

23796

M.Tech. (Structural Engg.) (w.e.f. Dec-2024)

CBCS Scheme 1st Semester

Examination, December-2024

ADVANCED STRUCTURAL ANALYSIS

Paper - 24MTSE21C1

Time allowed : 3 hours]

[Maximum marks : 100

Note : (i) Question No. 1 is compulsory.

(ii) Attempt one question from each section.

(iii) All questions carry equal marks.

1. (i) What is static and kinematic indeterminacy?
- (ii) Explain briefly about flexibility matrix method of Analysis.
- (iii) Application of stiffness matrix for frame.
- (iv) List the direct methods for solving linear equations.
- (v) What do you mean by Boundary conditions?

5×4=20

Section-A

2. Derive the stiffness influence coefficients of prismatic cantilever beam AB under UDL load subjected to unit displacement at free end B. 20

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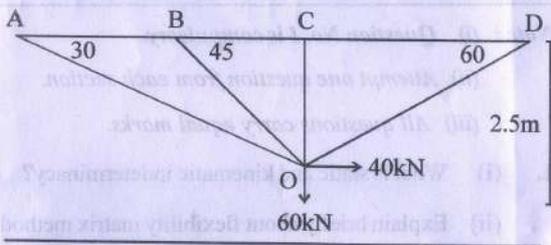
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3. Explain local and global stiffness matrix for a simple truss member with example. 20

Section-B

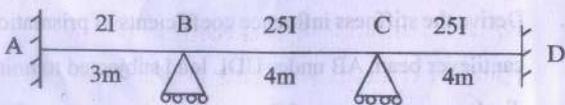
4. Analyse the pin jointed truss frame shown in following Figure by stiffness matrix. Assume cross sectional area of each member 1000mm^2 , $E=2 \times 10^5 \text{ N/mm}^2$. 20



5. Explain the step-by-step procedure for stiffness matrix method by giving example. 20

Section-C

6. Analyse the continuous beam shown in Figure, if the support B sinks by 10mm. Use Displacement method. Assume $EI = 6000 \text{ kN-m}^2$. 20



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7. Briefly explain the following :
(i) List of coordinate system used in FEM
(ii) Types of boundary conditions 20

Section-D

8. Derive shape function of one- and two-dimensional linear element (Use Matrix method). 20
9. What are the different types of element shapes used in finite element methods and explain with neat sketches. 20

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

Examination, December - 2024

ADVANCED STRUCTURAL ANALYSIS

Paper - 22MTSE21C1

Time allowed : 3 hours]

[Maximum marks : 100

Note : Question No. 1 is compulsory. Students have to attempt five questions in total selecting at least one question from each unit. All questions carry equal marks.

1. Write short note on :

(i) Stiffness influence coefficients

(ii) Explain sub-structuring.

(iii) Shape functions

(iv) Load Vector

(v) Semi bandwidth

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Unit - I

2. Write short note on :
- (i) Lack of fit
 - (ii) Member Approach
 - (iii) Physical Significance of Influence Coefficients
3. (i) What is meant by sub-surfacing? Explain briefly with examples.
- (ii) How matrices can be transferred from local to global coordinates of elements' stiffness?

Unit - II

4. If member 2 of the framed structure shown in Fig. 1 is shortened by 0.01 m. Determine the force in members. Assume $AE = 8 \times 10^6$ N.

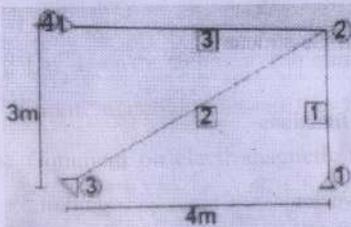


Fig.1.

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5. A two-span continuous beam is shown in Fig. 2. The moment of inertia is constant throughout. Analyse the beam by stiffness matrix method.

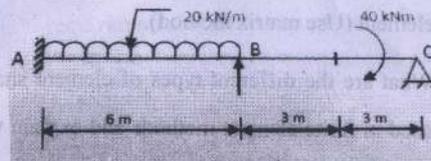


Fig. 2.

