

3AEI 1 MATHEMATICS-III

- 1 **DIFFERENTIAL EQUATIONS**: Ordinary differential equation of second order with variable co-efficients, Homogeneous form, Exact form solution when a part of C.F. is known, change of dependent variable, change of independent variable. Variation of parameters. Solution in series (without particular's integral). Partial differential equations of first order - Lagrange's method & standard forms, Charpit's method.
- 2 **NUMERICAL ANALYSIS**: Finite differences - Forward, Backward and Central differences. Newton's forward and backward differences, Interpolation formulae, Stirling's formula, Langrange's Interpolation formula, Differentiation Numerical Integration-Trapezoidal rule, Simpson's one third and three-eight rules, Numerical solution of ordinary differential equations of first order-Picard's method, Euler's and modified Euler's methods, Millne's method and Runga-Kutta fourth order method.
- 3 **STATISTICS AND PROBABILITY**: Elementary theory of probability, Baye's theorem with simple, applications, Expected value, theoretical probability distributions-Binomial, Poilsson and Normal distributions.
- 4 **FOURIER SERIES**: Expansion of simple function in Fourier series. Half Range series, Change of Intervals, Harmonic Analysis.

Reference Books:

1. Chandrika Prasad:
 - a. Mathematics for engineer: Prasad Mudralay
 - b. Advances Mathematics for engineers; Prasad Mudralay
2. B.S. Grewal – Higher engineering Mathematics; Khanna publications
3. M.Ray, J.C. Chaturvedi & H.C. Saxena - A text book of differential equation: Students friends & company
4. J.N. Kapoor & H.C. Saxena – Mathematics; S.Chand & Company
5. Gokhroo et al: Higher Engg. Maths – III , Unique Book Ajmer
6. Gaur & Kaul – Engineering Mathematics Vol I & IIL JPH
7. Johnson – Probability and Statistics for Engineers Pearson Education

3AEI 2 ELECTRONIC DEVICES & CIRCUITS

- 1 **SEMICONDUCTOR PHYSICS**: Mobility and conductivity, charge densities in a semiconductor, Fermi Dirac distribution, carrier

concentrations and fermi levels in semiconductor, Generation and recombination of charges, diffusion and continuity equation, Mass action Law, Hall affect.

- 2 DIODE CIRCUITS: Diode as a ckt element, load line concept, clipping and clamping circuits, Voltage multipliers.
- 3 DEVICES : Construction, characteristics and working principles of the following devices: Junction diodes, BJT, JFET, MOSFET, UJT, photo diodes, LEDs, Photo transistors. Solar cells. Thermistors, LDR.
- 4 TRANSISTORS : Transistor characteristics, Current components, Current gains; alpha and beta. Operating point, Hybrid model, h-parameter equivalent circuits, CE, CB and CC configuration, DC and AC analysis of CE, CC and CB amplifiers. Ebers-Moll model. Biasing & stabilization techniques. Thermal runaway, Thermal stability. Equivalent Circuits and biasing of JFET's & MOSFET's. Low frequency CS and CD JFET amplifiers. FET as a voltage variable resistor.
- 5 SMALL SIGNAL AMPLIFIERS AT LOW FREQUENCY: Analysis of BJT and FET, DC and RC coupled amplifiers. Frequency response, midband gain, gains at low and high frequency. Analysis of DC and differential amplifiers, Miller's Theorem. Cascading Transistor amplifiers, Darlington & cascade ckts. Emitter & Source followers.

Reference Books:

1. J. Millman & C.C. Halkias – Integrated Electronics; Tata Mc-Graw Hill, Pearson Education
2. Robert Boylestad & L. Nashelsky – Electronic Devices & Circuit theory
3. Sedra Smith – Micro Electronic Circuits; Oxford Press India
5. Floyed – Electronic Devices; Pearson Education
6. Shur – Physics of Semiconductor Devices, Prentice Hall of India

3AEI 3- NETWORK THEORY

1. NETWORK THEOREMS: Thevenin's Norton's, Reciprocity, Superposition, Compensation, Miller's, Tellegen's and maximum power transfer theorems. Networks with dependent sources.
2. TRANSIENTS ANALYSIS: Impulse, step, ramp and sinusoidal response Analysis of first order and second order circuits. Time domain & transform domain (frequency, Laplace) analysis. Initial

and final value theorems.

3. LINEAR NETWORK RESPONSE TO NON-SINUSOIDAL INPUTS: Complex periodic waves and their analysis by Fourier analysis. Different kind of symmetry, Power in a circuit.
4. COUPLING ELEMENTS & COUPLED CIRCUITS: Conductively coupled circuits, Inductively coupled circuits-mutual inductance, coefficient of coupling and mutual inductance between portions of same circuits and between parallel branches. Transformer equivalent, inductively and conductivity coupled circuits.
5. NETWORK FUNCTIONS: Terminals and terminal pairs, driving point impedance transfer functions, poles and zeros. Procedure of finding network functions for general two terminal pair networks. Stability & causality.
6. TWO PORT NETWORKS: Two port parameters and their interrelations, z-parameters, y-parameters, h-parameters, ABCD parameters. Equivalence of two ports, transformer equivalent, interconnection of two port networks. Image parameters. Attenuation & phase shift in symmetrical T and π networks.
7. NETWORK SYNTHESIS: Hurwitz polynomial, positive real function, RL & RC networks synthesis, Foster First & Second form, Cauer forms.

Reference Books:

1. Kuo, Franklin F. – Network Analysis and Synthesis, II Ed, 1999, John Wiley & Sons
2. Desoer, C. And Kuh, E.S. – Basis circuit theory, Mc-Graw Hill
3. Van Valkenburg, M.E. – Network Analysis; Prentice Hall, India
4. Schaum's Outline series on circuit analysis.
5. Hayt, W. And Kimmerly – Engineering circuit analysis; Mc-Graw Hill Inc.
6. Sushakar, A and Shyam Mohan, S.P. – Circuits & Networks; Tata Mc-Graw Hill India.

3AEI 4 - DIGITAL ELECTRONICS

1. NUMBER SYSTEMS & CODES: Radix and Radix conversion, sign & magnitude representation, complement notation, arithmetic shift weighted codes, BCD codes, excess-3 codes, gray codes, standard ASCII & EBCDIC codes.
Fixed point arithmetic: BCD addition, subtraction, multiplication &

division in sign & magnitude notation & complement notation.
BCD arithmetic: BCD addition, subtraction, multiplication & division. Introduction to floating point arithmetic.

2. BOOLEAN ALGEBRA AND DIGITAL LOGIC GATES: Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates; Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from boolean expressions and vice-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion.
3. MINIMIZATION TECHNIQUES: Minterm, Maxterm, Karnaugh Map, K. map upto 4 variables. Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions. Variable mapping. Quinn-Mc Klusky minimization techniques.
4. COMBINATIONAL SYSTEMS: Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders, BCD adder. Binary multiplier. Decoder. Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, demultiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers.
5. SEQUENTIAL SYSTEMS: Latches, flip-flops, R-S,D, J-K, Master Slave flip flops. Conversions of flip-flops, Counters : Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications. Registers: buffer register, shift register.

Reference Books :

1. A.P. Malivno & D.P. Leach – Digital Principles & Applications; Tata Mc-Graw Hill, Delhi
2. Morris Mano – Digital Circuit & Logic Design; Prentice Hall, India.
3. Tocci – Digital Systems; Pearson Education
4. Green - Digital Electronics; Pearson Education
5. Mano - Digital Design; Pearson Education
6. Bartee – Digital Computer Fundamentals; Tata Mc-Graw Hill

3AEI 5 BASIC ELECTRICAL & ELECTRONIC MEASUREMENT

1. Introduction :

Difference in measurement at low and high frequencies Types of indicating instruments, balance detectors and other auxiliary apparatus used. Shielding and grounding considerations. Noise problem. Effects of physical size of components.

2. Ammeter & Voltmeter :
Permanent magnet moving coil type, moving iron type, Electro-dynamic type
3. Galvanometer :
Construction and performance, equation of motion of vibrations. Ballistic Galvanometer.
4. Potentiometer :
DC Potentiometer, AC Potentiometer, rectangular type and polar type.
5. Characteristics of Lumped passive components :
Measurement of resistance, capacitance, self and mutual inductance and incremental inductance at audio and radio frequencies, Price's guard wire and loss of charge methods for resistance measurements. Introduction to inductively coupled ratio arm bridge. Special consideration for radio frequency bridges. Twin-T and bridge-T networks. Resonance and heterodyne methods of parameters measurements. Q-measurements. Q-Meter.
6. Electronic Voltmeter :
Characteristics and specification of Analog electronic voltmeters of different kinds, Circuits of d.c. voltmeters using tubes, FET's, BJT's, and IC's. Analysis of circuit with various configurations to compare sensitivity, stability, linearity and impedance characteristic. Theory of operation and circuits for average, peak, peak to peak and RMS responding-A.C. Voltmeters, use of compensated multipliers, CMRR and NMRR, R.F. Voltmeter. Common type of Voltmeter probes. Electronic VOM.
7. CRO :
Cathode Ray Tube and its internal structure CRT connections. Circuits for low and high frequency working. Characteristics of CRT amplifier. Free running and triggered mode CRO, Synchronization Dual-Beam and dual trace CRO's. Different sweep modes. Mesh storage, and phosphor storage CRTs, CRO specifications. CRO probes.

Reference Books:

1. H.S. Kalsi – Electronic Inst. & Measurement; Tata Mc-Graw Hill
2. W.D. Cooper – Electronic Inst. & Measurement Techniques; Prentice Hall, India
3. A.K. Sawhney – Electrical & Electronic Measurement & Inst.; Dhanpat Rai & Sons
4. F.E. Terl J.M. Pettit - Electronic Measurement; Mc Graw Hill Book Co.
5. S. Talbar & Upadhyay – Electronic Instrumentation, Dhanpat Rai & Sons

3AEI 6.1 ELECTRICAL MACHINES

1. D.C. Motor:
Development of torque equation Characteristics of shunts series and compound motor, Starting and Speed Control of D.C. Motor (starting resistance method speed control-armature, field, series parallel control, ward-Leonard method of control).
2. Transformer:
Construction, principle of operation, voltage and current ratio, transformer constants, phasor diagram equivalent circuit test. Transformer connection (Y-Y, Y- Δ , Δ -Y, Δ - Δ).
3. A.C. Machines:
Single phase and poly-phase winding, pitch and distribution factor, emf equation, phasor diagram synchronous impedance, voltage regulation by Syn. Impedance Method.
4. Induction Motor :
Construction and principle of operation, wound rotor and squirrel cage types phasor diagram and equivalent circuit, torque-slip characteristic, Methods of starting and speed control of Induction Motor
5. Synchronous Motor:
Construction and principle of operation, phasor diagram, effect of variation of excitation, method of starting synchronous motor. Application to p.f. improvement.
6. Drives: Electrical braking of motors, selection of motors for different drive.

