

SEMESTER - III

CS 1312 - NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING

(2-1-0)

Numerical analysis

Approximations and round of errors, truncation errors and Taylor series,
Determination of roots of polynomials and transcendental equations by Newton-Raphson, Secant and Bairstow's method.

Solutions of linear simultaneous linear algebraic equations by Gauss Elimination and Gauss-Siedel iteration methods. curve fitting – linear and nonlinear regression analysis.

Backward, forward and central difference relations and their uses in Numerical differentiation and integration, Application t of difference relations in the solution of partial differential equations.

Numerical solution of ordinary differential equations by Euler, Modified Euler, Runge-Kutta and Predictor-Corrector method.

Computer Programming

Introduction to computer programming in C and C++ languages. Arithmetic expressions, simple programs. The emphasis should be more on programming techniques rather than the language itself. The C programming language is being chosen mainly because of the availability of the compilers, books and other reference materials.

Example of some simple C program. Dissection of the program line by line. Concepts of variables, program statements and function calls from the library (printf for example).

C datatypes, int, char, float etc.

C expressions, arithmetic operations, relational and logic operations.

C assignment statements, extension of assignment to the operations. C primitive input output using getchar and putchar, exposure to the scanf and printf functions.

C statements, conditional execution using if, else. Operationally switch and break statements may be mentioned.

Concepts of loops, example of loops in C using for, while and do-while. Optionally continue may be mentioned.

One dimensional arrays and example of iterative programs using arrays, 2-d arrays. Use in matrix computations.

Concept of Sub-programming, functions. Example of functions. Argument passing mainly for the simple variables.

Pointers, relationship between arrays and pointers. Argument passing using pointers.

Array of pointers, Passing arrays as arguments.

Strings and C string library.

Structure and unions, Defining C structures, passing structures as arguments. Program examples.

File I/O, Use of fopen, fscan and fprintf routines.

Suggested Text Books and References

- Shastri S.S., "Numerical Methods", Prantice Hall Inc., India, 1998.
- Noble Ben, "Numerical Methods", New York International Publications, New York, 1964.
- Stanson Ralph, G., "Numerical Methods for Engineering", Englewood Cliffs, N.J., Prentice Hall Inc., 1961.
- Buckingham, R.A., "Numerical Methods", Sir Isac Pitman Sons. Ltd., London, 1957.
- Bakhvalov, N.S., "Numerical Methods", Mir. Pub., Moscow, 1977.
- Grewal, B.S., "Numerical Methods", Khanna Pub., New Delhi, 1998.
- Sudhit Kaicker, "The complete ANSI C", BPB Publications, New Delhi, 1996.
- Kernighan, B.W. and Ritchie, D.M., "The C Programming Language", Prantice Hall of India, 1998.
- Byron, S.Gottfried, "Programming with C", Tata McGraw Hill, 2nd edition 1998.

ME 1312 Materials Science (2-1-0)

History of materials: Source of engineering materials; categorization of engineering materials [2 or 3 materials, their properties and hence their application just to make an illustrative point]; Periodic table approach to engineering materials 2 hours

Atomic bonding vis-a-vis properties of materials: Crystal structure and noncrystalline structure; Miller indices. 2 hours

X-ray diffraction,

Defects, their origin, Frenkel and Schottky defects; Order-disorder transformations, association of defects, non-stoichiometric solids; role of defects in defining electronic properties of materials - Si, GaAs, Dislocations 3 hours

Diffusion in solids, atom mobilities, temperature and impurity dependence of diffusion, various processes 2 hours

Binary phase diagrams (Pb-Sr, Al-Si, Ge-Si, Au-Si etc) , microstructure and its effect on properties. 2 hours Materials for use in electronic devices: Polymers, ceramics. semiconductors and metals - their structure and properties', insulators; superconductors; dielectric, ferroelectric, memory and magnetic materials. Case studies, 7 hours Quantum mechanical approach to structure of materials : Energy bands in solids; electrical conductivity; extrinsic and intrinsic semiconductors; carrier concentration; work function. 6 hours

Carrier transport mechanism: Scattering and drift of electrons and holes; diffusion and drift of carriers; Hall effect. 3 hours

Technology of fabrication of semiconductor devices; Unit operations: Thin film deposition; oxidation; diffusion; implantation lithography; etching; metallization, bonding; encapsulation and packaging; Description of a discrete device fabrication; IC fabrication technology. 6 hours

Sensors and actuators: classification and terminology; acoustic sensor, mechanical sensors, magnetic sensors, radiation sensors, thermal sensors, biosensors, chemical sensors and mechanical sensors Examples of integrated sensors. 4 hours