Unit - III

6. (a) Explain the approximate solution of boundary value problems.
- (b) Describe the matrix formulation of the Modified Galerkin Method.
7. A stepped bar is subjected to an axial load of 200 kN at the place of change in cross-section as shown in Fig. 3. Find Reaction forces and induced stresses in elements 1 and 2.

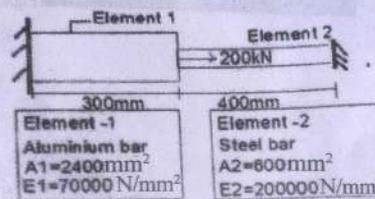


Fig 3.

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Unit - IV

8. (a) Derive shape function of one-dimensional linear element (Use matrix method).
- (b) What are the different types of element shapes used in finite element methods and explain with neat sketches.
9. Analyze the truss shown in Fig. 4 below by flexibility matrix methods. Also, evaluate the support reactions.
 $E = 200 \text{ kN/mm}$.

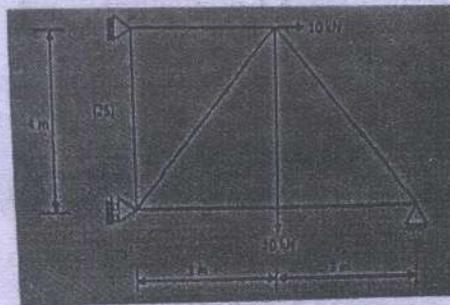


Fig.4.

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M.Tech. 1st Semester (Structural Engg.) CBCS Scheme
Examination, November-2023

ADVANCED STRUCTURAL ANALYSIS

Paper-22MTSE21C1

Time allowed : 3 hours] [Maximum marks : 100

Note : Question No. 1 is Compulsory. Attempt one question from each unit. All questions carry equal marks.

1. (i) What do you mean by influence coefficients ?
- (ii) Why do we use stiffness matrix ?
- (iii) What do you mean by Boundary conditions ?
- (iv) Define Shape function.
- (v) Application of stiffness matrix for grids.

5×4=20

Section-A

2. What is physical significance of influence coefficient ? What are the various approaches for analysis of structure ?

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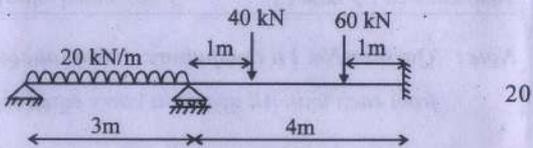
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3. Differentiate between local coordinate and global coordinates with suitable examples. 20

Section-B

4. Using stiffness method analyze the beam shown in Fig.



5. Discuss various steps to followed while analyzing structure by stiffness method. 20

Section-C

6. Solve the boundary value problem

$$x^2y'' - 2xy' + 2y - 2x^3 = 0, \quad y(1) = 4, \quad y'(2) = 3$$

given that $\{x, x^2\}$ is a fundamental set of solutions of the complementary equation. 20

7. What do you mean by Boundary Value Problems (BVP)? Explain any one method in detail. 20

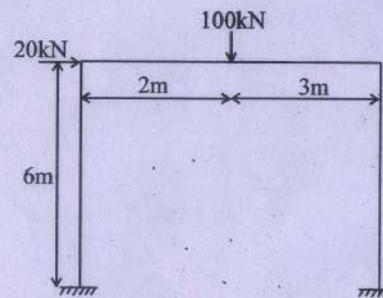
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Section-D

8. Discuss the solution of Poisson's equation for a linear bar element with suitable example. 20
9. Analyze the frame shown in Figure by any of suitable method. 20



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M.Tech. 1st Semester Civil Engg. (Specialisation in
Structural Engg.) Examination, December-2024

ADVANCED STRUCTURAL ANALYSIS

Paper-CE-611/MTSD-102

Time allowed : 3 hours] [Maximum marks : 100

*Note : Attempt any five questions. All questions carry
equal marks.*

1. (a) Briefly explain different types of coordinate system with neat sketches in matrix analysis.

