Advanced Mathematics
MTSD 101

Unit 1 : Partial Differential Equation
Solution of Partial Differential Equation (PDE) by separation of variable method, Numerical solution of PDE (Laplace, Poisson's, Parabola) using finite difference Methods.

Unit 2 : Matrices And Linear System Of Equations
Solution of linear simultaneous equations by Gaussian elimination and its modification, Crout's triangularization method, Iterative methods-Jacobins method, Gauss-Seidal method, Determination of Eigen values by iteration.

Unit 5 : Calculus Of Variations
Euler-Lagrange's differential equation, The Brachistochrone problems and other applications. Isoperi-metric problem, Hamilton's Principle and Lagrange's Equation, Rayleigh-Ritz method, Galerkin method.

Unit 4 : Fuzzy Logic
Operations of fuzzy sets, fuzzy arithmetic & relations, fuzzy relation equations, fuzzy logics. MATLAB introduction, programming in MATLAB scripts, functions and their
application.

Unit 5 : Reliability
Introduction and definition of reliability, derivation of reliability functions, Failure rate, Hazard rate, mean time t future & their relations, concepts of fault tolerant analysis.

Reference Books:
1. Higher Engineering Mathematics - by Dr. B.S. Grewal; Khanna Publishers
2. Calculus of Variations - by Elsgole; Addison Wesley.
3. Applied Numerical Methods with MATLAB by Steven C Chapra, TMH.
4. Introductory Methods of Numerical Analysis by S.S. Shastry,
5. Calculus of Variations - by Galfand & Fomin; Prentice Hall.
6. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
7. Advance Engineering Mathematics by Ervin Kreszig, Wiley Easten Edd.
8. Numerical Solution of Differential Equation by M. K. Jain
9. Numerical Mathematical Analysis By James B. Scarborogh
10. Fuzzy Logic in Engineering by T. J. Ross
11. Fuzzy Sets Theory & its Applications by H. J. Zimmersoms

Theories of Elasticity and Plasticity
MTSD 102

UNIT-I Introduction: Elasticity - notation for forces and stresses - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis - plane stress - plane strain - differential equations of equilibrium - boundary conditions - compatibility equations - stress function - boundary condition.

UNIT II : Two dimensional problems in rectangular coordinates - solution by polynomials - Saint-Venant's principle - determination of displacements - bending of simple beams - application of corier series for two dimensional problems - gravity loading. Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions - simple symmetric and asymmetric problems - general solution of two- dimensional problem in polar coordinates - application of general solution in polar coordinates.

UNIT III. Analysis of stress and strain in three dimensions - principal stresses - stress ellipsoid - director surface - determination of principal stresses - max shear stresses – homogeneous deformation - principal axes of strain rotation. General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem.

UNIT IV. Torsion of Prismatic Bars - torsion of prismatic bars - bars with elliptical cross sections - other elementary solution - membrane analogy - torsion of rectangular bars - solution of torsion problems by energy method - use of soap films in solving torsion problems - hydro dynamical analogies - torsion of shafts, tubes , bars etc. Bending of Prismatic Bars: Stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section - bending problems by soap film method - displacements.

UNIT V. Theory of Plasticity: Introduction - concepts and assumptions - yield criterions.

REFERENCES

1. Theory of Elasticity by Timeshanko, McGrawhill Publications.
2. Theory of Plasticity by J.Chakarbarthy, McGrawhill Publications.
3. Theory of Elasticity by Y.C.Fung.
4. Theory of Elasticity by Gurucharan Singh.

Optimization Techniques in Structure

MTSD : 103

UNIT I Introduction to Optimization:
Introduction - Historical developments - Engineering applications of Optimization - Statement of an Optimization problem - Classification of Optimization problems - Optimization Techniques. Optimization by calculus: Introduction - Unconstrained functions of a single variable - Problems involving simple constraints - Unconstrained functions of several variables - treatment of equality constraints - Extension to multiple equality constraints - Optimization with inequality constraints - The generalized Newton-Raphson method.

UNIT II Linear Programming:
Introduction - Applications of linear programming - standard form of a linear programming problem - Geometry of linear programming problems - Definitions and theorems - Solution of a system of Linear simultaneous equations - Pivotal reduction of a general system of equations - Motivation of the Simplex Method - Simplex Algorithm - Two phases of the simplex method. non-Linear Programming: Introduction - Unimodal Function - Unrestricted search - Exhaustive search - Dichotomous search - Interval Halving method - Fibonacci method - Golden section method - Comparison of elimination methods - Unconstrained optimization techniques - Direct search methods - Random search methos - grid search method - Univariate method - Powell's method - Simplex method - Indirect search methods - Gradient of a function - Steepest descent method - Conjugate gradient - Newton's method.

