

MMMD 101- Advanced Mathematics

UNIT 1

Linear Algebra: Linear transformation, vector spaces, hash function, Hermite polynomial, Heaviside's unit function and error function. Elementary concepts of Modular mathematics.

UNIT 2

Solution of Partial Differential Equation (PDE) by separation of variable method, numerical solution of PDE (Laplace, Poisson's, Parabolic) using finite difference methods, Elementary properties of FT, DFT, WFT, Wavelet transform, Haar transform.

UNIT 3

Probability, compound probability and discrete random variable, Binomial, Normal and Poisson's distributions, Sampling distribution, elementary concept of estimation and theory of hypothesis, recurred relations.

UNIT 4

Stochastic process, Markov process transition probability transition probability matrix, just and higher order Markov process, Application of Eigen value problems in Markov Process, Markov chain. Queuing system, transient and steady state, traffic intensity, distribution queuing system, concepts of queuing models (M/M/1: Infinity/ Infinity/ FC FS), (M/M/1: N/ Infinity/ FC FS), (M/M/S: Infinity/ Infinity/ FC FS)

UNIT 5

FEM: Variational functionals, Euler Lagrange's equation, Variational forms, Ritz method, Galerkin's method, discretization, finite elements method for one dimensional problems.

Reference Books:

1. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
2. Advance Engineering Mathematics by Ervin Kreszig, Wiley Eastern Edd.
3. Applied Numerical Methods with MATLAB by Steven C Chapra, TMH.
4. Introductory Methods of Numerical Analysis by S.S. Shastri,
5. Introduction of Numerical Analysis by Forberg
6. Numerical Solution of Differential Equation by M. K. Jain
7. Numerical Mathematical Analysis By James B. Scarborough
8. Fourier Transforms by J. N. Sheddon
9. Advance Mathematics for Engr and Sc, Spiegel, Schaum Series, TMH

MMMD 102- Theory of Elasticity & Plasticity

Unit 1

UNSYMMETRICAL BENDING: Product of inertia, transfer equation, transformation of coordinate axis, principal moment of inertia, bending stresses due to unsymmetrical bending of beams of symmetrical and unsymmetrical sections, location of neutral axis, deflection of beams subject to unsymmetrical bending.

Unit 2

SHEAR CENTRE: Location of shear centre for the symmetrical sections such as channel, round and I sections. Shear centre for unsymmetrical sections such as unequal angle, Z and channel sections.

Unit 3

CURVED BEAMS: Bending stresses in beams having initial curvature, location of neutral axis in beams having rectangular, circular, triangular, trapezoidal, I and T sections, variations of bending moment, normal and shear forces in curved beams, crane hooks and chain links, thin rings.

Unit 4

ELEMENTS OF THEORY OF ELASTICITY: Stress components, strain components, equilibrium equations, Generalized Hooks Law, compatibility equations, and stress function equations in Cartesian and Polar coordinate. Plane stress and plane strain problems: Saint Venant's principle use of polynomials. Applications to various cases such as pure bending of narrow beams, bending of prismatic bars, thick cylinders, rotating discs, rotating discs of variable thickness, rotating cylinders. Stress concentration due to a small hole in strained plate.

Unit 5

ELEMENTS OF THEORY OF PLASTICITY: Basic laws of plastic flow, criterion of yield under complex stress, the Von-Mises's yield criterion, the Tresca and Coulomb yield criteria. Rule for plastic flow, condition of plane strain, basic equations for plane strain plasticity, Mohr's circle and physical plane.

Reference Books:

1. MECHANICS OF MATERIAL - K. KUMAR AND GHAI
2. STRENGTH OF MATERIAL - SADIU SINGH
3. THEORY OF PLASTICITY - SADHU SINGH
4. STRENGTH OF MATERIALS (PART - II) - V.C. JINDAL

MMMD 103- Material Science

Unit 1

Crystal Structure of Metals: General review of crystal structure of metals, Molecular structure, crystallographic notation of atomic planes, imperfections in crystals, surface imperfections.

Unit 2

Electronic Theory of Metals: Electron and Bonding. Bonds in crystals and their effect on the properties of metals, Electron structure of atoms, conductors and insulators and semi-conductors.

Unit 3

Deformation of Metals: Dislocation and slip phenomenon, work-hardening and re-crystallization, elastic deformation of metals, atomic basis of elastic behavior. Plastic deformation of Metals, grain boundary, strain hardening. strain aging strain rate.

