



SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Course: M. Tech.
Academic Session: 2024-25

Branch: Structural Engineering

Semester: Ist
w.e.f - Date-02-09-2024

MSE101 Advance Mathematics and Numerical Analysis

Course Contents

Course Objectives:

1. Strengthen understanding of advanced mathematical topics such as linear algebra, real analysis, and complex analysis.
2. Introduce and develop numerical techniques for solving equations, integrating functions, and approximating solutions to differential equations.
3. Teach students how to analyze and minimize errors in numerical computations, including concepts of convergence and stability.

UNIT -I

Numerical solution of Partial Differential Equation (PDE): Numerical solution of PDE of hyperbolic, parabolic and elliptic types by finite difference method.

UNIT -II

Integral transforms: general definition, introduction to Mellin, Hankel and Fourier transforms and fast Fourier transforms application of transforms to boundary value problems in engineering.

UNIT -III

Integral equations: Conversion of Linear Differential equation (LDE) to an integral equation (IE), conversion of boundary value problems to integral equations using Greens function, solution of Integral equation, IE of convolution type, Abeles IE, Integral differential equations, IE with separable variable, solution of Feedhole Equation with separable kernels, solution of Freehold and Valera equations by method of successive approximations.

UNIT -IV

Calculus of Variation: Functional and their Variational, Euler's equation for function of one and two independent variables, application to engineering problems.

UNIT -V

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

Course Outcome: After completion of the course student will be able for

CO1 -Analyze and asses the accuracy of common numerical methods.

CO2- Apply numerical methods to obtain approximate solutions to mathematical problems.

CO3- Create programming code and present numerical results in an informative way..

CO4 -Apply the principles and techniques of brittle coating analysis Understand the fundamentals of the theory of elasticity

CO5 - Obtain numerical solution of ordinary and partial differential equations

Reference Books:

1. CF Froberg, Introduction to numerical analysis.
2. SS Sastry, Introductory methods of numerical analysis
3. Krasnove, Kiselevanded Makarenho, Integral equations
4. Buchanan, Finite element Analysis (schaum Outline S), TMH
5. Krishnamurthy, Finite element analysis, TMH
6. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
7. Advance Engineering Mathematics by Ervin Kreszig, Wiley Easten Edd.
8. Applied Numerical Methods with MATLAB by Steven C Chapra, TMH
9. Numerical Methods in engineering, Salvadori and Baron.
- 10.Theory and problems of Numeric analysis (Schaum Outline S), Schied, TMH



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MSE102 Strength of material and theory of elasticity

Course Contents

Course Objectives:

1. Understand the basic principles of stress, strain, and their relationships in materials.
2. Analyze different material properties such as elasticity, plasticity, and yield strength.
3. Evaluate how materials respond to various types of loads, including tensile, compressive, and shear forces.
4. Utilize stress-strain curves to determine the behavior of materials under various loading conditions.

UNIT-I

Plane Stress & Plane Strain: Plane Stress, Plane Strain, Stress and Strain at a points, Differential equations of equilibrium, constitutive relation : anisotropic materials Linear elasticity; Stress, strain, constitutive relations; Boundary conditions, Compatibility equation, stress function.

UNIT-II

Two Dimensional Problems in Rectangular Co-ordinates: Solutions by Polynomials , Saint-Tenants Principle, Determination of displacements, bending of beams, solution of two dimensional problem in Fourier series.

UNIT-III

Two Dimensional Problems in Polar Coordinates : General equations in Polar coordinates, Pure bending of curved bars, displacements for symmetrical stress distributions, bending of curved bar, stress distribution in plates with circular holes, stresses in a circular disc general solution.

UNIT-IV

Analysis of stress and strain in Three Dimensions : Principal stress and strain, shearing stress and strains, elementary equation of equilibrium , compatibility conditions, problems of elasticity involving pure bending of prismatic bars.