Recommended Books:

1. H. Cotton – Electrical Machines, Pitman Publications
2. M.G. Sag – Performance & Design of AC Machines
3. Clayton - Performance & Design of AC Machines
4. Draper – Electrical Machines
5. A Textbook of Electrical Technology – B.L. Theraja/A.K. Theraja Part-II

3AEI 6.2 MECHANICS OF SOLIDS

1. Concept of Stress:
Definition of stress, stress tensor-normal and shearing stresses in axially loaded members.
2. Concept of Strain :
Normal and shearing strains - stress-strain relationship-Generalised Hooke's Law-Poisson's ratio-relationship between E, G, K and ν -stress-strain diagram for uniaxial loading for ductile and brittle materials - working stress - factor of safety.
Concept of Mohr's circle, principal planes and principal stress/strain.
3. Analysis of Axially Loaded Members :
Composite bars in tension and compression - temperature stresses in composite rods - statically indeterminate problems, Euler's formula, Rankine formula..
4. Thin Cylinders and Spherical Shells :
Stresses in thin cylinders and thin spherical shells under internal pressure-wire winding of thin cylinders.
5. Torsion of Circular Shafts and Helical Springs:
Torsion formula-strength of solid and hollow circular shafts-design of circular members in torsion-power transmitted-close coiled helical springs.
6. Shearing Force and Bending Moment:
Members subjected to flexural loads relationships between load, shearing force and bending moment-shear force and bending moment diagrams of cantilever and simply supported beams-elastic curve.
7. Simple Bending of Beams :
Theory of simple bending of initially straight beams - bending stresses in beams, shearing stresses in beams - beams of two materials - carriage springs.
8. Slope and Deflection :- Macaulay's Method.
9. Measurement :-
Measurement of strain by strain gauge and strain rosettes - determination of principal strains from strain measurements.

Reference Books :

1. Engineering Mechanics of Solids – E.P. Popov, Prentice Hall of India Pvt. Ltd., New Delhi
2. Introduction to Solid Mechanics – L.H. Shames, Prentice Hall of India Pvt. Ltd., New Delhi
3. Elements of Strength of Materials – S.P. Timoshenko and D.H. Young, Affiliated East West Pvt. Ltd.

4. Strength of Materials – G.H. Ryder, ELBS

3AEI6.3 ELECTRONIC MATERIALS & PROCESSES

1. CONDUCTOR MATERIALS : Electrical properties of conductive and resistive materials. Important characteristics and electronic applications of specific conductor & resistance materials.
2. DIELECTRIC BEHAVIOUR OF MATERIALS :Polarisation phenomena, spontaneous polarisation, dielectric constant and loss, piezo and ferro electricity.
3. MAGNETIC BEHAVIOUR OF MATERIALS : Dia, para, ferro-ferrimagnetism, soft and hard magnetic materials and their applications.
4. SEMI CONDUCTORS : Crystal growth, zone refining, Degenerate and nondegenerate semiconductors, Direct and Indirect band gap semiconductors, Electronic properties of silicon, Germanium, Gallium, Arsenide, gallium phosphide & Sillicon carbide.
5. SUPER CONDUCTORS : Type I and Type II superconductors and their applications.
6. DISCRETE PASSIVE COMPONENTS FABRICATION : Brief study of fabrication methods of fixed and variable general purpose, precision, carbon, metal film and wire wound resistors; fixed and variable capacitors of different types for various electronics application; solenoidal and toridal air core, iron core and ferro core conductors. Design consideration and fabrication of input inter-stage and out-put transformers for electronic circuits.
7. PCBs: Printed Circuit Boards-Types, Manufacturing of copper clad laminates, PCB Manufacturing process, Manufacture of single and double sided boards. Surface mount devices - advantages & limitations.

Reference Books:

1. S.O. Kasap – Principles of Electrical Engineering Materials & Devices, Mc-Graw Hill
2. B.D. Indu - Electrical Engineering Materials; Jain Brothers
3. Robert M. Rose, Lawrence A. Shepard and John Wulff - Structures and Properties of Materials Vol IV, Electronic Properties, Wiley Eastern Ltd.

4. S.P. Seth and P.V. Gupta – A course of Electric Engineering Material; Dhanpat Rai & Sons
5. C.S. Indulkar & S. Thiruvengandam , An Introduction to Electrical Engineering Materials; S.Chand & Co.
6. N. Grover & K.S. Jamwal – Electronic Components & Materials; Dhanpat Rai & Company

3AEI 6.4 DATA STRUCTURES & ALGORITHMS

1. PERFORMANCE MEASUREMENT : Space complexity and Time complexity, big oh, omega and theta notations and their significance.
2. LINEAR LISTS : Array and linked representation, Singly & Doubly linked lists. Concept of circular and multiply linked lists.
3. ARRAY & MATRICES : Row and Column Major mapping & representation, irregular 2D array, Matrix operations, Special matrices; diagonal, tridiagonal, triangular, symmetric. Spares matrices representation and its transpose.
4. STACKS : ADT, representation in array & linked lists, basic operation, Applications of stacks in parenthesis matching, towers of Hanoi etc.
5. QUEUES:ADT, representation in array & linked lists, applications, circular queues.
6. TREES : Binary Tree, representation in array & linked lists, basic operation on binary trees, binary tree traversal (preorder, postorder, inorder). Single source shortest path algorithm, minimum cost spanning tree.
7. SEARCH TREES : Binary search tree, indexed binary search tree, basic operation, AVL tree, B-tree.
8. GRAPHS : Representation of unweighted graphs, BFS, DFS, Files.
9. SORTING : Bubble sort, insertion sort, merge sort, selection sort, shell sort, quick sort, heap sort.

Reference Books:

1. Harowitz & Sawhni – Data Structures in Pascal (BPB Publications)
2. Harowitz & Sawhni – Data Structures in C & C++ (BPB Publications)

3. Langran Augenstein & Tenenbaum - Data Structures using C & C++ (Prentice Hall, India)
4. Termbyl & Sovensen: Data Structures; Mc-Graw Hill International
5. Anon AV, JE Horproft, JD Vilman - Data Structures Algorithms (Addison Wesley) Pearson Education.
6. Kruse, Leng & Tondo: Data Structures & Program Design in C; Pearson Education

3AEI 7 ELECTRONICS CIRCUITS LAB

1. Study the following devices :
 - [a Analog & digital multimeters
]
 - [b Function/Signal generators
]
 - [c Regulated d.c. power supplies [constant voltage and constant current operations]
]
 - [d Study of analog CRO, measurement of time period, amplitude, frequency & phase angle using Lissajous figures.
]
2. Plot V-I characteristic of P-N junction diode & calculate cut-in-voltage, peak reverse voltage. Saturation current and static & dynamic resistances.
3. Plot V-I characteristic of zener diode and study zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator.
4. Plot frequency response curve for single stage amplifier and to determine gain bandwidth product.
5. Plot drain current - drain voltage and drain current - gate bias characteristics of field effect transistor and measure of I_{dss} & V_p
6. Application of Diode as clipper & clamper
7. Plot gain-frequency characteristic of two stage RC coupled amplifier & calculate its bandwidth and compare it with theoretical

value.

- . 8. Plot gain-frequency characteristic of emitter follower & find out its input and output resistances.
- . 9. Characterising a given passive network using Y & Z parameters.
- . 10 Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their h-parameters.
- . 11 Study half wave rectifier and effects of filters on wave. Also calculate ripple factor.
- .. 12 Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.

3AEI 8 DIGITAL ELECTRONICS LAB

To study and perform the following experiments.

- 1. (a) Operation of digital multiplexer and demultiplexer.
(b) Binary to decimal encoder.
(c) Characteristics of CMOS integrated circuits.
- 2,3. Compound logic functions and various combinational circuits based on AND/NAND and OR/NOR Logic blocks.
- 4. Digital to analog and analog to digital converters.
- 5,6. Various types of counters and shift registers.
- 7. Interfacing of CMOS to TTL and TTL to CMOS ICs
- 8. BCD to binary conversion on digital IC trainer.
- 9. Voltage comparator circuit using IC-710
- 10. Schmitt transistor binary circuit.
- 11,12. Voltage waveforms at different points of transistor

(a) Astable (b) Monostable (c) Bistable
Multivibrators and the frequency variation with different parameters.

3AEI 9 Electrical & Electronics Measurement Lab

1. Calibrate an ammeter using D.C. potentiometer.
2. Measurement of impedance by an A.C. potentiometer.
3. Measurement of logarithm decrement of a ballistic galvanometer.
4. Measurement of high resistance by loss of charge method.
5. Measurement of self capacitance of a coil by resonance method.
6. [a] Measurement of inductance by Anderson's bridge.
[b] Measurement of inductance by Deauty's bridge.
7. Study and application of Q meter.
- 8-11 Assembly and testing of electronic voltmeter circuit based on :-
 - a. Average rectifier principle.
 - b. Peak reading principle.
 - c. Peak to peak reading principle.
 - d. R.M.S. reading principle.
- 12 Study of a triggered, dual trace with and without storage facility CRO.

3AEI 10 COMPUTER PROGRAMMING LAB

COMPUTER PROGRAMMING IN C

1. Write a program to find the greatest between four numbers.
2. Write a program to prepare mark sheet of students using structures.
3. Write a C program to read several different names and addresses, rearrange the names in alphabetical order and print name in alphabetical order using structures.
4. Write a program to implement concatenation of two strings using pointers.
5. Write a program to create a singly link list of ten students names and implement add node, delete node and is empty list operations.
6. Write a program to search a pattern in a given string.
7. Write a program to print the following output using FOR loop.

22	2	2			
333	3	3	3		
4444	4	4	4	4	
55555	5	5	5	5	5

8. Write a Program to read add, subtract and multiply integer matrices.
9. Factorial computation and sine function computation.
10. Reversing the digits of an integer.
11. Character to number conversion.
12. Smallest divisor of an integer.

4AEI 1 MATHEMATICS IV

1. TRANSFORM CALCULUS :
Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficients with special reference to the wave and diffusion equations. Fourier transform : Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inverse. Applications of Fourier Transform to solution of partial differential equations having constant co-efficient with special references to heat equation and wave equation.
2. COMPLEX VARIABLES:
Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple application, Line integral in complex domain, Cauchy's theorem. Cauchy's integral formula, Taylor's series Laurent's series, poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.
3. CALCULUS OF VARIATIONS:
Functional, strong and weak variations simple variation problems, the Euler's equation.

Reference Books :

1. Chandrika Prasad
 - a) Mathematics for Engineers, Prasad Mudralay
 - b) Advanced Mathematics for Engineers, Prasad Mudralay
2. B.S. Grewal – Higher Engineering Mathematics; Khanna Publications
3. Gokhroo and Jain – Advanced Engineering Maths - IV
4. Gaur & Kaul – Engineering Mathematics Vol I & II; JPH

4AEI 2 APPLIED ELECTRONICS

1. FEEDBACK AMPLIFIERS : Classification, Feedback concept, Transfer gain with feedback, General characteristics of negative feedback amplifiers. Analysis of voltage-series, voltage-shunt, current-series and current-shunt feedback amplifier. Stability criterion.
2. OSCILLATORS : Classification. Criterion for oscillation. Tuned collector, Hartley, Colpitts, RC-Phase shift, Wien bridge and crystal oscillators, Astable, monostable and bistable multivibrators. Schmitt trigger. Blocking oscillators.
3. HIGH FREQUENCY AMPLIFIERS : Hybrid Pi model, conductances and capacitances of hybrid-Pi model, high frequency analysis of CE amplifier, gain-bandwidth product. Emitter follower at high frequencies.
4. DIGITAL LOGIC GATE CHARACTERISTICS: TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET. Interfacing logic families to one another.
5. POWER AMPLIFIERS : Power amplifier circuits, Class A output stage, class B output stage and class AB output stages, class C amplifiers, pushpull amplifiers with and without transformers. Complementary symmetry & quasi complementarsy symmetry amplifiers

Reference Books :

1. J. Millman & C.C. Halkias – Integrated Electronics; Tata Mc-Graw Hill
2. Robert Boylestad & L.Nashelsky – Electronic Devices and Circuit Theory; Pearson Epubaction
3. Sedra Smith – Microelectronic Circuits, Oxford Press, India.

