M. Tech. (Structural Engg.) 1st Semester

(w.e.f. Dec-2024) CBCS Scheme

Examination, December 2025

ADVANCED STRUCTURAL ANALYSIS

Paper : 24MTSE21C1

Time allowed : 3 Hours] *[Maximum marks : 100*

Note: ***Question No. 1 is compulsory.*** *Attempt* ***one*** *question from each section. All questions carry equal marks.*

1. (i) Differentiate between DOF and DOR.
   (ii) What are the different types of element shapes used in finite element methods?
   (iii) What is the physical significance of influence coefficients?
   (iv) What do you mean BVP?
   (v) Why do we use stiffness matrix? 5×4=20

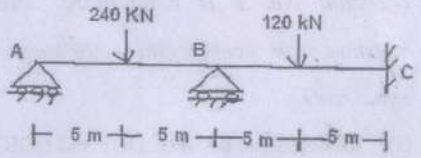
Section-A

2. What is the effect of settlement and temperature on influence coefficient? What are the various approaches for analysis of structure? 20

3. Write step by step procedure of stiffness matrix in the analysis of continuous prismatic beam ABC fixed at A and simply supported at B and C with UDL load (W) over the entire span.
Assume support B is mid span and C at end. 20

Section-B

4. Using stiffness method analyze the beam as shown in Fig. 1. 20



EI = constant **Fig.1.**

5. Analyze the portal frame ABCD shown in Figure 2 by stiffness method and also draw the bending moment diagram. 20

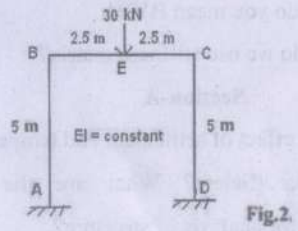


Fig.2.

Section-C

6. Analyze the frame shown in Figure 3 by stiffness method. Assume EI constant. 20

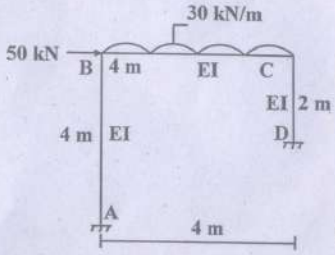


Fig.3.

7. Briefly explain different types of coordinate systems with neat sketches in matrix analysis. Also discuss Modified Galerkin method. 20

Section-D

8. Discuss the solution of Poisson's equation for a linear bar element with suitable example. 20

9. Briefly explain different types of coordinate systems with neat sketches in matrix analysis. 20

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M. Tech. (Civil Engg.) 1st Semester
(Specialization in Structural Engg.)
Examination, December 2025
ADVANCED STRUCTURAL ANALYSIS
Paper : CE-611/MTSD-102

Time allowed : 3 Hours *[Maximum marks : 100*

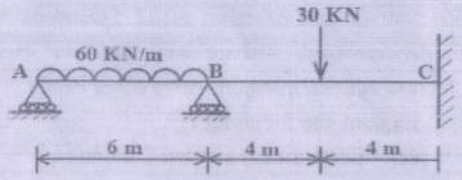
Note: *Attempt **five** questions in all. **Questions No. 1 is compulsory.** Attempt **one** question from each section. All questions carry equal marks.*

1. Explain the following : 10×2=20
   (a) Eccentrically Loaded Column
   (b) Under balanced section
   (c) Ultimate load condition
   (d) Stress block parameters
   (e) Development length of deformed bars
   (f) Name of the codes used for designing earthquake resistant structures.
   (g) Use of SP-16 in structure design
   (h) Ultimate nominal shear stress
   (i) Membrane theory
   (j) Shear connectors

Section-A

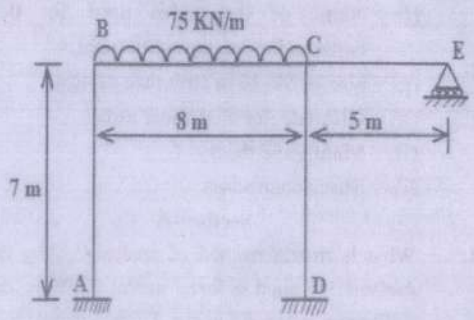
2. What is matrix method of analysis? Why flexibility method is called a force method? Write down the difference between force and displacement method.20

3. Analyze the continuous beam shown by flexibility method in which support reaction at A and B are treated as the redundant. Hence calculate the bending moment at B. Assume flexural rigidity EI as constant for all the beams. 20