UNIT-V

Torsion of Prismatic Bars : Torsion of prismatic bars, membrane analogy, torsion of a bar of narrow rectangular cross section, torsion of rectangular bars, solution of torsional problem, torsion of rolled section, torsion of hollow shafts and thin tubes, torsion buckling torsional flexural buckling.

Course Outcome:

- CO1- Interpret the theory of elasticity including strain/displacement and Hooke's law relationships.
- CO2- Analyze principal stresses and strains using theories of failure.
- CO3- Analyze the two-dimensional problems using Airy's stress function.
- CO4- Explain linearly elastic bodies behavior using Hooke's law.
- CO5- Be able to analyze real problem and to formulate the conditions of theory of elasticity Applications.

References Books:

1. Timoshenko, S.P. , Theory of Elasticity
2. Timoshenko, S.P., Theory of Elastic Stability
3. Iyenger N.G.R., Structural Stability of Columns & Plates



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MSE103 Advance Structural Analysis

Course Contents

Course Objectives:

1. Combine classical methods of Structural Analysis with programming and commercial software.
2. Determine deflections and forces in statically determinate and indeterminate structures using force and stiffness methods.
3. Use a physical interpretation of stiffness matrices to assemble stiffness matrices analytically.
4. Write and use computer programs which implement the matrix stiffness method.

UNIT-I

Matrix Method (Flexibility Method): Force methods, Basic Concepts, evaluation of flexibility, transformation, analysis of a single member of different types, transformation of single member.

UNIT-II

Applications to plane and space structures with pin joints and rigid joints, energy approach in flexibility method, effect of support displacement and transformation.

UNIT-III

Matrix Method (stiffness Method): Displacement methods, Basic concepts, Evaluation of stiffness coefficients, Direct stiffness method, energy approach in stiffness method. Code No. approach for global stiffness matrix, effect of support displacement and temperature.

UNIT-IV

Symmetrical & anti-symmetrical problems, Stiffness of plane & space frames solution of problems, comparison of force and displacement methods of solution.

Course Outcome: After completion of the course student will be able for

CO1- Apply basic concepts of structural analysis for analyzing beams and trusses.

CO2- Analyze indeterminate structures using moment distribution method.

CO3 -Analyze the indeterminate structures using flexibility matrix method.

CO4 -Analyze the indeterminate structures using stiffness matrix method.

Reference Books:

1. C.S. Reddy , Basic Structural Analysis ,TMH, Publishers
2. W Wearer Jr. & James M. Gere, Matrix Analysis of Framed Structures, CBS Pub.
3. Rajsekeran, Sankarsubramanian, Computational structural Mechanics, PHI
4. Pandit, Structural Analysis: a matrix approach, TMH



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MSE104 Design of Concrete Structures

Course Contents

Course Objectives:

1. To introduce the students to the fundamentals of reinforced concrete design with emphasis on the design of rectangular and T beams,
2. Short and slender columns, slabs, and footings and foundations.
3. In addition, student will learn how to analyze and design reinforced concrete structural members under bending, shear.
4. Axial loads according to the ACI building code requirements (including computer applications).

UNIT-I

Earthquake and wind effects on structures, loads on structures, reinforced concrete design of flat slabs, grid floors, deep beams, design of buildings load bearing and framed structures, design of foundations, seismic analysis.

UNIT-II

Design of ground and elevated water tanks, design of bridge decks.

UNIT-III

Pre-stressed concrete: analysis and design of sections under flexure using limit state approach, anchorage zone and end block design, composite construction, introduction to statistically indeterminate pre-stressed concrete structures.

UNIT-IV

Silos and bunkers, Janseens and Airys theory, rectangular bunkers with sloping bottoms and with high side walls, battery of bunkers.

UNIT-V

Earthquake resistant Design and detailing Ductility of reinforced concrete members, Design principles and code provisions, Detailing of reinforcement in slab, beams, columns foundations, walls and junctions.