4AEI 3 MICROPROCESSORS & MICROCOMPUTERS

1. Introduction to Microprocessor :
Architecture of 8085 (Register, Stack, Interrupt), instruction set and programming. Addressing.
2. Introduction to 16 bit Microprocessors:
Architecture of 8086 CPU Architecture, Internal operations, Machine Language instructions, Addressing mode, Instruction Format, Instruction execution timing, comparison of 8088 with 8086.
3. Assembly Language Programming and Instructions:
Assembly instruction Format, Data Transfer, Arithmetic, Branch, Flag manipulation, Logical, Shift and Rotate, String Manipulation, Stack manipulation, Call and return instructions, REP Prefix, Segment override prefix and simple assembler directives such as label, Variable, DB, DW, DD, EQU, END, Assume, Pointer (byte, Word, Double Word, Near, Short and Far).
4. System Bus Structure:
Basic 8086/8088 configuration, Minimum Mode, Maximum Mode, System Bus timing, Interrupt Priority management with 825*9 single and multiple.
5. I/O Programming :
Fundamentals of I/O, Programmed I/O, Interrupt I/O, Block Transfer and DMA, I/O and memory configuration and design example.
6. I/O Interface :
Serial communication interface using 8251, parallel communication interface using 8255, Use of 8255 for A/D and D/A conversion with examples, Programmable timer and event counter using 8254, its application to ADC.
7. Memory Organisation -
RAM, ROM, Auxiliary, Associative, Cache and Virtual memory, Memory management.

Reference Books :

1. R. Gaonkar – Microprocessor Architecture, Programming & Applications, Wiley Eastern Ltd.
2. INTEL – Microcontrollers Handbook
3. Ayla – 8051 Microcontrollers, Penram Press
4. Mazidi – The 8051 Microcontrollers & Emedded System, Pearson Education
5. Peatman – Designing with PIC Microcontrollers, Pearson Education

4AEI 4 TRANSDUCERS & DISPLAYS

Role of transducers in Instrumentation – Transducer construction, classification and characteristics, Analogue and digital transducers, Principle of operation and characteristics of :

1. Transducers for measurement of displacement, strain, velocity, acceleration, torque etc. Potentiometric, LVDT, Strain gauge, capacitance gauge, piezoelectric transducers and accelerometers.
2. Transducers for measurement of pressure and force, Pirani gauge, ionization gauge, LVDT, strain gauge as pressure sensing device, force summing devices like Bourden's tube, bellows etc.
3. Transducers for temperature transduction, principle of operation of bimetallic thermometer, resistance thermometer, Radiation and optical pyrometers.
4. Transducers for measurement of flow and level. Turbomagnetic, Electromagnetic and other flowmeters. Various methods of level measurements, Ultrasonic level gauge.
5. Transducers for Measurement of humidity and moisture.
6. Various sensors employed in Instrumentation.
7. Electronic Display :
Principle of LED matrix and alpha numeric displays, gas discharged plasma panels, flat panel CRT, LCD, electro-luminiscent and electrophoretic displays.

References Books:

1. Norton – Handbook of Electronic Transducers
2. Murthy – Practical Electronic Instruments & Transducers
3. A.K. Sawney – A course in Electrical & Electronic Instrumentation
4. Sonde- Transducers and Displays

4AEI 5 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

1 Theory of Errors:

.

Accuracy and precision. Methods of reducing systematic errors in measurements. Statistical analysis of random errors. Normal error curve. Estimation of error in computed results.

2 Instrumentation Amplifiers:

.

Operation, performance and characteristics of single ended, differential, chopper stabilized amplifiers used in Instrumentation, Different types of choppers and their characteristics.

3 Electronic Analog Ammeters:

.

Performance-specifications of instruments for audio and radio frequency current measurements. Rectifier and thermocouple ammeters. Principle of Hall effect ammeters. Use of amplifier type d.c. Voltmeter as ammeter.

4 Power Measurements:

.

Power measurements at audio and radio frequencies. Absorption, calorimetric and transmission power meters. Electronic wattmeters.

5 Wave Measurements:

Various types of wave and spectrum analyzer for audio, radio and microwave frequencies. Field strength measurements of radio waves.

6 Special Measurements and Tests:

Sampling, vector and differential Voltmeter. Vector impedance meter, function generators, RF Signal generators and pulse generators. Introduction to frequency synthesizers.

7 Digital Instrumentation:

Principle of operation of probes, logic monitors, digital pulsar and logic analyser. Components of a digital universal counter. Digital period; frequency and time interval measurement. Errors in digital counter. High frequency measurement with digital counters. Different types of integrating and non-integrating digital voltmeters. Digital oscilloscopes.

Reference Books:

1. Cooper & Helfrick - Electronic Instrumentation & Measurements
2. Oliver & Cage - Electronic Instrumentation & Measurements
3. Coombs - Electronic Instrument Handbook
4. Terman & Pettit - Electronic Instruments

4AEI 6.1 OBJECT ORIENTED PROGRAMMING

1- OOP FUNDAMENTALS:

- [a] Structured vs object oriented approaches.
- [b] Data abstraction, information hiding and encapsulation
- [c] Objects and classes.
- [d] Polymorphism, single and multilevel inheritances.

2- JAVA PROGRAMMING :

- [a] Introduction to Java, bytecode and virtual machine.
- [b] Program Elements: Primitive data types, variables, assignment, arithmetic, shortcircuit, logical operators, arrays. Decision and control statements.
- [c] Objects and classes: Objects, constructors, returning and passing objects as parameter, Nested and inner classes.
- [d] Single and Multilevel Inheritance, Extended classes, Access Control, usage of super overloading and overriding methods. Abstract classes. Using final with inheritance.
- [e] Package and interfaces: Defining package, concept of CLASSPATH, access protection, importing package. Defining and implementing interfaces.
- [f] Exception Handling: Exception handling fundamentals, Exception types, Uncaught exceptions, try, catch and multiple catch statements. Usage of throw, and finally.
- [g] String Handling: String constructors, special string operations, character extraction, searching and comparing strings, string Buffer class.
- [h] Applet: Applet Fundamentals, using paint method and drawing polygons.

Recommended Books :

1. Folk: File Structures: An Object Oriented Approach to C++, Pearson Education.
2. Patric Naughton; Java 2, Tata Mc-Graw Hill.
3. C Gottfried: Programming in C, Schaum Series, Tata Mc-Graw Hil.
4. Balaguruswamy: Object Oriented Programming in C++, Tata Mc-Graw Hill.
5. Booch G : Object Oriented Analysis & Design, Benjamin-Commings.
6. Rumbaugh J. Et..al: Object Oriented Modelling & Design. Prentice Hall of India.

7. Deitel: Java; How to Programme, Pearson Education
8. Kelley: A Book on C, Pearson Education.

4AEI 6.2 THEORY OF ELECTRONIC DEVICES

1. Physical Theory: Review of schrodinger wave equation .Physical interpretation of wave function. Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Interatomic forces and types of bonding. Theory of band structure and electronic states in conductors, Semi-conductors, and Insulators. Fermilevel
2. Theory of semi-conductors: Conduction mechanism in semi-conductors. Concept of mobility and diffusion. Concentration of carriers and ionized impurities in non-degenerate semi-conductors. Evaluation of fermi level. Concept of effective electron mass and hole mass. Carrier transport mechanism in semi-conductors. Thermal equilibrium and non-equilibrium conditions. Carrier recombination, continuity equations and time dependant diffusion equation. Surface state and surface recombination .Carrier life time, photo conductivity. Introduction to optical absorption, photo luminescence
3. Solid state devices: Space charge region and junction capacitance. Minority carrier injunction, carrier storage and transient response. Impact ionization and avalanche break-down. Analytical theory of junction diodes. BJT, JFET, MOSFET, UJT, diffused transistors, avalanche transistors and multi-junction pnpn devices. Degenerate semi- conductors and theory of tunneling, Theory of tunnel diodes, Zener diodes, varactor diodes. photo diodes, LEDs, photo-transistors, photo FETs and LASCR. Introduction to laser. Elementary theory of composite junction. Ohmic junctions and hetro junctions.
4. Theory of Vacuum and Gas Devices : Analysis of different methods of electron emission. Motion of electron in electric magnetic and combined fields. Electrostatics and magnetic deflection in CRT, Method of electron-beam focusing. Ratings of vacuum and gas devices.

Reference Books:

1. S.M. Sze, Physics of Semiconductor Devices
2. Streetman & Benjamin – Solid state Electronic Devices
3. Jasbeer Singh - Semiconductor Devices

4AEI 6.3 POWER SYSTEM ENGINEERING

- 1- Introduction :
Different conventional and non-conventional sources of electrical energy. D.C. v/s A.C. power. Concepts of real and reactive power. Single phase and three phase transmission.
- 2- Generation:
Basic components of electricity generating stations based on thermal, nuclear and hydel sources. Merits and limitations of each.
- 3- Structure of Electric Energy Systems:
Basic consideration of electrical energy transmission, sub transmission and distribution. Concepts of short, medium and long transmission lines. Introductory study of conductors, power cables, insulators and supports.
- 4- Operational considerations :
Load characteristics of power system network. Concepts of voltage and reactive powers variation. Real power balance and load frequency control. Introductory idea about economic operation of power system. Meaning of steady state and transient stability of power system.
- 5- Power Systems Faults and Protection:
Various types of faults occurring on power system. Purpose of protective relays and circuit breakers. Introduction to surge protection.

Reference Books :-

- 1- Power System Engineering by Nagarath & Kotharis by TMH Publications.
- 2- Electric Energy Systems Theory by Elgerd by TMH Publications
- 3- Electrical Power Systems by Ashfaq Hussain by CBS Publishers & Distributors

4AEI 6.4 FILTER ANALYSIS & DESIGN

- 1 Active network elements, various control sources, ideal and non-ideal conditions, properties of GIC, NIC, gyrators, FDNR etc. using Op-Amp. Impedance, inverters, inversion factor, inductance simulation using linear active circuits.
- 2 Fundamentals of approximation theory Butter worth's, Chebyshev approximation and elliptic filters.
- 3 Realization of Butterworth's filters of first to fourth order using Op-Amps. Lowpass, Highpass, Bandpass and Bandreject type of filters. Active resonant bandpass filters, active RC bandpass filters.
- 4 Analysis of Active networks using IAM approach, reduction of multipole, parallel connections of multipoles, analysis of networks containing active elements and operational amplifiers.
5. LC ladder simulation, cascade realization, Sallen's and Key's filters and their realization, Kerwin's circuit.
6. Constant KLC filters and their analysis, M-derived filters, composite filters and attenuators.

Reference Books:

1. S.K. Mitra – Analysis & Synthesis of Linear Active Network
2. G.G. Temes – N.J.W. Lajoatra, Circuit Synthesis & Design

4AEI 7 APPLIED ELECTRONICS LAB

1. Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1kHz with and without negative feedback.
2. Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor.
3. Plot and study the characteristics of small signal amplifier using FET and observe the high frequency performance.
4. Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency.
5. Study transistor phase shift oscillator and observe the effect of variation in R&C on oscillator frequency and compare with theoretical value.
- 6, 7 Study the following oscillators and observe the effect of variation of C on oscillator frequency :(a) Hartley (b) Colpitts
- 8, 9, 10 To design and study voltage waveforms at different points of transistor.
(a) Astable (b) Monostable (c) Bistable
Multivibrators and frequency variation with different parameters.
- 11 Design and testing of pushpull class A/B power amplifier and calculate distortion.
- 12 Assembling complementary pushpull power amplifier and its testing.

4AEI 8 MICROPROCESSORS LAB

- 1- Study the hardware, functions, memory structure and operation of 8085 microprocessor kit.
- 2- Program to perform integer division:(i) 8-bit by 8-bit (ii) 16-bit by 8 bit.
- 3- Transfer of a block data in memory to another place in memory in the forward and reverse order.
- 4- Searching a number in an array and finding its parity.
- 5- Sorting of array in:(i) Ascending (ii) Descending order.
- 6- Programme to perform following conversion (i) BCD to ASCII (ii) BCD to Hexadecimal.
- 7- Programme to multiply two 8-bit numbers.
- 8- Programme to generate and sum15 fibonacci number.
- 9- Programme for rolling display of message "INDIAN".
- 10- To insert a number of correct place in a sorted array.
- 11- Serial and Parallel data transfer on output port 8155 & 8255 & designing of disco light, running light and sequential lights on off by above hardware.
- 12- Generation of different waveform on 8253/8254 programmable timer.