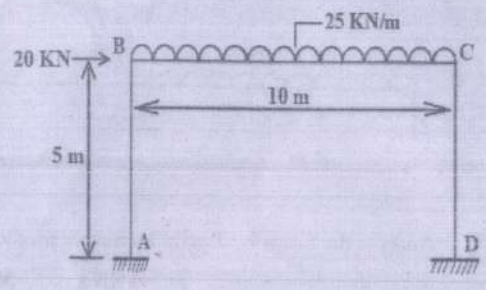


Section-B

4. Using stiffness matrix method, analyse the frame. Take EI constant through out. 20



5. Analyze the rigid frame shown in figure below by flexibility matrix method. 20



Section-C

6. (a) List the properties of stiffness matrix. Also write down the difficulties with direct stiffness method of formulation. 10

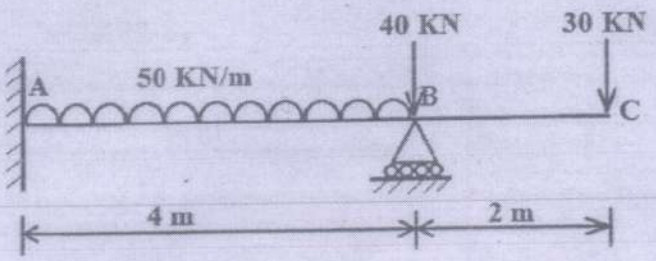
   (b) Write down the relationship between stiffness matrix and flexibility matrix. 10

7. (a) How do the flexibility and stiffness matrices depend on static and kinematic indeterminacies? 10

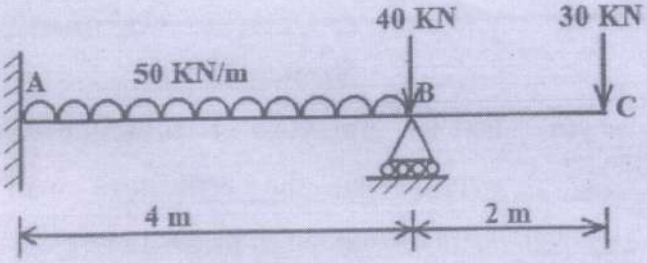
   (b) Write down the difference between flexibility and stiffness matrix. 10

Section-D

8. Analyze the beam by stiffness matrix method. 20



9. Analyze the beam by flexibility matrix method. 20



M.Tech. 1st Sem. (Structural Engg.) (w.e.f. Dec-2024)
CBCS Scheme Examination, December-2025
ADVANCED SOLID MECHANICS
Paper-24MTSE21C2

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions in all, by selecting **one** question from each Section. **Question No. 1 is compulsory.** Each question carries equal mark. Assume suitable data if missing.*

1. Explain the following: 5×4=20

(i) Explain about components of strain at a point.

(ii) What is Airy's stress function?

(iii) Explain Saint-Venant's principle with example.

(iv) Explain the term uniqueness of solution.

(v) Explain Center of twist.

Section–A

2. (a) Derive the differential equation of equilibrium in terms of displacement components for plane stress problem in the presence of body forces. 10

(b) What are the Cartesian and Curvilinear Tensor? 10

3. (a) Obtain the compatibility equation for plane stress problem in Cartesian form. 10

(b) Elaborate the elementary concept of stress and strain at a point. 10

Section–B

4. (a) Derive the compatibility conditions for the two-dimensional Cartesian coordinates. 10

   (b) What is stress function (φ) ? Show that $\nabla^4 \phi = 0$. 10

5. Discuss the various stress cases obtained by taking third order polynomial as Airy's stress function. 20

Section–C

6. Write the simple bending equation for symmetrical cross-sections of a beam and discuss the assumptions followed in the bending equation. Write about membrane analogy theory. 20

7. Explain and derive the equation for the Prandtle's membrane analogy applied to a narrow rectangular section. 20

Section-D

8. Explain in detail about Strain hardening and Isotropic hardening. Explain how the strain hardening of the material will occurs in detail. 20

9. Generalize the constitutive relations in theory of elasticity problems. Also explain idealized stress strain curve. 20

M. Tech. (Structural Engg.)1st Semester

(w.e.f. Dec-24) CBCS Scheme

Examination, December-2025

THEORY OF THIN PLATES AND SHELLS

Paper : 24MTSE21C3

Time allowed : 3 Hours] *[Maximum marks : 100*

Note : Q No . 1 is compulsory. Attempt **one** question from each unit. All questions carry equal marks.