Opto-electronic materials and devices: Modulation of light: birefringence; Kerr effect, magneto-optic effects, acousto-optic effects. Display devices' CRTs. LEOs, LCDs, photoconductors, IR detectors, Photon devices, Lasers, Optical switching devices. 4 hours

Structural, chemical characterization of materials - introduction to X-ray Analysis, optical microscopy, ESCA, SEM-EDAX, STM, AFM; case studies of Si, GaAs, ferrites, lithium niobate. 3 hours

Environmental assessment of semiconductor device production' retrospect and prospect. 1 hour

Fourier series

Fourier series, Half-range series, Harmonic analysis.

Solution in Series

Differentiation and integration of Infinite series, series solution of differential equation; Bessel and Legendre equations, their solution, elementary properties of Bessel functions and Legendre polynomials.

Complex Variable

Functions of complex variable; Exponential, trigonometric, hyperbolic and logarithmic functions; Differentiation, Analytic functions, Cauchy-Riemann equations, conjugate functions; Application of two dimensional potential problems; Conformal transformations, Schwartz-Christoffel transformation; Cauchy's Integral theorem, Taylor's and Laurent's expansions; Branch points, zeros, poles and residues; Simple problems on contour integration.

Boundary Value Problems

Equations for vibrations of Strings, heat flow and electrical transmission lines; Laplace's equation in Cartesian, cylindrical polar and spherical polar coordinates; Solutions by separation of variables.

Integral Transforms

Fourier integral theorem, Fourier transforms, Convolution theorems, Inversion theorem for Fourier and Laplace transforms Simple applications of these transforms to one-dimensional problems.

Suggested Text Books & References

- Npiskunov, S., "Differential and Integral Calculus", Vol. I & II, Mir Publishers, Moscow, 1979.
- Churchill, R.V., "Fourier Series and Boundary value Problems", Mc Graw hill, 1963.
- Sneddon, I.N., "Fourier Transforms", Mc Graw Hill, 1951.
- Churchill, Brown and Verhey, "Complex Variables and The Laplace Transform for Engineers", Mc Graw Hill, 1961.
- Markushevich, A.I., "The Theory of Analytic Functions", Mir Publishers. Moscow. 1983.

ME1303 STRENGTH OF MATERIALS

(3-1-0)

Stress: axial load-safety concept, general concepts; stress analysis of axially loaded bars; member strength of design criteria. (4 lectures)

Strain: Axial strain and deformation; strains and deformation in axially loaded bars, stress-strain relationship, Poisson's ratio, thermal strain and deformation, strain concentration. (4 lectures)

Generalized Hooke's law, Pressure vessels, constitutive relationship-generalized concepts, relationship between elastic constants; thin wall pressure vessel. (6 lectures)

Torsion: torsional stress and deformation in circular members, design of circular members in torsion, closed coil helical spring. (5 lectures)

SFD & BMD: Axial force, shear and bending moment diagram, introduction-direct approach for axial force, shear and bending, bending of beams with symmetrical cross-section. (4 lectures)

Stresses in Beam: Shear stress in beams; introduction-shear flow-share stress in beams. (4 lectures)

Combine stresses: Transformation of stress and strain; analysis for combined loading; transformation of stress and strain-Mohr's rule for stress transformation. (6 lectures)

Deflection of beams: Introduction-deflection by integration-deflection by moment-area method. (6 lectures)

Stability of column: Introduction-Euler's buckling load formula, Rankin's formula-introduction to beam column. (2 lectures)

EC 1301 - SWITCHING AND PULSE THEORY

(3-1-0)

Logic families – RTL, DTL, TTL, ECL, NMOS/CMOS, Switching algebra, minimization functions using K-maps; Combination logic circuits – Adder / subtractor, multiplexes / demultiplexer, encoder / decoders, parity checker and generator etc
Sequential logic circuits – flip – flops, latches, shift registers, counters etc.
Pulse response of RC circuits: HP & LP. Pulse response of a band limited circuit. Switching properties of diodes: Clipper, clamper and voltage multiplier. Multivibrators: Astable, monostable, and bistable.

Suggested Text Books and References

- Kohavi, "Switching and Finite Automata Theory", 2nd ed., Tata McGraw Hill; 1978.
- Hill F.J. & Patterson, G.L., "Switching Theory and Logical Design", 3rd Ed: Hohn Wiley 1981.
- Millman, J & Taub, H., "Pulse, Digital and Switching Waveforms", McGraw Hill.
- Allen, Mottershed, "Electronic Devices and circuits", An Introduction: Prentice Hall; 1989.