4AEI 9 TRANSDUCER & MEASUREMENT LAB

- 1- Study the performance of piezo electric transducer for measuring acceleration.
2. Plot the characteristic of potentiometric transducer.
3. Demonstrate and study the characteristic of anemo meter for windflow measurement.
4. To study the operation of membrane type of hygrometer.
5. Study the performance for measuring distance using ultrasonic transmitter and receiver.
6. Study the performance for measuring displacement using LVDT.
7. Draw the characteristics for the following temperature transducers :
(a) RTD(Pt-100) (b) Thermistors (c) Thermocouple
- 8 Draw the characteristics between temperature & voltage of a K type thermocouple.
9. Measure the speed of table fan by using stroboscope.
10. Measurement of strain/force with the help of strain gauge load cell.
11. Study the various pressure and force sensors.
12. Study the various transducers for nuclear radiation measurement.

4AEI 10 ELECTRONICS WORKSHOP

1. Identification, Study & Testing of various electronic components;

<ol style="list-style-type: none"> (a) Resistances-Variou types, Color coding (c) Inductors (e) Transistors (g) ICs (i) Photo transistor (k) LDR 	<ol style="list-style-type: none"> (b) Capacitors-Variou types, Coding (d) Diodes (f) SCRs (h) Photo diode (j) LED (l) Potentiometers
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2. Study of symbols for various Electrical & Electronic Components, Devices, Circuit functions etc.

3. To study and perform experiment on CRO demonstration kit.

4. Soldering & desoldering practice.

- 5,6.
 - (a) To Design & fabricate a PCB for a Regulated power supply.
 - (b) Assemble the Regulated power supply using PCB and test it.

- 7,8. To study and plot the characteristics of following Opto-Electronic devices-

<ol style="list-style-type: none"> (a) LED (c) Photovoltatic cell (e) Photo diode 	<ol style="list-style-type: none"> (b) LDR (d) Opto-coupler (f) Photo transistor
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9. To study the specifications and working of a Transistor radio kit and perform measurements on it.

10. To study the specifications and working of a Tape Recorder kit.

- 11,1
2. Coil winding and testing.

5AEI1 Theory and Application of Integrated Circuits

1. Introduction :

Distinction between characteristics of linear and digital IC's, Biasing consideration in linear IC's. Parasites and their effects in IC's. General performance, differences between discrete circuits and IC versions. Power requirements and power supplies for linear IC's.

2. Operational Amplifiers:

Differential amplifier stage. Characteristics and error signals. Multistage operational amplifiers. Characteristic of operational amplifiers-in different configurations. Frequency response and stability considerations of operational amplifier, Compensation in operational amplifiers. Characteristics of wide band operational amplifiers.

3. Applications of Operational Amplifiers:

General applications of Op. Amps. in linear and non-linear circuits. Theory and characteristics of Active filters. Applications of Op. Amps. in wave form generators.

4. Other Linear IC's:

Four quadrant multiplier and its simple applications. CMOS multiplexers. Voltage Regulator ICs with feed back current limiting. Positive and Negative voltage IC regulators.

5. Linear PLL:

Basic theory of first, second and higher order loops. Lock-in and Lock-out processors, Tracking performance. Noise in linear PLL systems. Important applications of linear PLL. Measuring PLL parameters.

6. Digital PLL:

Digital PLL with intermediate analog signals, All digit and software based PLL. Simple applications.

Reference Books :

- 1. Linear Integrated Circuits – Gayakwad.**

2. **Operational Amplifiers & linear Integrated Circuits – Coughlin & Driscall.**

5 AEI 2 HIGH FREQUENCY ELECTRONICS

1. Electromagnetics :

Elements of vector calculus: Gradient, divergence and Curl; Gauss and Stokes theorems, Maxwell's equations, Differential and Integral forms. Wave equations, Poynting vector.

2. Transmission Lines :

General transmission line equations. SWR. Transmission lines at audio and radio frequencies. Transmission equalizers. Characteristics of quarter wave, half wave and other lengths. Smith chart and its applications. Transmission line applications. Stubmatching.

3. High Frequency Devices :

High frequency transistors and their equivalent circuit analysis. Microwave semiconductor devices. Klystron, Magnetron and TWT. Microwave Instrumentation in Air-Traffic Control.

4. Coupling Circuits and Impedance Matching Networks:

Resistive, capacitive, inductive, mutual inductive and combination type of R.F. couplings single and double tuned couplings. Effect of loose, tight and optimum couplings, load conditions and Q. Various impedance matching networks for low and high impedance loads. Balanced-to-unbalanced network.

5. R.F. Voltage Amplifiers:

Theory, operation, performance and design of R.C. coupled and transformer coupled single and double tuned amplifiers using JFETs, MOSFETs & BJTs. Time and frequency domain analysis. Synchronously tuned multistage amplifiers. Stagger tuned, stagger damped circuits. Neutralization circuits. Cascode amplifiers. Integrated circuit frequency selective R.F. and IF amplifiers.

6. R.F. Power Amplifiers:

Special features of R.F. Power devices. Theory and design of tuned class C amplifiers using VTs, BJTs, JFETs and MOSFETs. Graphical and approximate analytic methods of solution: Output circuit efficiency considerations. Biasing circuits. Characteristics of driver and output circuit power supplies, Effect of input circuit distortion. Neutralization Parasitic oscillations. Class-C amplifiers, adjustments. Theory of frequency multipliers.

Reference Books :

1. Electromagnetic Engineering – Hayt.
2. Electronics – Alley & Atwood.
3. Analysis & Design of Electronic Circuits – Chilian.
4. Electronics Communication – Raddy & Cooten.

5 AEI 3 Theory of Communication System

1. Random Variables and Processes:
Probability, Mutually exclusive events, Joint probability, Statistical independence, Random variables, probability density function, Average and variance. The Gaussain probability density. The error function, Mean and Variance of sum of random variables. Probability density of $Z=X+Y$. The central limit theorem, correlation between random variables, auto correlation, power spectral density.
2. Amplitude Modulation Systems:
Frequency translation, Recovery of base band signal, Amplitude Modulation, Maximum Allowable Modulation. The Square Law demodulator, Spectrum of AM signal, Balanced Modulator, SSB modulation and generation, VSB, FDM.
3. Frequency Modulation System:
Phase and frequency modulation and their relationship, Frequency deviation, spectrum of FM Signal, BW of FM Signal, Effect of modulation on BW, constant BW, FM phaser diagram, Narrow band F.M., Armstrong and Parameter variation methods of FM generation and FM demodulators.
4. Digital Communication:
Sampling theorem, Quantization or Signals, Quantization error, pulse code modulation (PCM) and the system, Commanding, Time division multiplexing (TDM), DPCL, DM, ADM, PSK, FSK and DPSK.
5. Noise in Communication System:
Source of noise. Frequency domain representation of noise, Superposition of noise, Linear filtering, Noise bandwidth, Resistor noise, Available power, Noise temperature, Two ports Noise bandwidth, Input Noise temperature, Noise figure, Equivalent-Noise temperature of a Cascade, An example of receiving system.
6. Elements of Information Theory:
Concept of self and mutual information, Entropy, Shannon Hartly Law.

Reference Books:

1. Principles of Communication System by H. Taub and D.L. Shilling.
2. An Introduction to the Principle of Communication Theory by J.C. Hancock, Mc-Graw Hill.
3. Signal Processing, Modulation and Noise - by Betts, English University Press, London.
4. Communication System – by A.B. Carlson, Mc-Graw Hill.

5 AEI 4 Control System Engineering

1. Introduction :

The Control system, The basic elements of a servomechanism, Types of servomechanism, Development of Automatic Control.

2. Mathematical Model :

Mathematical representation of Physical system, Electrical-Mechanical systems, liquid level system, Transfer function and impulse of linear systems, Block Diagram, Signal flow graphs, Application of the signal flow graphs for gain formula to block diagrams.

3. Control System Components :

Potentiometer, Synchros, L.V.D.T., Modulators & Demodulators, A.C. Servomotors, D.C. & A.C. Tachogenerator, Mathematical modeling of D.C. Motors, Example of closed loop Systems using D.C. & A.C. servomotors, Synchros, Tachogenerators, etc.

4. Hydraulic systems & Pneumatic Systems:

Pump controlled & Valve controlled Hydraulic motor & Actuators, Hydraulic Valve, Hydraulic Controllers & Pneumatic Controllers.

5. Time Response of Feedback Control Systems :

Typical test signal for the transient analysis, time domain performance characteristics of feedback control systems, transient response, transient response of 2nd order systems, transient response of a positional servomechanism, Effects of derivative and integral controls on the transient performance, P.I., P.D. Controllers, Tacho Meter feedback, Steady state response, steady state error, The generalized error analysis, Stability of linear control system, The Routh-Hurwitz criterion.

6. The Frequency Response Method :

Bode's Plot, Magnitude versus phase shift plot, Frequency response of feedback control system, Frequency domain specifications, MP and WP for a second order system.

7. The Nyquist Criterion and Stability :

Introduction, The Principle of argument, the Nyquist Path, Nyquist criterion and the GH Plot, The application of the Nyquist criterion, The effects of additional poles and zeros of $G(s)H(s)$, on the shape of the Nyquist locus, Relative stability, gain margin, conditionally stable systems.

8. The Root Locus Technique:

Introduction, Root Loci, construction of the Root Loci, some other properties of the root locus, Root Locus of conditionally stable systems.

contd....

5 AEI 4 Control System Engineering

- 2 -

9. State Variable Analysis:

Introduction, concept of state, state variable and state model, state equations of continuous data control system, Derivation of state model from transfer functions and Vice-versa. Diagonalisation, solution of state equation.

Reference Books:

1. K. Ogata, Modern Control Engineering, Prentice Hall of India.
2. B.C. Kuo, Automatic Control System, PHI
3. J. Diazzo and C.F. Houpis, Feedback Control System Analysis and Syntesis.

5 AEI 5 Automation in Instrumentation

1. **Automatic Test system Configuration :**
 GPIB Bus Talker/ listener/ controller. IEEE compatible programmable instruments. Specifications and operation –
 - a. P.C. Based Instrument controller.
 - b. Programmable oscilloscope.
 - c. Programmable function generator.

2. **Automatic Testing of Electronic Components:**
 - a. Operational Amplifier.
 - b. Digital Integrated Circuits.
 - c. Sample and hold circuit/ switches/ multiplexers.
 - d. Instrumentation amplifier.

3. **Automatic performance Evaluation of Electronic System & Instrumentation:**
 - a. Data Loggers, programmable data logger configurations.
 - b. Operation of data loggers, applications of data logging system.

4. **Automatic ON Line condition Monitoring :**
 - a. Condition Monitoring, failure of plants/ components.
 - b. Logical fault finding, maintenance logging, vibration monitoring, noise level monitoring, thermal sensing, infrared monitoring, ultrasonic condition monitoring.

5. **Microcomputer based Numerical Control Systems :**
 - a. Types of numerical control machines.
 - b. Part programming.
 - c. Computer numerical control machine tools.

6. **Quality Control & Automated Inspection :**
 Sensor technologies for automated inspection, machine vision.

Reference Books :

1. A.K. Kochar & N.D. Burns, Microprocessors and their manufacturing Applications.
2. Mikell P. Groover, Automation, Production Systems and Computer Integrated Manufacturing.

5 AEI 6.1 Analytical Instrumentation

1. Introductions:

Selection of instruments for application in industries – on line instrumentation and laboratory techniques – a brief review, introduction to the subject, difference between analytical and other instruments.

