design representation.

Module IV

Logic synthesis: Verilog and logic synthesis -VHDL and logic synthesis. Simulation: types of simulation. : Testing: boundary scan test – fault simulation - automatic test pattern generation.

Module VI

ASIC construction: System partition - FPGA partitioning - partitioning methods - Floor planning and placement: floor planning - placement - physical design flow. Routing : global routing - detailed routing - special routing - circuit extraction - DRC.

Text book:

1. M.J.S .Smith, - Application - Specific Integrated Circuits – Pearson Education -1997.

References:

1) Andrew Brown, - VLSI Circuits and Systems in Silicon -, McGraw Hill, 1991.
2) S.D. Brown, R.J. Francis, J. Rox, Z.G. Uranesic, "Field Programmable Gate Arrays"- Kluever Academic
3) Publishers, 1992.
4) Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.
5) S. Y. Kung, H. J. Whilo House, T. Kailath, " VLSI and Modern Signal Processing ", Prentice Hall, 1985.
6) Jose E. France, Yannis Tsividis, " Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

EB/EC/EI 804 C – MECHATRONICS

Module I

Introduction to mechatronics - mechatronics in manufacturing - mechatronics in products - scope of mechatronics - fundamentals of numerical control - advantages of NC systems - classification of NC systems - point to point and contouring systems - NC and CNC - incremental and absolute systems - open loop and closed loop systems - features of NC machine tools - fundamentals of machining - design consideration of NC machine tools - methods of improving machine accuracy and productivity - special tool holders

Module II

System devices - system drives - hydraulic systems - DC motors - stepping motors - AC motors - feedback devices - encoders - pulse digitizers - resolvers - inductosyn - tachometers - counting devices - flip flops - counters - decoders - digital to analog converters - interpolation - linear interpolator - circular interpolators – Complete interpolator -Control Loops for CNC-CNC software interpolator - flow of data in NC machines

Module III

Computer Integrated Manufacturing (CIM)

Introduction-Automated Storage and Retrieval Systems- Group Technology-Computer Aided Process Planning-Material Requirement Planning-Computer Aided Inspection - Machine Vision

NC part programming - manual programming - concepts - tape formats - tab sequential - fixed block word address and variable block formats - part programming examples - point to point programming and simple contour programming - computer aided programming - concepts - post processor programming languages - APT programming - part programming examples

Module IV

Industrial robotics - basic concepts - robot anatomy - robotics and automation - specification of robots - resolution - repeatability and accuracy of manipulator - classification of robots - industrial application –robot control systems - robot

drives - characteristics of end of arm tooling – end effectors - sensors - tactile, proximity and range sensors - contact and non-contact sensors - velocity sensors - touch and - slip sensors - force and torque sensors
Robot programming - lead through programming - textual programming - programming languages –generations robot programming languages - robot language structure- on line and offline programming - intelligent robots

Module V * (This Module is only for internal evaluation)
Computer Aided Design (CAD)
Design Process-Application of Computers for Design- Benefits of CAD AutoCAD –file menu –edit menu –draw menu – modify menu-format menu - tools menu - AutoCAD Dimensioning- 3D representations in CAD- View menu - 3D drawing Entities - Rendering in Auto CAD - solid and surface modelling, comparisons with 2D methods, spline curve and surface representations, parametric methods and data exchange

Reference books

1. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill
2. HMT, Mechatronics, TMH.
3. Michel P. Groover, Industrial Robots-Technology, Programming and Applications, McGraw Hill
4. M.P. Groover, and Emory W, Zimmers, CAD/CAM:Computer Aided Design and Manufacturing, Prentice – Hall Englewood Cliffs
5. C.Ray Asfahl ,Robotics and Manufacturing Automation, John Willey & Sons, Inc.
6. Fu K.S., Gonzales et al, Robotics -Control, Sensing, Vision and Intelligence, McGraw Hill.
7. Yoram Koren & Ben Yuri, Numerical Control of Machine Tools, Khanna Publishers.

*For University Examination, Questions from First four modules only and Fifth module is for internal evaluation.

EI 804 D - SPACE INSTRUMENTATION

Module I

Introduction to Telemetry systems – Aerospace Transducers, Signal conditioning, Multiplexing methods, Analog and digital telemetry-Command link and remote control system-Application of telemetry in flight systems.