(b) What are the different types of element shapes used in finite element methods and explain with neat sketches ?
2. Generate the stiffness matrix and obtain the load vector for the gable frame shown in Fig. 1.

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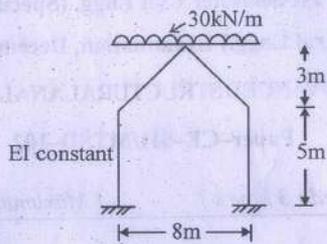


Fig. 1.

3. Analyze the frame shown in Fig. 2 by using flexible method.

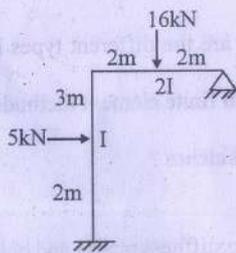


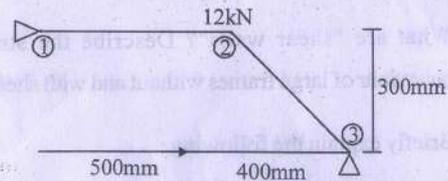
Fig. 2.

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4. For the two-bar truss element shown in Fig. 3 determine the displacement at Node 2 and stresses in the elements. Assume cross sectional area of each member $A = 200 \text{ mm}^2$ and $E = 70 \text{ GPa}$.



Assume c/s area $A = 200 \text{ mm}^2$ $E = 70 \text{ GPa}$

Fig. 3.

5. Develop the stiffness matrix for the continuous beam ABCD with an internal hinge at B, as shown below in Fig. 4.

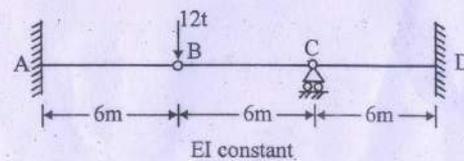


Fig. 4.

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6. (a) Write the steps to develop stiffness matrix for indeterminate plane frames.
- (b) Explain the significance of proper-node numbering when analyzing by matrix methods.
7. What are "shear walls"? Describe the structural behaviour of large frames without and with shear walls.
8. Briefly explain the following :
- (i) List of coordinated system used in FEM.
 - (ii) Types of boundary conditions.
 - (iii) Local of Global co-ordinates
 - (iv) Semi-bandwidth

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M.Tech. 1st Semester Civil Engg. (Specialisation in
Structural Engg.) Examination, November-2023

ADVANCED STRUCTURAL ANALYSIS

Paper-CE-611/MTSD-102

Time allowed : 3 hours] [Maximum marks : 100

*Note : Attempt any five questions. All questions carry
equal marks.*

1. (a) Derive the expression for transformation of stiffness matrix from local to Global co-ordinates.
- (b) What is a shear wall. Discuss the structural behavior of a frame with and without a shear wall.
2. (a) Determine the global stiffness matrix for the structure in Fig. 1. Neglect axial deformations in

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columns. Assume horizontal displacement of node 1 and node 2 as same and assume equal horizontal displacement at nodes 3, 4 and 5.

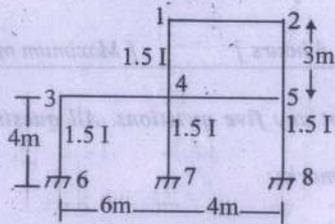


Fig. 1.

- (b) If the member 2 of framed structure shown in Figure. 2. is shortened by 0.01 m. Determine the force in members. Assume $AE = 8 \times 10^6 \text{ N}$.

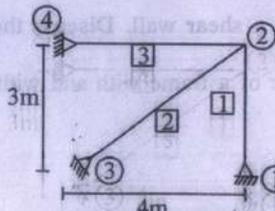


Fig. 2.