2. Sampling Techniques:

Sampling Systems for liquids and gases for analysis purposes, components, automatic sampling, maintenance.

3. Gas Analysis:

Gas analysis by chemical absorption, Orsat apparatus, carbon dioxide & monoxide and hydrogen measurements, Mathanometer, Gravimetric method of gas analysis.

4. Humidity and Moisture Measurements :

Measurement of humidity, definition of wet and dry basis moisture content, laboratory methods and online measurement techniques, electrical methods, radiscope technique, IR Techniques, moisture in gases.

5. Spectrochemical Analysis :

Classification of techniques, Mass spectrometry, Principle, Components, Applications to analysis of solids, Liquids and gases, Emission spectrometry components, Spectrograph, Applications, Absorption Spectrometry, Electromagnetic radiation spectrum, Schemes for UV, IR and near IR analyzers, Comparison of the methods, Examples of Absorption patterns.

Reference Books :

1. Patranabis, D., Principles of Industrial Instrumentation, TMS Publication, New Delhi, 1976.
2. Jones, E.B., Instrument Technology Vol.II, Analysis Instruments, Butterworths Scientific Publication, London, 1956.
3. O Riggins, P.T., Basic Instrumentation in Industrial Measurement, Mc-Graw Hill Book Co., 1966.
4. Holman, J.P., Experimental Methods of Engineers, Mc-Graw Hill Book Co., Int. Student edition, 1966.

5 AEI 6.2 Computer System Architecture

1. Register Transfer Language:
Data movement around registers, data movement from/to memory, arithmetic and logic micro operations, Concept of bus and timings in register transfer.
2. CPU Organization :
Addressing Modes, Instruction format. CPU organization with large registers. Stacks and handling of interrupts & subroutines Instruction pipelining.
3. Arithmetic Algorithm :
Array multiplier, Booth's Algorithms, Addition Subtraction for signed unsigned numbers and 2's complement numbers.
4. Micro-programmed Control Unit :
Basic organization of micro-programmed controller, Horizontal & Vertical formats, Address sequencer.
5. Memory Organization :
Concept of RAM/ROM, basic call of RAM, Associative memory, Cache memory organization, Vertical memory organization.
6. I/O Organization :
Introduction to Peripherals & their interfacing. Strobe based and handshake-based communication, DMA based data transfer, I/O processor.

Reference Books:

1. J.P. Hayes – "Computer Architecture & Organization", MC-Graw Hill.
2. Heuring – Computer System Design and Architecture, Pearson Education.
3. M.Morrismanno – " Computer System Architecture", Prentice Hall of India.
4. Bartee – Computer Architecture, Tata Mc-Graw Hill.
5. Stallings – Computer Organization and Architecture, Pearson Education.

5 AEI 6.3 IC Technology

1. Introduction to Technologies :
Semiconductor Substrate-Crystal defects, Electronic Grade Silicon, Czochralski Growth, Flot Zone Growth, Characterization & evaluation of Crystals; Wafer Preparation – Silicon Shaping, Etching and Polishing, Chemical Cleaning.
2. Diffusion & Ion Implantation :
Ficks diffusion equation in One Dimension, Atomic Model, Analytic Solution of Ficks Law, correction to simple theory, Diffusion in SiO₂ Ion Implantation and Ion Implantation System oxidation. Growth mechanism and Deal-Grove model of Oxidation, Linear and parabolic Rate Co-efficient, the structure of SiO₂, Oxidation techniques and system, Oxide properties.
3. Chemical Vapour Deposition and Layer Growth :
CVD for deposition of dielectric and polysilicon – a simple CVD system, Chemical equilibrium, and the law of mass action, Introduction to atmospheric CVD of dielectric, low pressure CVD of dielectric and semiconductor. Epitaxy-Vapour Phase Epitaxy, Defects in Epitaxial growth, Metal Organic Chemical Vapour and a Deposition, Molecular beam epitaxy.
4. Pattern Transfer :
Introduction to Photo/Optical lithography, Contact/Proximity Printers, Projection Printers, Mask generation, Photoresists. Wet etching, Plasma etching, Reaction ion etching.
5. VLSI Process Integration :
Junction and Oxide isolation, LOCOS methods, Trench Isolation, SOI; Metallization, Planarization. Fundamental consideration for IC Processing, NMOS IC Technology, CMOS IC Technology, Bipolar IC Technology.

Reference Books:

1. S.M. Sze – VLSI Technology, Tata Mc-Graw Hill.
2. D. Nagchoudhary –Principles of Microelectronics Technology, Wheeler Publishing.
3. Stephen A Campbell – The Science and Engineering of Microelectronic Fabrication, Oxford Unviersity Press.
4. Hong Xiao – Introduction to Semiconductor Manufacturing, Prentice Hall India.

5 AEI 6.4 Information Theory & Coding

1. Elements of Information Theory :
Measure of Information. Average Information. Entropy, Information Rate. Communication Channel. Discrete and Continuous channel, Shannon – Hartley Theorem and its Implications, Channel capacity, Gaussian channel, Bandwidth – S/N tradeoff.
2. Introduction of Coding :
Type of Errors. Types of codes, Error control coding. Methods of Controlling errors.
3. Linear Block and Binary Cyclic Codes :
Matrix decryption of linear block codes, Error detection and error correction capabilities of linear block codes. Hamming codes. Structure of cyclic codes, encoding using an $(n-k)$ bit shift register, syndrome calculation, its error detection & correction, Special classes of cyclic codes: BCH.
4. Burst and Convolutional Codes :
Burst and random error correcting codes, Encoders for convolutional codes, Decoders for convolutional codes, performance of convolutional codes, performance of block codes in error correction & detection. Comparison of error rates in coded and uncoded transmission.

Reference Books :

1. K. Sam Shanmugam – “Digital and Analog Communication System” John Wiley Sons.
2. Herbert Taub, Donald L. Schilling – “Principle of Communication System” Tata Mc-Graw Hill.

6AEI1 ADVANCED CONTROL THEORY

1. State-Space Analysis :
Review of State space representation of Control System, Diagonalisation, Controllability & Observability, State feedback control, pole placement through State feedback.
2. Nonlinear Systems :
Introduction, common physical nonlinearities. The phase plane method, Construction of phase trajectories, system analysis by phase plane method. Application of phase plane method to on-off control systems. Describing function of Relay with dead band, with Hysteresis, Amplifier

with saturation, Gears with backlash, Stability Analysis of closed loop nonlinear system.

3. Discrete Data System :

- A) Basic elements Discrete Data control systems, digital control system and digital computer controlled systems. Mathematical modeling of the sampling process. Time and frequency domain representation.
 - B) Z-Transform relationship between the Laplace's transform and Z-Transform, Z Transform Theorems, Inverse Z-transforms, limitations and applications of Z-transform.
 - C) Transfer function, Block diagrams & Signal flow graphs. The characteristic functions, Contact-Damping, Constant-Frequency and constant-Damping-ratio loci, Sampled signal flow graph Comparison of Time Responses of continuous-Data and Discrete-Data Systems, Steady state error analysis, deadbeat response at the sampling instants, root loci, Stability, Modified Routh- Hurwitz criterion, Jury's stability Test.
 - D) Frequency Domain Analysis: Polar Plot of $GH(Z)$, Nyquist criterion, Bode's plot, Gain margin, phase margin.
PI, PD, PID Controller, Pole zero cancellation Design, design of discrete-data systems with deadbeat response.
4. Optimal Control :
Formulation of optimal control problem, characteristics and requirements of industrial plants for optimal control minimum time and minimum energy strategies, state regulator problem.

Reference Books:

1. Digital Control Systems by B.C. Kuo International Edition.
2. K. Ogata, Modern Control Engineering, Prentice Hall of India.
3. J.E. Gibson, Non-linear Automatic Control, Mc-Graw Hill.
4. N.Gopal, Digital Control Engineering, Willey Eastern Ltd.

6AEI2 TELEMATICS

1. Digital Telephony: Principle of working of SPC digital telephone exchanges. Digital switching, space, time, TS, ST, STS, TST switch blocks. Synchronization aspect for digital telephony.
2. Radio Communication Systems:
Various types of AM and FM transmitters, Various types of AM and FM communication receivers. Receiver testing.
3. Satellite Communications:

Basic considerations. Up-link and down link parameters. Orbit and frequency selection. Elements of multiple access techniques. Functional description of earth stations.

4. System Performance Communication:
Noise-performance of analog CW and pulse modulation systems using coherent and non-coherent detection. Baseband PCM and delta modulation systems performance in terms of probability of error and S/N ratio. Matched filters. Probability of error performance of band pass. ASK, FSK, BPSK, QPSK and simple QAM systems.
5. Mobile Communication:
Essential aspects of working, of radio paging, cellular radio telephone and cordless telephone.
6. Integrated digital networks:
Basic aspects of multiplexing, signaling and synchronization in integrated digital networks. Overview of ISDN and BISDN. Concepts of basic rate and primary rate ISDN. Elements of fast packet switching, frame relay, ATM and SONET. Introduction to photonic switching.

Recommended Books:

1. Electronic Communication by – D. Roody and J. Coolen, PHI, India
2. Telecommunication and computers by – J. Mortin, PHI, India
3. Principles of Communication systems by –H.Taub and D.L. Schilling; McGraw

Hill, Kogakusha

6AEI 3 BIOMEDICAL ELECTRONICS INSTRUMENTATION

1. Bio-electric Signals & Electronics
Origin of bio-electric signals, Recording Electrodes, Skin-contact impedance, Electrodes for ECG, Electrodes for EEG, Electrodes for EMG, Micro electrodes.
2. Pressure transducers,
Transducers for body temperature measurement, Pulse sensors, Respiration sensors.
3. Biomedical Recorders:

- Electrocardiograph, Phonocardiograph, Electroencephalograph (EEG), Electromyograph.
4. Patient Monitoring System:
 System concepts, Measurement of heart rate, Blood pressure measurement,
 Measurement of temperature, Measurement of respiration rate, Apnoea detectors.
5. Blood Flowmeters:
 Electromagnetic blood flow meter, Ultrasonic blood flowmeter, NMR blood flowmeter, Laser Doppler flowmetry.
6. Blood Gas Analysers:
 Blood pH Measurement, Measurement of blood PCO₂ measurement.
7. Blood Cell Counters :
 Method of cell counting, Coulter counters, Automatic recognition and differential counting of cells.
- 8 Patient Safety :
 Electric shock hazards, Leakage currents, Test instruments for checking safety parameters of biomedical equipments.

Reference Books:

1. R.S. Khandpur Handbook of Biomedical Instrumentation
Tata Mc-Graw New Delhi 1991
2. Cromwell et al: Biomedical Instruments & Measurement

1. ANTENNA : Antenna fundamentals and definitions. Radiation from a current element in free space. Quarter & half wave antenna. Reciprocity theorem. Resonant and non-resonant antenna. Effective length and aperture, gain, beamwidth, directivity, radiation resistance, efficiency, polarization, impedance, and directional characteristics of antennas, antenna temperature.
VLF, LF, MF and HF antennas, Effect of ground on antennas, Antenna loading.
Antenna Arrays : Two element array, N-element linear arrays, Broadside, end fire, collinear and combination arrays, Multiplication of patterns, Binomial arrays.
Long wire, V and Rhombic antennas, Folded dipole, Yagi-Uda antenna, Frequency independent antennas, Log-periodic antennas.
UHF and Microwave antennas- Antenna with parabolic reflectors, Horn and Lens antennas, Helical antennas, Square and Circular loop antennas, Fundamentals of Slot and Microstrip antennas.
Antenna Measurements : Antenna impedance, radiation pattern, gain, directivity, polarization and phase measurements.
2. RADIO WAVE PROPAGATION : Mechanism of radio wave propagation. Reflection, refraction interference and diffraction of radio waves. Theory of ground wave, space wave and sky wave propagation. Plane earth reflection, Reflection factors for horizontal and vertical polarisations. Duct propagation and tropospheric scattering. Various Ionospheric layers. Characteristics of ionosphere and its effects on wave propagation. Critical frequency, virtual height, skipzone & maximum usable frequency. Multiple hop transmission. Oblique & vertical incidence transmission. Effect of earth's magnetic field, solar activity and meteorological conditions on wave propagation.