Indicating instruments

Review of fundamental and derived units – Measurement errors – Standards of measurements – Deflecting and restoring torques in moving coil, moving iron and induction type meters – Ammeters, Voltmeters, Wattmeters and Energy meters.

Voltage, Current and Power

Measurement of direct current and voltage – methods of measuring alternating voltages and currents – Rectifier Instruments – Thermocouple instruments – VTVM – TVM – Amplifier rectifier type volt meters, Power measuring techniques – Bolometer method – Calorimeter method.

RLC Measurements

DC resistance – AC Wheatstone bridge – common types of bridges: Maxwell, Hay, Wein and Schering bridges – Twin T and Bridged – T null networks – resistance and Q of resonant circuits – Q meter – Impedance Measurement by substitution I Tuned circuit – Measurement of low value capacitances – Measurement of incremental inductances.

Frequency and Period Measurements

Standards of frequency – Frequency measurement by the absorption method – Comparison methods – Hetrodyne frequency meter – Capacitpr charge discharge method – Pulse counting method – Digital Frequency meter.

Waveform and Phase Measurements

Wave and distortion analyzer for audio frequency waves – spectrum analyzer – wave analyzer for RF signals – Phase measurements using oscilloscope – Null balance method – Phase shift to pulse conversion method – *DigiW* phasemeter.

Amplifier Measurements

Definition of amplification and gain – Voltage gain measurement – Insertion gain – Available power gain – Impedance measurements – Phase shift characteristics – Square wave testing of amplifier – Measurements of non linear distortion – Measurement of noise figure of amplifiers.

Suggested Text Books and References

- Sawhney, A.K., "A course in Electrical and Electronic Measurements and instrumentation" Dhanpat Rai & Sons, 11th edition, 1995.
- Kushnir, F., "Radio Measurements" MIR Publishers, Moscow, 1978.
- Terman, F.E. and Petit, J.M., "Electronic measurements", McGraw Hill Book Co., 1984.
- Cooper, W.D., "Electronic instrumentation and measurement Techniques", Prantice Hall of India, 3rd Reprint 1995.

PRACTICAL / DRAWING / DESIGN

ME 1307 - P - Material Science Lab.

(0-0-3)

List of experiments

- To study the lattice structure of various types of unit cell. Observe the Miller Indices for various Planes and directions in a unit cell.
- To study the microstructure of cast iron, mild steel, brass, solder under annealed, cold worked, forged / rolled conditions.
- To verify the Hall effect
- To determine the fracture characteristics of ductile and brittle materials
- To determine the chemical composition of a few common alloys
- To determine percentage of C and S content in an alloy with Fe as main constituent.

ME 1308 -P - Strength of Material Lab.

(0-0-3)

List of experiments

- Introduction to testing equipments
- Uniaxial tension test (Mild steel, Timber)
- Uniaxial compression test (Timber – along and across, concrete, bricks, etc.)
- Torsion test (Mild steel / aluminium)
- Bending stress distribution in beams using demac gauges and extensometer
- Analysis of truss model with spring members
- Compression test on brick masonry specimen
- Hardness test
- Creep test
- Impact test
- Strength of etched and un-etched glass
- Spring test
- To study the microstructure of various metals

CS 1313 - P - Numerical Analysis And Computer Programming Lab.

(0-0-3)

List of experiments

Development of computer program for

- Numerical integration by Trapezoidal and Simpson's rule
- Gauss – Siedel iteration method
- Various matrix operation and their use as sub-routines
- Uses of pointers, data structures, loops, arrays.

EC 1303-P - Switching and pulse theory lab.

(0-0-3)

List of experiments:

- Verification of logic gates,
- Verification and realization of different flip-flops (RS, JK ,D and T),
- Study of 4-bit register, study of b. C. D. Counter,
- Study of bi-stable multi-vibrator (using 555 timer or l),
- Study of astable multivibrator, study of high pass and low pass single order filter.

EC 1304-P - Electronics Measurements Lab.

(0-0-3)

List of experiments:

- Study of Thermocouple Instruments like VTVM - TVM.
- Study of Power Measuring Techniques – Bolometer & Calorimeter Method.
- Study of A C Wheatstone bridge.
- Measurement of Low Value Capacitances.
- Measurement of Incremental Inductances.
- Study of Digital Frequency Meter.
- Phase measurement using C. R. O. Square Wave Testing of amplifiers.
- Study of digital frequency meter.

HS 1303 – P GENERAL PROFICIENCY – III

(0-0-0)