Unit 4

Elasticity: Thermo-elastic effect, relaxation time, measurement of damping capacity, creep phenomenon, hot and cold working of metals, theories of fracture, fatigue limit and its significance, theory of radiation heat treatment of metals.

Unit 5

Ceramics: Composition, crystal structure, effect of structure on properties. Glass, fabrication of ceramic bodies, reinforced structure.
Polymers: Types, response to change in temperature, elasticity.

REFERENCE BOOKS:

- 1.The structure and properties of metals- Vol.I,III.IV. Wolf Series.
- 2.Element of materials science- Van Vlack.
- 3.Physical Metallurgy Principles- Reed Hill.
- 4.Engg. Material Science- Cidric W. Richards. ,
5. Material Science - Narula

MMMD-104- Theory of Vibration

Unit 1

Review of single degree freedom free, damped and forced vibration isolation, Transmissibility.

Unit 2

Two degree freedom System: Free vibrations. principal modes or vibration various examples such as double pendulum, two rotor system torsional oscillations etc. Undamped forced vibrations with harmonic excitation. Principle of vibration absorbers, Undamped dynamic vibration absorber, tuning of vibration absorber, Torsional vibration absorber system.

Unit 3

Many degrees of freedom systems: Exact analysis. Un-damped free vibrations. Influence numbers and Maxwell's reciprocal theorem, torsional vibrations of multi-rotor system, vibrations of geared systems. Continuous systems: Vibrations of strings, longitudinal vibrations of bars, torsional Vibrations of circular shafts.

Unit 4

Many degree of freedom system Numerical Methods: Rayleigh's method, Dunkerley's method, Stodola's method, Matrix iteration method.

Unit 5

Nonlinear Vibration: Various Examples. Perturbation method, forced vibrations with nonlinear spring forces, Jump phenomenon. Self Excited Vibrations: Elementary idea of stable and unstable oscillations, self excited vibrations caused by dry friction, various examples.

REFERENCE BOOKS:

1. MECHANICAL VIBRATION - GROVER{ G. K.
2. THEORY OF VIBRATIONS - THOMSON W T.
3. MECHANICAL VIBRATION ANALYSIS - SRINIVASAN P.
4. ELEMENTS OF VIBRATION ANALYSIS-LEONARD MEIROVITCH

MMMD-105 Computer Aided Design & Drafting

UNIT I

Fundamentals of CAD, Automation and CAD, Product Cycle & CAD, Introduction to Computer Hardware, Design of Workstation, Graphics terminal, Operator input & output devices, CPU and secondary storage, Introduction to computer software and their applications.

UNIT 2

Curve Fitting: Regression Analysis: Introduction, Linear Regression. Polynomials regression, Fitting exponentials and trigonometric functions (accompanied by their Computer Programs in FORTRAN OR BASIC) Interpolation: Newton's divided difference interpolation, Polynomials, Lagrange's, interpolation, polynomials, spline, interpolation.

UNIT 3

Introduction to Optimization and its Applications: Statement or an optimization problem, Classification of optimization problems, single variable' optimization, multivariable optimization with no constraints, multivariable optimization with inequality constraints, one dimensional minimization methods, elimination methods (Unrestricted Search), exhaustive search (Fibonacci method).

UNIT 4

Computer Graphics: Algorithm for generation of simple drawing elements such as Line, Circle etc, Computer Aided Drafting (AutoCAD)

- a) Creating Drawing: Various drawing command Line P-line Ellipse Circle Area Hatch
- b) Text, Dimension, Limits, Scale, Grid, Layers, Fill, Snap. Trace, Units. Ortho,
- c) Editing Drawing: Various editing commands: Move, Erase, Copy, Zoom, Pan, View, Chamfer, Break. Explode, Extend, Trim, Help. Rotate, Mirror etc.
- d) Other Utilities: Block, Array, Save. Quit. Plot. P-plot
- e) Advanced Features of Autocad: UCS. 3D-line. JD-objects. DXF & DXB files.

REFERENCE BOOKS:

- 1, CAD/CAM by Groovers and Zimmers
- 2. Optimisation and its Application by S,S Rao
- 3. Mastering AutoCAD by J.Omura
- 4. Inside AutoCAD by Raker
- 5. Numerical analysis by Shanta Kumar
- 6, Computer Graphics by D, Hearn and N.P. Baker