Recommended Books :

1. E.C. Jordan and K.G. Balmain, `Electromagnetic waves and Radiating Systems', Prentice hall of India.
2. J.D. Kraus, Antennas', Mc-Graw Hill.
3. K.D. Prasad, `Antenna and Wave Propagation', SATYA Prakashan, New Delhi.
4. C.A. Balanis, `Antenna Theory', Harper & Row.
5. R.E. Collin, `Antennas & radio Wave Propagation', Mc-Graw Hill.

6AEI 5 MICROCONTROLLER AND EMBEDDED SYSTEMS

1. THE 8051 MICROCONTROLLER:

Introduction, The 8051 microcontroller hardware, I/O pins, Port, External memory, Counters and Timers, Serial data, Interrupts.

2. 8051 ASSEMBLY LANGUAGE PROGRAMMING:
Addressing modes, External data moves, push and pop opcodes, Logical operations, Byte level and bit level logical operations, Arithmetic operations, Jump and call instructions, Interrupts & return.
3. REAL WORLD INTERFACING:
Interfacing of LCD, ADC to 8051.
4. INTRODUCTION TO REAL-TIME OPERATING SYSTEMS:
Round robin with interrupts RTOS Architecture., Task and task states, Semaphores and shared data.
5. BASIC DESIGN USING RTOS:
Encapsulating Semaphores and Queues, Saving Memory Space, Saving power.

Recommended Books:

1. K.J. Ayala - The 8051 Microcontroller, Penram International
2. M.A. Mazidi-The 8051 Microcontroller and Embedded Systems, Pearson Education Asia.
3. David Simon-An Embedded software Primer, Pearson Education Asia
4. J.W. Valvano Brooks/Cole-Embedded microcomputer Systems, Thomson Learning™

6AEI 6.1 PROCESS CONTROL SYSTEM

1. Introduction: General concepts and terminology, Laws, Languages and levels of process control.

2. Open Loop Response of Simple Systems: Response of a thermometer bulb, Concentration response of a stirred tank. Temperature response of a stirred tank. Linearization and perturbation variables. Response of pressure systems. Response of non-interacting first order elements in series and response of interacting elements in series.
3. Transient response of control system: General equations for transient response. Proportional control of single and two capacity process, Integral control, P-I control, Effect of measurement lag and time delay.
4. Level Control: Level as a major variable. Averaging control, Tank dynamics, Measurement lag, Performance of averaging controllers.
5. Flow Control: Process lag, Measurement lag, Effect of transmission lag on flow control, Control with noisy signal, Non linearities in flow systems.
6. Control of Distillation Column: Basic features of composition control schemes, Control of overhead composition, Bottom composition and both product compositions, Location of sensing element, Control of columns with varying feed rates, Pressure control, Control of feed temperature and internal reflux control.
7. Control of Heat Exchangers: dynamics of steam heated exchangers, Control schemes, Measurement lag, Response of filled bulbs, Bulbs in vells, Thermocouple response, Resistance thermometers, Reducing the measurement lag.
8. Advanced Control System: Cascade control, feed forward control concept, Ratio control, Non linear and adaptive control, Value position control, Override control, Laplace domain analysis of cascade control, Feed forward control, Process with inverse response.
9. Optimum Controller Settings: Optimum settings from the plant response, Continuous cycling methods, Damped oscillation method, Reaction curve method.

Recommended Books:

1. P.Harriott- Process Control, Tata Mc-Graw Hill
2. D.P. Eckman- Automatic Process Control, Wiley Eastern Ltd.
3. Luyben- Essentials of Process Control, Tata Mc-Graw Hill

6AEI6.2 NUCLEAR INSTRUMENTATION

1. Various transducers used in Instrumentation.
2. Physics of Nuclear process.
3. Nuclear reactors - control & design.
4. Various detectors: Geiger-Muller counter, Proportional counter.

5. Scintillation counter, Ionization detector.
6. Synchrotron sources and its applications.
7. Computer simulations of various nuclear process.

Recommended Books :

1. Glasstone, Nuclear Reactor Engineering
2. Oliver, Practical Instrumentation Transducers
3. Control of Nuclear Reactor & Power Plants

6AEI 6.3 WIRELESS COMMUNICATION

1. Introduction: Cellular revolution, Global Cellular Network, Broad band and troubles with wireless.
2. Cellular Wireless Networks: Principles of Cellular Networks, First generation analog, Second generation TDMA and Third generation systems.
3. Cordless Systems And Wireless Local Loops: Cordless systems. Wireless local loop and IEEE 802.16 Fixed Broadband Wireless Access standard.
4. Mobile IP and Wireless Access Protocol: Mobile IP, Wireless Application Protocol, Internet Control Message Protocol and Message Authentication.

5. Satellite Systems: Application Basics-GEO, LEO and MEO Introduction to Mobile Satcom. Routing, Localization and Handover.
6. Broadcast Systems: Overview, Cyclic repetition of data, Digital audio broadcasting-mobile object transfer protocol. Digital video broadcasting.
7. Wireless LAN :
Infrared vs radio transmission, Infrastructure and ad hoc networks. IEEE 802.11- System architecture, Protocol architecture, Physical layer, Medium access control layer and MAC management HIPER LAN-protocol architecture, physical layer, channel access control sub layer, information base and networking Bluetooth-User scenarios, Physical layer, MAC Layer. Networking Security and Link Management.

Recommended Books:

1. William Stallings, Wireless Communications and Networks, Pearson Education.
2. John Schiller Mobile Communications, Pearson Education.
3. Sandeep Singhal and Thomas Bridgman, The Wireless Application Protocol, Pearson Education.
4. Millman C.Y.Lee Mobile Cellular Telecom
5. T.S. Raopaport, Wireless Communication, Principles & Practices

6AEI 6.4 OPTICAL COMMUNICATION (Elective)

1. Optical Fibres: Basic optical laws and definitions, Principles of light propagation in fibres, Ray theory, Optical fiber modes and configurations, Step index and graded index fibres monomode and multimode fibres, Fibre materials, fiber fabrication, fiber and optic cables.
2. Signal Degradation in Optical Fibres: Attenuation, signal distortion in optical fibers, Pulse Broadening Dispersion modified SM fibers.
3. Optical Sources : LED's-Structure, Materials, Characteristics, Power & efficiency Laser Diodes-Basic concepts, Structure, properties and modulation.

3. To plot the frequency response curve and calculate cut off frequency for the following networks:
(a) Lag network (b) Lead network (c) Lag-Lead network
4. To design an ON-OFF controller using relays and OP-Amp.
5. To design and performance evaluation of a suitable compensating network for a given system.
6. To study the characteristics of synchro transmitter- Receiver and draw Error v/s angle characteristics.
7. To study the operation and characteristics of Stepper motor.
8. To design P, PI, PD & PID controllers using process simulator.
9. To test & determine time domain specifications of a control system.
10. To test & determine frequency domain specifications of a control system.
11. To study the performance of potentiometer error detector in position control system.
12. To study the characteristics of control valves and actuators.

7 AEI 1 Industrial Electronics

1. Semiconductor Power Devices :
Basic characteristics of Power Diodes, Diac, SCR, Triac, Power Transistor, MOSFETs, IGBT and GTO.
2. Rectifiers, Inverters and Choppers :
Working principles of single and three phase bridge rectifiers, Voltage and current sources inverters, Choppers: Principles of Operation, Step up, Step down and reversible choppers.

3. Industrial Applications :

- (i) Motor Control : Introduction to speed control of DC motors using phase controlled converters and choppers, Basic idea of speed control of three phase induction motors using voltage and frequency control methods. Stepper Motors: Variable reluctance, Permanent magnet and hybrid stepper motors.
- (ii) Power Supplies : Switch mode Power Supply : fly back converter, forward/back converter, boost converter and buck-boost converter. Uninterruptible power supply.
- (iii) High frequency electronic ballast. Induction and dielectric heating control.
- (iv) Introduction to Programmable Logic Controller.

Reference Books:

1. Biswanath Paul, Industrial Electronics and Control, Prentice Hall of India.
2. S.N. Biswas, Industrial Electronics, Dhanpat Rai & Co.
3. Zbar, Industrial Electronics : A Text Lab Manual, Tata Mc-Graw Hill.
4. Morris, Industrial Electroncis, Tata Mc-Graw Hill.

7 AEI 2 Digital Signal Processing

1. Sampling :
Discrete time processing of continuous time signals, Continuous time processing of discrete time signals, Changing the sampling rate using discrete time processing.
2. Transform Analysis of LTI Systems :
Introduction, The frequency response of LTI Systems, System functions for system characterized by LCCD, (Linear constant coefficient difference) equation, All pass system, Minimum phase systems, Linear systems with Linear Phase.
3. Structure of Discrete Time System :
Block diagram and signal flow graph representation of LCCD, (LCCD – Linear constant coefficient difference) equations, Basic structure for IIR and FIR systems, Transposed forms.
4. Filter Design Techniques :
Introduction design of discrete time IIR filter from continuous time filters, filter design by impulse invariance, Bilinear transformation. Design of FIR filters by windowing examples of FIR filter design by the Kaiser window method.
5. The Discrete Fourier Transform :
The discrete Fourier Series (DFS) Properties of the DFS, the discrete Fourier Transform (DFT), Properties of DFT. Implementing LTI systems using the DFT, Efficient computation of the DFT, The Goertzel Algorithm, Decimation in time and decimation-in frequency FFT Algorithms, Implementation of the DFT using convolution.

Reference Books :

1. Schafer, Buck – Discrete Time Signal Processing, Pearson Education, Asia.
2. Prokis & Manolakis – Digital Signal Processing, Principles, Algorithms & Applications, Prentice Hall of India.
3. S.K. Mitra – Digital Signal Processing, Tata Mc-Graw Hill.
4. Rabiner & Gold – Theory & Application of Digital Signal Processing, Prentice Hall of India.

7 AEI 3 Data Acquisition System and Technology

1. Instrumentation System :
Classification of instrumentation system. Block diagram of analog & digital data acquisition system with detailed study of different blocks.
2. Signal Conditioning :
Block Diagram of Signal Conditioning System, AC & DC Signal Conditioning Instrumentation Amplifier, AC Amplifier, Direct coupled, Chopped Amplifier. Operational Amplifier and its Applications, Compensation and Modulation. Active & Passive filter, Bridge circuits, Calculation of SNR and other Parameters.
3. Multiplexing :
Analog & Digital multiplexer, Digital to Analog multiplexing, Analog to Digital multiplexing, Different types of multiplexing. Single channel and multi channel data acquisition system.
4. Data Converters :
Analog to Digital and Digital to Analog converters, Sample and Hold circuits.
5. Grounding and Shielding Techniques :
Noise analysis, effect of noise, various techniques of grounding and shielding.
6. Data Acquisition and System Design :
Design Cycle, different designing aspects, Hardware & Software for designing, Data processing, Programmable DAS, Distribution DAS, Microcontroller 8091, 8051, 8751 etc.
7. Telemetry :
Different methods of data transmission, Block diagram of Telemetry system, different form of telemetry systems, multiplexing-in telemetry systems, Digital Telemetry systems.

Reference Books :

1. Krishan Kant, Microprocessor Based Data Acquisition System.
2. Tobey – Graeme – Huelsman, Operational Amplifier System & Design, Mc-Graw Hill.