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3. Analyse the continuous beam given below in Fig. 3. using flexibility method.

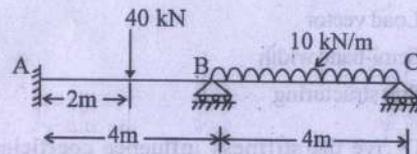


Fig. 3.

4. Analyse the pin jointed truss frame shown in following Fig. 4. by stiffness matrix. Assume cross sectional area of each member 1000 mm^2 , $E = 2 \times 10^5 \text{ N/mm}^2$.

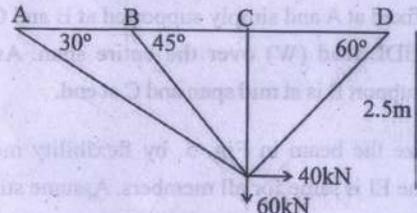


Fig. 4.

5. (a) Derive shape function of one-dimensional linear element (use matrix method).
 (b) What are the different types of element shapes used in finite element methods and explain with neat sketches?

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[P.T.O.]

6. Write short notes on any *three* :
- Local of Global co-ordinates
 - Load vector
 - Semi-band width
 - Sub structuring
7. (a) Derive the stiffness influence coefficients of prismatic cantilever beam AB under UDL load subjected to unit displacement at free end B.
- (b) 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 at mid span and C at end.
8. Analyze the beam in Fig. 5. by flexibility method. Assume EI is same for all members. Assume stiffness of spring k at support 2 = 10000 KN/m. $EI = 20000$ KN/m².

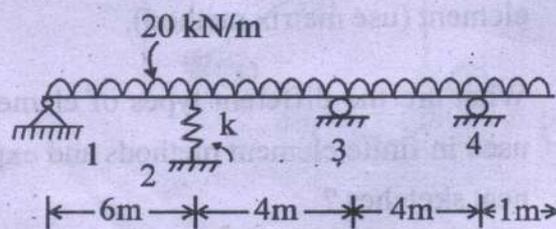


Fig. 5.

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**M. Tech. 1st Semester (Civil Engg.)
(Specialization in Structural Engg.)**

Examination – January, 2023

ADVANCED STRUCTURAL ANALYSIS

Paper : CE-611/MTSD-102

Time : Three hours]

[Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all. Q. 1 is compulsory. Attempt four more question from the sections A, B, C & D by selecting one question from each Section.

1. Describe the following : 20
- (a) Types of supports
 - (b) Determinate and Indeterminate structure
 - (c) Types of beams
 - (d) Types of loading
 - (e) Stiffness method

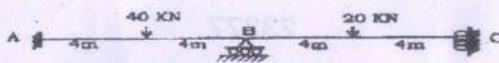
SECTION – A

2. Discuss various steps to be followed while analyzing the structure by stiffness method. 20

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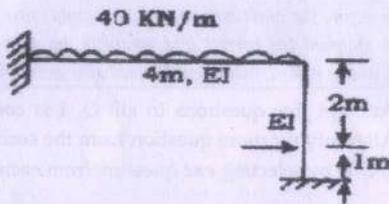
P. T. O.

3. A continuous beam ABCD is loaded as shown in figure. It has constant flexural rigidity. Fixed support at A, roller support at B and guided support at C. Analyze the beam using stiffness method. 20

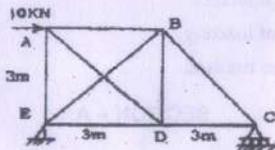


SECTION - B

4. Portal frame ABC is loaded as shown in figure. It is subjected to UDL 4 kN/m over span AB. Draw Bending moment diagram taking EI constant for AB and BC. Use stiffness method for analysis. 20