Module II

Aircraft Compass – Magnetic compass – Errors and their minimization – Remote indicating type magnetic compass – Rate of climb indicator – principle, construction and application – pitot static systems – construction – position of pitot probes and static vents – airspeed indicator – Mach meter – Integrated flight instruments.

Module III

Gyros – Rate gyro, rate integrating gyro, free gyro, vertical gyro, directional gyro, Analysis and applications. Inertial guidance platforms – Inertial accelerometers, microsyns, singl-axis servo loops etc.

Module IV

Flight control systems – Block diagram – Methods of control, applications of digital and adaptive control systems, Autopilot.

Module V

Space communications – sensor subsystems, signal conditioning subsystems, UHF, SHF Transmitters, antennas, receivers, repeaters, transponders.

References:

1. Electronic Testing – Parkas
2. Aerospace Telemetry – Hari L Stiltz.

3. Aircraft Instruments – Williams
4. Space Communication Techniques – Richard F F
5. Aircraft Instruments Principles and applications – FHJ Palledt Pitman

EC 801/EI 804E Audio and Video Engineering

Module I

Audio Engineering: Audio frequency range – loudness –-pitch - decibel - sound pick up devices microphones –types condenser –carbon –piezo electric - direction pattern – parameters of microphone: - frequency range- sensitivity - impedance-noise. Sound reproduction devices: loud speaker- typical specifications Production of speech signal: - Simple view of speech production – spectrogram Acoustics of speech production. Uniform tube model- discrete time model –vocal fold / Vocal tract interaction Characteristics of hearing —acuity threshold and masking of detection

Module II

Speech coding and Compression:- companding- adaptive quantization - diferential and residual quantization –Vector quantization. Frequecy domain coding : Subband coding . Model based coding : linear predictive coding –VQ LPC coder. MPEG : Block diagram of audio encoder decoder. Recording of sound: recording media - magnetic – optical storage systems Coding and decoding applied to CD

Module III

Video Engineering : Elements of Television system:- Basic block schematic of television transmitter and receiver, camera , picture tube, Scanning, human factor consideration, flicker, interlaced scanning, number of scanning lines, Horizontal and vertical resolution, maximum video frequency, resolution and bandwidth, Composite video signal - vertical and horizontal synchronization Television camera: - Working principle of CCD- its working - Color television camera: block schematic explanation Modulation -Positive and negative modulation and its comparison, high level and low level modulation and its comparison. vestigial side band transmission. Transmission of sound signal.

Module IV

Colour Television: Compatibility consideration, Color response of human eye, Three color theory, additive mixing of colors, chromaticity diagram, Luminance and chrominance, color difference signal and its generation, Frequency interleaving and Colour burst signal Colour TV picture tubes : CRT, LCD and plasma displays.Monochrome and colour reception: Detailed block schematic - Block schematic explanation Basic colour television systems: PAL and NTSC -Block schematic explanation

Module V

Video coding and video compression: Demand for video compression- video image representation- quantization of image data intraframe compression techniques; DPCM - DCT based transform coding -

Motion compensation –H. 261 video conference coding standard - MEPEG video compression. Digital audio bradcasting- Block schematic explanation-Audio compression and source encoding – HDTV: pixel transmission rate – video compression for HDTV

I. References

1. Multi Media Communication Fred Halsal Pearson Education
2. Basic Television Engineering: Bernad Grob, Mc Graw Hill.
3. Monochrome and colour television: R R Gulati, Wiley Eastern
4. Discrete time Speech Signal Processing :Thomas Quatieri Pearson Education
5. Digital Communication B salkar :Pearson Education
6.The Electronics Hand Book :J C Whitaker IEEE press

EI 805 PROJECT

The project work commencing from the VII th semester shall be completed and project report shall be submitted by each student by the end of the VIII th semester. There will be an internal examination of the project that includes demonstration and oral examination of the project work. The evaluation panel shall consisting of at least three faculty members including the project guide as appointed by Head of the department

EI 806 VIVA_VOCE

Each student is required to appear for a viva-voce examination, and he/she has to bring his/her seminar report and project report. The evaluation panel should contain at least one External and Two internal examiners appointed by the university. There can be more than one panel in case the number of students is large