7 AIE 4 Neural Networks and Fuzzy Logic Control

1. Neural Networks : Introduction Motivation.
Biological neural networks and simple models. The artificial neuron model, Hopfield nets, Perceptrons & Threshold logic devices, Multilayer networks- their variants and applications. Capacity of multilayer network; Back propagation, Recurrentnets, Unsupervised learning, Habbian learning, competitive learning.
Recent trends & future directions:
2. Fuzzy Logic :
Introduction uncertainty and precision, Statistics and random process, uncertainty in information, Fuzzy sets and membership.
3. Membership Functions :
Features of membership function, Standard forms and boundaries, Fuzzification, Membership value assignment-Intuition, Inference, Neural Networks.
4. Fuzzy to Crisp Conversions : Maximum Membership Principles.
5. Defuzzification Methods :
Centroid method, weighed, average method, Mean max membership.
6. Fuzzy Rule Based System :
Natural language, linguistic hedged, Rule based system – Canonical rule forms, Decomposition of compound rules, Likelihood and truth qualification Aggregation of Fuzzy rules. Graphical techniques of reference.
7. Fuzzy Control System :
Simple Fuzzy Logic controller, General FLC, Special forms of FLC system models, Industrial applications.

Reference Books:

1. Timothy J. Ross – Fuzzy Logic with Engineering Applications, Mc-Graw Hill India.
2. Yagya Narayana – Artificial Neural Networks, Prentice Hall India, 1999.

7 AEI 5 Instrumentation System Design

1. Design of Electrical Components and Transducers :
Variable capacitance transducers, associated circuits, variable resistance transducers, wire wound potentiometers, strain gauge, metal resistors and thermistors, variable inductance transducers, ferromagnetic cores with air gaps, ferromagnetic plunger type core, associated circuits, Design of LVDT with output circuitry, permanent magnet moving coil instruments, capacitive transducers, clamped diaphragm and membrane, bridge circuitry, Piezo electric transducers, charge amplifiers.
2. Interface of primary elements with end devices :
Temperature sensing from a distance, current mode transmission of signals, ambient referenced thermocouples.
3. Design of Controllers :
Controller configurations (P, PI, PD, PID Cascade, etc.) setting, tuning, realization of controllers, electrical, pneumatic displacement, balanced and forced balance, controllers for interacting processes.
4. Reading and Drawing of Circuit Diagrams of Instrumentation Systems :
Standards, Specifications, one line diagram of hydraulic, pneumatic and electrical instrumentation systems.

Reference Books :

1. Neubort, H.K.P. – Instrumentation Transducers – An Introduction to Their Performance and design, Clarendon Press, Oxford, 1975.
2. Dobelin, E.O. – Measurement Systems : Application and Design, Mc-Graw Hill Kogakusha Ltd., Tokyo, 1996.
3. Rangan C.S. et al. – Instrumentation Devices and Systems, Tata Mc-Graw Hill Publication Co., New Delhi, 1983.

7 AEI 6.1 Aeronautical Instrumentation

1. Various Transducers required for Aeroplane system to measure velocity, acceleration, vibration, force, torque, strain, and stress. Fluidic Instrumentation for ship and Aeroplane. Electronic Signal processing and indicating system of cockpit.
2. Aircraft Flight : Engine Navigational and Control Instrumentation.
3. Air Traffic Control : Aerodrome control, Approach control, area control.
4. Instrumentation landing system and Airport surface detection system.

Reference Books :

1. Indian Society of Aeronautical Engineering manual & IEEE Transaction.

7 AEI 6.2 Microwave Engineering

1. Resonators :
Theory and application of cavity resonators. Coupling to cavity, Q of Cavity resonators.
2. Microwave Components :
Attenuators, phase shifters, directional couplers, tees, isolators, circulators, tuning, screws, coupling probe, loops, mixers and detectors.
3. Microwave Generators and Amplifiers :
Theory of velocity modulation. Operation and characteristics of two cavity and multicavity klystron, amplifier and oscillators. Reflex Klystron, TWT, Magnetrons.
4. Microwave Solid State Devices :
Special considerations for UHF and microwave transistors and oscillators. Parametric amplifiers. Manley-Rowe relation, Principle of working and application of impatt diode; hot Carrier Diode, PIN Diode, Gunn Diode and LSA diode, MASER amplifiers. Principle of ruby, Semiconductor junction and gas LASERS.
5. Microwave Measurements :
Basic methods of measurement of frequency, power, attenuation, phase-shift, SWR noise-figure, impedance reflection coefficient, Q, Characteristics of antenna and directional couplers and dielectric constants at microwave frequencies.

Reference Books:

1. S. Y. Lias – Microwave Device & Circuits, PHI.
2. H.J. Reich – Microwave Principles, East West Press.
3. R.E. Collin – Foundations for Microwave Engineering, Mc-Graw Hill.
4. Sisodia, V.L. Gupta – Microwave Engineering, New Age.
5. T.C. Edwards, K.C. Gupta – Microwaves, New Age International.

7 AEI 6.3 Laser and Radar Instrumentation

1. Laser – Theory and Technology :
Principles of emission, modes of resonant cavity, CW and pulse operations, Mode locking Gas, Solid state, Semiconductor and liquid lasers, application of lasers.
2. Optical Fiber and its Applications :
Joints, Connectors and couplers, sources – laser, LEDs, Detector – PIN Diodes, APD, Application to Communication and Instrumentation.
3. Pulsed Radar :
Basic Principle, Block diagram, Operation of Pulse Radar, Range Radar equation and minimum detection signal, Limitation of Radar, PFR and Range ambiguities, Brief idea of pulser circuits and indicators.
4. CW and FM Radar :
Doppler effect, CW Radar, Range Measuring Doppler system, FM CW Radar, Airborne Doppler navigation, Multiple Frequency CW Radar MTI Radar, Pulse Doppler Radar.

Reference Books :

1. Young M., Optics and Laser: An Engineering Physics Approach, 1977.
2. Cheo, Peter K., Fiber Optics: Devices and Systems, Prentice Hall Series on Solid State Physical Electronics, 1985.
3. Introduction to Radar System by Skolnock.
4. Electronic and radio Engineering by F.E. Terman.
5. Radar System Engineering by Reidnour.
6. Principles of Radar by M.I.T. Staff.

7 AEI 6.4 Applied Robotics

1. Introduction to Robotics, Manipulation, classification of robot, Automation & robot, Industrial applications environment.
2. Control of robot manipulator, Robot arm kinematics & dynamics, trajectory planning, sensors, PID Control.
3. Robot Programming, different methods. Features of various programming methods. Case study, Robot task planning, Robot learning.
4. Applications of Robot in Medicine : Case studies for :-
 - (i) Laboratory test and (ii) Operations Theatre Equipment.
5. Application of Robot in Industries: Case Studies –
 - (i) Welding Robot and (ii) Assembly Shop Tool.
6. Automatic guidance for marine robots, Navigation control in multiple robot environment. Fault detection in Industrial Robots, Environmental recognition, Fuzzy and Neural applications in robotics systems.

Reference Books :

1. M.P. Groover, M. Weins, R.N. Nagel, N.C. odrey, Industrial robotics, Mc-Graw Hill.
2. Andrew C. Staugard, Robotics & AI, PHI Inc.
3. S. Sitharama Iyengar, Alberto Elfes, Autonomous mobile Robots- Perception, Mapping & Navigation, IEEE Computer Society Press.
4. S. Sitharama Iyengar, Alberto Elfes, Autonomous Mobile Robots- Control, Planning & Architecture, IEEE Computer Society Press.
5. K.S. Fu. R.C. Gonzalez, CSZ Lee, Robotics Control, Sensing, Vision & Intelligence, Mc Graw Hill.
6. IEEE Transaction on Robotics & Automation.

Digital Signal Processing Lab (7AEI8)

Introduction to Modelling and simulation using MAT LAB.

- (1) RANDOM NUMBERS: Meaning and Generation.
 - 1.1 To generate Random Number sequence uniformly distributed in the interval (0,1).
 - 1.2 To generate RN sequences with arbitrary distributions, means and variances:
 - (a) Rayleigh distribution.
 - (b) Binomial and Poission distribution.
 - (c) Normal distributions: $N(0,1)$.
 - (d) Gaussian distributions: $N(m_x, \sigma_x^2)$.
 - 1.3 To plot the probability density functions and find mean and variance.

- (2) SIGNALS AND SYSTEMS:
 - 2.1 To generate elementary signals like unit impulse, unit step, exponential and ramp.
 - 2.2 To carry out linear and circular convolution in both continuous time and discrete time systems.
 - 2.3 To design and simulate FIR filters and IIR filters.
 - 2.4 To find autocorrelation between signals and sequences.

- (3) FOURIER TRANSFORMS:
 - 3.1 To carry out discrete Fourier transform of continuous and discrete time systems.
 - 3.2 To carry out fast Fourier transform of continuous and discrete time systems.
 - 3.3 To carry out implementation of DFT using convolution.

- (4) Generation of waveform using DSP starter kit:
 - 4.1 Generation of Square wave.
 - 4.2 Generation of Sine wave.
 - 4.3 Generation of Sawtooth wave.
 - a. Study of Sampling theorem.

Industrial Electronics Lab (7AEI7)

- (1) To plot static V/I characteristics of SCR and determine,
 - (a) Latching & Holding current
 - (b) Breakdown voltage

- (2) To determine the firing angle by observing the waveform for the following triggering ckts of SCR,
 - (a) R-triggering ckt
 - (b) RC- triggering ckt
 - (c) UJT-triggering cktAlso find limitation of firing angle.

- (3) To plot the V-I characteristics of DIAC and determine breakover voltage.

- (4) To obtain the waveforms for single phase half wave controlled converter and determine its firing angle, V_o (dc) & compare it with theoretical value.

- (5) To obtain the waveforms for single phase half wave controlled symmetrical & asymmetrical bridge converter and determine its firing angle, V_o (dc) & compare it with theoretical value.

- (6) To obtain the waveforms for single phase fully controlled bridge converter and determine its firing angle, V_o (dc) & compare it with theoretical value.

- (7) To obtain the waveforms for voltage commutated chopper and determine its firing angle, V_o (dc) & compare it with theoretical value.

- (8) Study and obtain the waveforms for current-commutated chopper and determine its firing angle, and make a comparison between practical & theoretical values.
- (9) To study the operation and characteristics of single phase PWM inverter.
- (10) To determine Line regulation and Load regulation of buck, boost & buck-boost regulators.
- (11) To measure the speed of motor in open loop control for different firing angles and also determine regulation.
- (12) To measure the speed of motor in closed loop control for different firing angles and also determine regulation.

8AEI 1 VLSI DESIGN TECHNIQUE

1. Introduction to VLSI Systems:
MOS, NMOS, PMOS, Device Modeling effects of scaling down; performance limitation.
2. Fabrication Principles:
Lithography, Diffusion, Ion implantation, Electron Beam Technology.
3. Introduction to Circuit Simulation: SPICE, IRSIM
4. CMOS Analog Design:
Basic Amplifier, Gain boosting techniques, Difference Amplifier, Current Mirrors, Output Stages, Frequency Compensation, OP-AMP Design, Comparators, Basic Building Blocks, Bias Generation, Current Mode Operations, Low Power Analog Design, An example of Quartz Oscillator.
5. Digital Design-Basic Circuits and Cell of Digital VLSI System:
Gates, Flip-Flops, Shift Registers, Counters, Adders
6. Memory Circuits:
Static and Dynamic RAM, ROM Application
7. System Design of VLSI:
Various Design approaches, Random Logic PLA, Standard Cells, Examples like Single Chip, Watch, Calculator, Microprocessor (Pentium), Computer Aids in Design, Simulation and Layout of IC's.

Reference Books:

1. "VLSI Design Techniques for Analog and Digital Circuits" by R.L. Gerger, P.E. Allen and N.R. Strudder.