1. (i) What are the merits and demerits of plates ?
   (ii) Give a brief account of classification of plates.
   (iii) Briefly explain about the types of shells.
   (iv) Levy's solution for rectangular plate.
   (v) Give the differential relations of the conditions of compatibility. 5×4=20

Section-A

2. Write short notes on. 20
   (i) Ruled surface
   (ii) Shells of translation
   (iii) Shells of revolution with sketches
3. (a) Discuss space curves and spaces. 2×10=20

(b) Explain the bending and membrane theories for analysis of shells.

Section-B

4. Derive the general solution for simply supported rectangular plates. Obtain the maximum deflection. What happens if the plate is square of side a? 20

5. Find the deflection equation for a plate subjected to hydrostatic pressure use Levy's basic equation for calculating deflection. 20

Section-C

6. Obtain the expression for deflection in case of uniformly loaded circular plate with clamped edges by Rayleigh-Ritz method. 20

7. Derive the differential equations for plate subjected to cylindrical bending. 20

Section-D

8. Write the structural components of cylindrical shells with neat sketch mention the various loads acting on the shell. 20

9. Derive the governing differential equation for the membrane analysis of shells of double curvature. 20

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M Tech. (Structural Engg.) 1st Semester

(w.e.f. Dec-2024) CBCS Scheme

Examination, December 2025

ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING

Paper : 24MTSE21C4

Time allowed : 3 Hours] *[Maximum marks : 100*

Note: *The students have to attempt **five** questions in total, **Q. No. 1 being compulsory** and selecting **one** from each unit. All questions carry equal marks.*

1. (a) If number N is correct up to 3 significant digits, then what will be the maximum relative error. 20

(b) If $y = ae^{bx}$ can be written in linear form $Y = A + BX$, what are Y, A, B and X.

(c) Find the iterative formula of the Newton Raphson Method to find the approximated value of the irrational number $\sqrt{2}$.

(d) State Intermediate value Theorem. Also define Transcendental Equation.

(e) Write the name of direct and iterative methods to solve linear system of equation.

(f) Define Interpolation and extrapolation along with suitable example.

(g) Define Euler's Method and Taylor Series Method.

(h) Write the finite difference approximation to partial derivatives in x and y directions.

Unit-I

2. (a) If $R = \frac{4xy^2}{z^3}$ and error in x, y, z be 0.001. Find the maximum relative error at $x \approx y \approx z = 1$ 10

(b) Fit a straight line by method of least square to the following data : 10

x :	1.0	2	3	4	5
$f(x)$:	14	27	40	55	68

3. (a) Find the real root of $xe^x - 2 = 0$ correct to three decimal places using Newton Raphson method. 10

(b) If $f(-4) = 1245, f(-1) = 33, f(0) = 5, f(2) = 9, f(5) = 1533$, find the Lagrange interpolating polynomial. 10

Unit-II

4. (a) By Gauss-elimination method solve the system of linear equations : 10

$x + 4y - z = -5,\ x + y - 6z = -12,$

$3x - y - z = 4.$

(b) Solve the system by using iterative method : 10

$54x + y + z = 110,\ 2x + 15y + 6z = 72,$

$-x + 6y + 27z = 85$

5. Determine the largest eigenvalue of the following matrix A, starting with the initial vector : 20

$[1 \quad 1 \quad 1]^T$ where $A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix}$

Unit-III

6. Evaluate $\int_0^1 e^x dx$ by taking number of subinterval $n = 5$ 20

(i) Trapezoidal rule

(ii) Simpson 1/3 rule

(iii) Sampson 3/8 Rule

Also find the error in each case with exact solution.