UNIT III Dynamic Programming:
Introduction - Multistage decision processes - concept of sub-optimization and the principle of optimality - computational procedure in dynamic programming - example illustrating the Calculus method of solution - example illustrating the Tabular of solution - conversion of a final value problem into an initial value problem - continuous dynamic programming - Additional applications.

UNIT IV Network Analysis:
Introduction - Elementary graph theory - Network variables and problem types -
Minimum-cost route - Network capacity problems - Modification of the directional sense of the network.

UNIT V Application of Optimization techniques to trusses, Beams and Frames

REFERENCES
1. Optimization: Theory and Applications by S.S.Rao.
2. Numerical Optimization Techniques for Engineering Design with applications by G.N.Vanderplaats.
3. Elements of Structural Optimization by R.T.Haftka and Z.Gurdal.
4. Optimum Structural Design by U.Kirsch.
5. Optimum Design of Structures by K.I.Majid.
6. Introduction to Optimum Design by J.S.Arora.

Matrix Analysis of Structures
MTSD 104

Unit I : Introduction of matrix methods of analysis – Static Indeterminacy and kinematic indeterminacy – Degree of freedom co-ordinate system – Structure idealization stiffness and flexibility matrices – Suitability. Element stiffness matrix for truss element, beam element and Torsional element- Element force - displacement equations Element flexibility matrix – Truss, Beam, frame and Torsional element – force Displacement equations.

Unit II :Flexibility method – Strain energy and member forces – Deformation of a Structure Compatibility condition – Analysis of plane pin – jointed truss – continuous beams.

Unit III :Stiffness method – member and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames Direct stiffness method for continuous beams and simple frames. Stiffness method – development of grid elemental stiffness matrix – coordinate transformation. Examples of grid problems – tapered and curved beams – idealizing the beam stiffness solutions – curved beam element stiffness matrix.

Unit IV :Additional topics in stiffness methods – discussion of band width – semi band width – static condensation – sub structuring – inertial and thermal stresses- Beams on elastic foundation by stiffness method. Multi-storied frames – shear walls necessity – structural behavior of large frames with and with out shear wall – approximate methods of analysis of shear walls – tall structures – limitation of rigid frames with and without shear walls Different types of very tall frames.

Unit V :Space frames – Analysis of in filled frames in tall building – Secondary effects in the analysis of tall building - effects of axial deformations – effect of shearing forces in the analysis of shear wall.

REFERENCES:

1. Matrix analysis of structures- Robert E Sennet- Prentice Hall- Englewood cliffs-New Jercy
2. Advanced structural analysis-Dr. P. Dayaratnam- Tata McGraw hill publishing company limited.
3. Indeterminate Structural analysis- C K Wang
4. Matrix methods of structural Analysis – Dr. A.S. Meghre & S.K. Deshmukh – Charotar publishing hour.
5. Analysis of tall buildings by force – displacement – Method M.Smolira – Mc. Graw Hill.
6. Foundation Analysis and design – J.E. Bowls.

Advanced Concrete Technology
MTSD 105

UNIT-I

Concrete Making Materials : Cement – Bogue's Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alkali Silica Reaction – Admixtures – Chemical and Mineral Admixtures.

UNIT-II

Fresh And Hardened Concrete: Fresh Concrete – workability tests on Concrete – Setting Times of Fresh Concrete – Segregation and bleeding. Hardened Concrete: Abrams Law, Gel space ratio, Maturity concept – Stress strain Behaviour – Creep and Shrinkage – Durability of Concrete – Non Destructive Testing of Concrete.

UNIT – III

High Strength Concrete – Microstructure – Manufacturing and Properties – Design of HSC Using Entroy Shaklok method – Ultra High Strength Concrete. High Performance Concrete – Requirements and Properties of High Performance Concrete – Design Considerations

UNIT – IV

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete – Reactive Powder Concrete – Bacterial Concrete - Requirements and Guidelines – Advantages and Applications.

Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit - Mix Design Method – BIS Method – DOE Method – Light Weight Concrete, Self Compacting Concrete.

UNIT – V

Form work – materials – structural requirements – form work systems – connections – specifications – design of form work – shores – removal of forms - shores – reshoring – failure of form work.

REFERENCES:

1. Special Structural concretes by Rafat Siddique, Galgotia Publications 2000.
2. Design of Concrete Mixes by N.Krishna Raju, CBS Publications, 2000.
3. Concrete: Micro Structure by P.K.Mehta, ICI, Chennai.
4. Properties of Concrete by A.M.Neville, ELBS publications Oct 1996.
5. Concrete Technology by A.R. Santhakumar, Oxford University Press
6. Concrete Technology by M.S.Shetty, S.Chand & Co 2009.
7. Concrete Technology by M.L. Gambhir, Tata McGraw-Hill Publishing Company Limited.
8. Building Construction by J.K.Mckay, Pearson Publications.