Course Outcome:

- CO1- Estimate the deflection of Concrete beams and slabs
- CO2- Analyze and design concrete members subjected to fire
- CO3- Examine the structures for earthquake forces
- CO4- Understand the thermal effect on concrete members
- CO5 -Apply codal provisions for ductile detailing of flexural members

Reference Books:

1. Jaikrishna, Chandrasekaran, Elements of earthquake engineering.
2. Shah and Karve, Text book of reinforced concrete
3. Punamia, RCC designs
4. IS-456, -875, -1893, -1984
5. Krishna Raju, Prestressed concrete.
6. Varghese, Advanced RC Designs, PHI
7. Everard, Theory and problems of RC design (Shaum's Outline S), TMH



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MSE105 Computer Aided Design

Course Contents

Course Objectives:

1. Introduce the fundamental concepts of CAD, including its history, applications, and advantages in design processes.
2. Develop proficiency in popular CAD software tools (e.g., AutoCAD, SolidWorks, Rhino) through hands-on practice and project-based learning.
3. Discuss the role of CAD in promoting sustainable design practices and ethical considerations in the field of design.

UNIT-I

C++ programming language: Basics of programming, loops, decisions, structures, functions, objects/classes, arrays.

UNIT-II

Overloading, inheritance, virtual functions and pointers, object oriented programming, Turbo C++ features and programming, structure engineering problems programming.

UNIT-III

Computer Aided drafting, 2-D and 3-D drawings, Introduction to CAD software, drawing of buildings.

UNIT-IV

Introduction to computer graphics, 3-D modeling software and analysis software.

UNIT-V

Submission / Working Drawing : Generation of line plan, Detailed Plan, elevation, section, site plan, Area statement, Generation of 2D view and print commands, Introduction to Auto Civil.

Course Outcome :

CO1- Develop Computer Programs for Analysis and Design of various Structural Elements

CO2 -Use different Structural Engineering software's to solve various civil Engineering programs

CO3- Determination of mode shapes and frequencies of tall buildings using lumped mass (stick model) approximation

CO4- Analysis Computer Aided drafting, 2-D and 3-D drawings, Introduction to CAD software

CO5 -Introduction to computer graphics, 3-D modeling software and analysis software

Reference Books:

1. Robert Lafore, Object oriented programming in CPP
2. E. Balaguruswamy, Programming in C
3. Syal and Gupta, Computer programming and engineering analysis.
4. AutoCAD, Solid Edge, Cad lab software and Manuals.



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MSE106P Lab-I Concrete Lab

Course Contents

List of Experiments:

Laboratory work shall be based on the topics of Advanced Concrete and as per the facility available in the institution.

1. To study and perform the important physical tests on various types of cement.
2. To study and perform the important physical tests on fine aggregates.
3. To study and perform the important physical tests on coarse aggregates.
4. To study and perform the physical tests on reinforcement steel bars.
5. To study and perform the various tests on fresh and hardened concrete.
6. To carry out the mix design of concrete as per IS 10262:2019 or latest version.
7. To carry out the mix design of special concretes such as:

High strength concrete (HSC) (such as M40, M50 and so on)

Self compacting concrete (SCC)

Pump able concrete

Mass concrete

OPC with fly ash

OPC with GGBS

OPC with industrial or agricultural wastes

Reference Books:

1. Neville A.M., Properties of Concrete, Pearson Education
2. SP23, Handbook on Concrete Mixes, Bureau of Indian Standards, New Delhi.



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MSE107P Lab-II CAD Lab

Course Contents

Introduction and important features of software dealing with analysis and design of structures.

The following structures has to be performed using various analysis and design software's or any open source software's as per the facility available in the institution.

1. Analysis and design of various types of beams subjected to different loadings.
2. Analysis and design of slabs
3. Analysis and design of plane frames with different support conditions.
4. Analysis and design of multi-storey frames.

References Books:-

1. AutoCAD 2000 Complete – et. al. (BPB Publications)
2. An introduction to AutoCAD 2000 – A. Yarwood (Pearson Educations)