7. (a) Solve $\frac{dy}{dx} = x^2y - 1,\ y(0) = 1\ by$ Tayler's series method. Hence find the values of y at $x = 0.1$ and $x = 0.2$ to five places of decimals. 10

(b) Using Runge-Kutta method of fourth order, find approximate value of y for $x = 0.2$ taking $h = 0.2$, if $\frac{dy}{dx} = x + y^2$, given that $y(0) = 1$. 10

Unit-IV

8. (a) Derive standard five-point formula and diagonal five-point formula for Laplace equation using finite difference approximations. 10

(b) Solve the boundary value problem $y'' = y + x, y(0) = 1$ and $y(1) = 0$ using the method of finite deference with $h = 0.25$ 10

9. Discuss the solution of one dim Heat flow $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial^2 x}$ by Schmidt method and Cranck-Nicholson Method. 20

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M. Tech. (Structural. Engg.)1st Semester

(w.e.f. Dec. 2024)-(CBCS Scheme)

Examination, December-2025

ADVANCED. STEEL DESIGN

Paper : 24MTSE21C5

Time allowed : 3 Hours] *[Maximum marks : 100*

Note : Question No. 1 is compulsory. Each question carries equal marks (20 marks). Students have to attempt **five** questions in total at least **one** question from each section. Assume suitable data if missing. IS : 800 & IS : 808 is allowed.

1. (i) What are the load combinations for the design purposes?

(ii) Explain about web buckling.

(iii) Write short notes on column splices.

(iv) What is the significance of shear lag?

(v) Discuss P-effect. 5×4=20

Section-A

2. Can structural elements fail in a brittle manner? Give examples. There are three design philosophies for designing steel structures- The working stress, the ultimate method, and the lim . state. In what sense limit state method of design is more rational. 20

3. An I–section beam is fabricated with plates of following dimensions :
Flange: 380×20mm,
Web: 1600×15mm.
Classify flanges, web and the section. Also determine the plastic moment capacity of the beam about its strong axis, if the grade of steel is Fe 410. 20

Section-B

4. Design a steel column using single rolled I-section to carry an axial load of 850 kN. Both of the columns are restrained against translation and rotation. The actual length of column between intersections is 6 m. The yield stress of steel is 250 MPa. 20

5. Describe in detail about the following: 20
(i) Compression member
(ii) Wall Studs

Section-C

6. How first-order plastic analysis does differ from the second-order inelastic analysis? Why are restraints required in members designed by plastic method? 20

7. A steel column is of 4 m height with both of its ends restrained against translation and rotation, it is built up of an ISHB 400 @ 822 N/m with two cover plates of 420×20 mm size one on each flange connected by fillet welds along the length of flanges. The yield stress of steel is 340 MPa. Determine the design strength of the column assuming gross area of section is effective insisting compression. 20

Section-D

8. Design a slab base for a column ISHB300 @ 630 N/m to carry an axial factored load of 1100 kN. Assume Fe410 grade steel and M20 grade concrete is used to provide welded connection between column and base plate. 20

9. Explain the following in detail: 20
(a) Biaxial bending
(b) PM interaction

M. Tech. (Structural Engg.)1st Semester

(CBCS Scheme) Examination, December-2025

ADVANCED STEEL DESIGN

Paper : 22MTSE21C5

Time allowed : 3 Hours] *[Maximum marks : 100*

Note : Question No. 1 is compulsory. Each question carries equal mark (15 marks). Students have to attempt 5 questions in total at least one question from each section. Assume suitable data if missing. IS: 800 & 808 is allowed

1. (i) Explain fully plastic moment capacity

5×4=20

(ii) Discuss Local buckling of elements and post buckling of elements.

(iii) Explain the two main types of moment-resistance connections?

(iv) Write about Principles of plastic analysis

(v) State the condition to be satisfied in order to use elastic method of analysis as per IS 800.

Section-A

2. (a) Discuss inelastic bending curve. 10

   (b) Differentiate between compactness and non-compactness. 10

3. What are the design criteria for stability of steel structure? Also discuss drift and strength criterion.20

Section-B

4. Determine the bending strength of ISMB 450 considering the beam to be laterally unsupported. Assume low shear case and take the grade of steel Fe 410. 20

5. What are the various possible mode of failure for compression member? Determine the design axial load capacity of the column ISMB300@577 N/m, If the length of the column is 3m and its both ends pinned. 20

Section-C

6. Discuss the flowing method:

   (a) Plastic design in detail. 10

   (b) Splices 10

7. Design a built up column of length 10 m carrying an axial factored load of 1400 KN. The column may be restrained in position but not in direction at both ends. Design battens instead of lacing system. 20

Section-D

8. Explain the following in detail:

   (a) Derive the moment curvature relationship in plastic analysis. 10

   (b) Joint Panel Zone 10

9. A column 6 m long is to support a load 2500 kN. The ends of the column are effectively held in position and direction. Design the column using deformation- based design if rolled steel beams and 16 mm plates are only available. 20