8AEI 2 INDUSTRIAL INSTRUMENTATION

1. Instrumentation in Petrochemical Industries :
Instrumentation and control in reactors and distillation column, Temperature and pressure control, Optimisation, Elementary idea of batch reactors, Measurement and control of column pressure, Control of feed, reboiler, Reflux rates, Optimisation of distillation columns, Instrumentation and control in dryers, Batch and continuous dryers, Types of evaporators, Instrumentation and control in evaporators, Measurement and control of pressure, density, conductivity, differential pressure
2. Power Plant Instrumentation :
Instrumentation for thermal power plants-testing, monitoring and control instrumentation coal handling/crushing units, boilers, turbines, condensers, generators and auxiliary systems.
3. Nuclear reactor instrumentation:
Diffusion, Moderation, Absorption and delay processes, Neutron flux measurement, Control rod calibration, Nuclear fuel inspection and testing including poisoning, Radiation energy measurement, Remote control Instrumentation, Nuclear Instrumentation, Maintenance
4. Measurement of Chemical Composition :
Chemical Analysis-Introduction, Spectroscopy-X-Ray, Photo-acoustic, Microwave, Mass-spectrometers Electrochemical Techniques-Conductivity, P.H. Potentiometry, etc.
Gas Analysis- Chromatography Moisture Measurement

Reference Books:

1. Bela G. Liptakt Instrumentation in the Processing Industries, Chillion Book company 1973
2. M. Douglan Constidine and S.P. Ross: Handbook of Applied Instrumentation McGraw Hill 1964
3. CEGB Modern Power Station Practices, V-6 and V-8 Pergaman, Process 1971
4. H.V. Morse; Nuclear Power Cambridge University press
5. Jones Instrument Technology Vol:-2, Butterworths

8AEI 3 DATA COMMUNICATION & NETWORKS

1. Communication Model: Transmission system in communication, introduction to WAN, MAN and LANs, broadband and narrowband ISDN, Architecture, Protocols and protocol architectures. Layered Architectures OSI/ISO, TCP/IP protocol Architecture.
2. Data Transmission: Concepts and terminology, Frequency, spectrum and bandwidth, time domain and frequency domain analysis and digital data transmission, audio and video signals, Transmission impairments. Guided transmission media, twisted pair, UTP cables, Coaxial and optical fiber cables, wireless microwave and satellite transmission.
3. Data Encoding: Amplitude, frequency and phase modulation techniques, NRZ-1, Bipolar AMI, manchester and differential manchester encoding techniques. Scrambling techniques. ASK, FSK and PSK techniques Pulse code and pulse Amplitude Modulations. Delta Modulations.
5. Multiplexing: Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing.
6. Switching Networks: Circuit switching Networks, Space and time division switching, routing in circuit switched networks. Control signaling Packet Switching principles. Fixed, flooding and adaptive routing strategies-X.25 interface, packet format and X.28 protocol.
7. Frame Relay: Frame Relay protocol Architecture-Frame Relay Call Control and congestion control.
8. MAC Sublayer: Channel allocation problem, pure and slotted ALOHA protocols, persisted and Non-persisted CSMA, Collision free protocols, Digital cellular radio, CDMA.

Recommended Books:

1. William stallings-Data and Computer communications(PHI, 5th Ed.)

2. James Martin-Telecommunication and the computer (PHI 3rd Ed.)
3. A.S. Tanenbaum-Computer Networks (PHI 3rd Ed.)

8AEI 4.1 INTELLIGENT INSTRUMENTATION

1. Introduction:
 - 1.1 Intelligent versus dumb instrument
 - 1.2 Information signals and systems
 - 1.3 Elements of a Microcomputer and operation
 - 1.4 Interfacing
 - 1.5 Intelligent instrument in use
2. Digital Computation:
 - 2.1 The powers of digital computer
 - 2.2 Information transfer and input output structure
 - 2.3 Measurement of digital computer power and performance
3. Interfacing:
 - 3.1 Interface components and techniques
 - 3.2 Signal processing
 - 3.3 Interface system and standard
4. Communication:
 - 4.1 Interconnection devices
 - 4.2 Serial computer and equipment connection
 - 4.3 Communication standards
5. Intelligent Sensors:
 - 5.1 Intelligent pressure, Flow, Level, Temp. sensor
 - 5.2 Intelligent sensor application in proces control
 - 5.3 Intelligent analytical instruments
 - 5.4 Application of intelligent sensor in biomedical engineering
 - 5.5 Future scope of intelligent instrument

Reference Book:

1. Intelligent Instrumentation-George C. Borney, Prentice Hall of India P Ltd., New Delhi-1992

8AEI 4.2 AUDIO & VIDEO SYSTEMS

1. Audio Systems: Important types of microphones and speakers, Monophonic, stereophonic and quadraphonic audio systems.
2. Disc and Magnetic Recording & Reproduction: Monophonic and stereophonic disc recording and reproducing systems. Magnetic recording & playback Biasing & equalisation, Recording medium, Magnetic heads-record, replay & erase heads, Audio cassettes, Tape speed, Maximum usable frequency, Tape transport mechanism, Distortion & noise aspects, HI-FI stereo system.
3. Video Cassette Recorders: Video recording requirements, Video tape formats. Modulation-up conversion and down conversion of video signal, Servo systems, Functional Block diagram of VCR. Video disc recording & playback.
4. Compact Disc Recording & Reproduction: Compact disc advantages, Specifications, CD player optical requirements, CD technology & manufacturing, CDRom, CD Video.
5. Video Cameras; Image conversion principle, Vidicon, Plumbicon, Sidicon camera tubes, Three tube colour camera, Block diagram of colour camera tube.
6. TV Engineering: Scanning process, interlaced scanning, Composite video signals, Principle of black & white TV & colour TV receivers. Primary colours, Chrominance & luminance signals. Colour TV Systems-NTSC, SECAM, PAL, Transmission & reception using PAL systems.

Recommended Books:

1. S.P. Bali & R. Bali-Audio Video Systems, Khanna Book Publishing Co.,Delhi
2. Ajay Sharma-Audio and Video Systems, Dhanpat Rai & Co.
3. R.G.Gupta-Audio and Video Systems, Tata Mc-Graw Hill

8AEI 4.3 VHDL

1. COMBINATIONAL CIRCUIT BUILDING BLOCKS: Multiplexer, Decoders, encoders, Code Converters, VHDL Code for Combinational Circuits.
2. SEQUENTIAL CIRCUITS: VHDL code for Flip-Flops, shift registers, Counters.
3. SYNCHRONOUS/ASYNCHRONOUS SEQUENTIAL CIRCUITS: Mealy & Moore type FSMs, VHDL Code for Mealy & Moore Machines, VHDL Codes for Serial Adder, Vending Machine.
4. DIGITAL SYSTEM DESIGN: Building Block circuits, Memory organization, SRAM, Design examples of divider, Multiplier, Shifting & Sorting Operations, Clock Synchronization, CPU organization and design concepts.

Recommended Books:

1. Stephen Brown and Zvonki Vranesic-Fundamentals of Digital Logic circuit VHDL design, Tata MC-Graw Hill.
2. Z. Navabi-Analysis and Modeling of Digital Systems, Tata Mc-Graw Hill
3. D.L. Perry-VHDL 3rd ed. Tata Mc-Graw Hill.
4. Morris Mano-Digital Logic & Computer Design, Prentice Hall of India

Computer communication lab (8AEI5)

- (1) To observe Pulse Amplitude Modulated waveform and study Time Division Multiplexing.
- (2) Study of data formatting techniques.
- (3) Study of data reformatting techniques.
- (4) To investigate the characteristics of quantization, noise and the effect of injected noise on the performance of PCM system.
- (5) Study of perfect transmission on a point-to-point link on LAN trainer.
- (6) To study data transfer between nodes over a network using the stop and wait protocol.
- (7) To study data transfer between nodes over a network using the sliding window protocol.
- (8,9,10) To study the packet communication between number of nodes connected to a communication bus using (i) ALOHA protocol (ii) CSMA protocol (iii) CSMA/CD
- (11) To study the token passing access method for BUS LAN.
- (12) To study the token passing access method for RING LAN

Advanced Instrumentation Lab (8AEI6)

- (1) To plot and analyze step/impulse response of a first order system in
 - (i) Interacting mode
 - (ii) Non interacting mode.
- (2) To design and study the effect of PI and PID control actions on a temperature control system. Also tune the controller with closed loop method.
- (3) To study the control valve operation and the following characteristics
 - (i) Valve flow coefficient
 - (ii) Hysteresis of control valve
 - (iii) Rangeability of equal percentage control valve.
- (4) To design PI controller for level and flow control system using open/closed loop tuning techniques to optimize system performance.
- (5) To study the hardware design of PLC system
 - (i) By developing and testing of ladder logic in simulation mode.
 - (ii) For a real time water filling system.
- (6) To study the spectrophotometer and estimate the
 - (i) Percent transmittance.
 - (ii) Absorbance.
 - (iii) Concentration of a given solution with single wavelength mode.
- (7) To study the flame photometer and estimate the concentration of Na and K in a given solution with
 - (i) High concentration mode
 - (ii) Low concentration mode.
- (8) To observe the ECG waveforms of a human body using standard bipolar leads and
 - (a) Study P-Q-R-S-T waves for different configurations.
 - (b) Analyze the abnormalities present in heart by monitoring the heart rate.
- (9) To design PID controller for a temperature control system with SCADA software.
- (10) To study the operation, configuration and remote calibration/programming of a smart pressure transmitter having control capability for remote data acquisition and control of an industrial pilot plant to demonstrate PID control of Level loop/Flow loop.

- (11) Design a Fuzzy knowledge based controller for a car braking system using MATLAB software. Analyze the change of control variable on the switching surface.
- (12) Design a Fuzzy logic controller to control real time-system such as ac motor control/relay control.

Simulation & design Lab (8AEI7)

Make schematic design and PCB layout of following circuits.

1. FET Amplifier in common drain mode.
2. Mod-13 asynchronous counter.
3. 3-bit DAC with Op-amp.
4. Active filter using Op-amp (i) Band Pass (ii) Band Reject (iii) High Pass (iv) Low Pass
5. Oscillator (i) Collpits (ii) R-C Phase Shift

Design the following circuit using appropriate software like VHDL/FPGA.

6. 3-input NAND gate.
7. Half adder.
8. D-Latch.
9. Serial in, serial out shift register.

- 10,11. Measurement of Propagation loss and numerical aperture.

12. Characterization of laser diode and light emitting diode.

Industrial Economics and Management (8AEI8)

1. **MONEY CREDIT AND FINANCE:** Function of money, types: coins, notes, cheques, Bill of Exchange. The banking mechanism and government control. The Reserve bank of India, nationalized banks, money market. Hire purchase finance. The stock exchange and issuing houses.
2. **MANAGEMENT:** Evaluation of management thought, principles and functions of management, motivation, Types of business forms and organization.
3. **FINANCE AND FINANCIAL STATEMENTS:** Needs of finance, kinds of capital sources, working capital cycle. Financial statements: basic concepts, balance sheet, profit and loss account sources and uses of funds statement-working capital, cash and total resource basis. Ratio analysis, liquidity ratios, capital structure ratios, profitability ratios, turnover ratios.
4. **INTEREST AND ANNUITY:** Capital recovery annuity, present worth annuity, sinking fund annuity, compound amount annuity. Nominal and effective rate of interest, Depreciation need of depreciation, methods of depreciation.
5. **QUALITY:** Conception quality of design, quality of conformance, value of quality & cost of quality, Evaluation of TQM concepts and philosophy, TQM and traditional management. Introduction to ISO-9000, ISO-14000, Just in Time, BPR.
6. **PROJECT PLANNING:** Network analysis, PERT & CPM, Project evaluation. Labour Legislation. Plant location, investment decisions. Concept of industrial economics and its importance. Industrial & cost theory, Optimum size, Market structure.