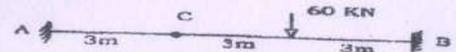


5. A pin jointed truss shown in figure. Analyze the truss by stiffness method. 20



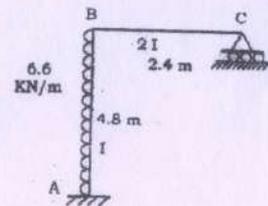
SECTION - C

6. Differentiate between structure approach and member approach used in stiffness matrix method. Explain how support condition are accounted in both approaches? 20
7. Analyze the beam AB having internal hinge at C. Use flexibility method. EI is uniform for all the spans. 20



SECTION - D

8. Analyze and draw bending moment diagram for portal frame using portal frame. Use flexibility matrix method. 20



9. (a) State Maxwell reciprocal theorem and indicate where its effect is evident in matrix analysis of a structure. 10
- (b) Explain properties and special characteristics of flexibility matrix of a structure. 10

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M.Tech. (Structural Engg.) (w.e.f. Dec-2024)

CBCS Scheme 1st Semester
Examination, December-2024
ADVANCED SOLID MECHANICS
Paper - 24MTSE21C2

Time allowed : 3 hours]

[Maximum marks : 100

Note : (i) Question No. 1 is compulsory.

(ii) Each question carries equal marks.

(iii) Students have to attempt five questions in total
at least one question from each section.

(iv) Assume suitable data if missing.

1. (i) State Hooke's law and explain about pure shear.
(ii) Discuss von Mises yield criterion.
(iii) List the six components of strain.
(iv) Discuss Isotropic hardening.
(v) Write about membrane analogy theory. $5 \times 4 = 20$

Section-A

2. Derive the strain components between the same for the
different planes. Obtain the relationship between three
elastic moduli for plan stress problem. 20

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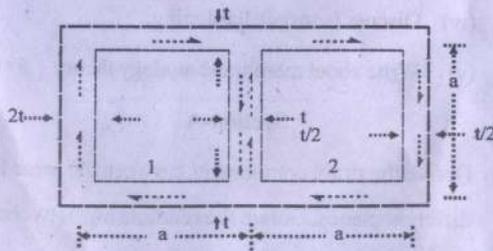
3. The state of stress at a point is such that $\sigma_x = \sigma_y = \sigma_z = \tau_{xy} = \tau_{yz} = \tau_{xz} = p$. Determine the principal stresses and their directions. 20

Section-B

4. Derive the differential equations of equilibrium and compatibility equations in 2-dimensional Cartesian co-ordinate system. 20
5. What is Airy's stress function? Discuss the application of stress function approach of solving of two-dimensional bending problems. 20

Section-C

6. The following Figure below shows a two-cell tubular section whose wall thickness are as shown. If the member is subjected to a torque T, Determine the shear flows and the angle of twist of the member per unit length. 20



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7. Discuss in detail the various failure theories of plasticity with its limitations. 20

Section-D

8. Discuss the following : 2×10=20
- (a) Tresca Yield Criterion
- (b) Principle of Normality and Plastic Potential
9. Explain Plastic stress strain relation. Also discuss how Isotropic Hardening of the material will occur. 20

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**M.Tech. (Structural Engg.) 1st Semester
CBCS scheme Examination, December-2024**

ADVANCED SOLID MECHANICS

Paper - 22MTSE21C2

Time allowed : 3 hours]

[Maximum marks : 100

Note : (i) *Question No. 1 is compulsory.*

(ii) *Each question carries equal mark.*

(iii) *Students have to attempt five questions in total
one question from each section.*

(iv) *Assume suitable data if missing.*

1. (i) State and explain Saint Venant's principle.
- (ii) Define Tensors.
- (iii) State and prove uniqueness theorem in theory of elasticity.
- (iv) Describe about the significance of stress invariants.
- (v) Write down the strain - displacement relation in Cartesian Coordinate System. $5 \times 4 = 20$

Section-A

2. Derive the differential equation of equilibrium in terms of displacement components for plane stress problem in the presence of body forces. 20

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3. List the six components of strain. Derive the strain components between the same for the different planes. 20

Section-B

4. What is Airy's stress function? Discuss the application of stress function approach for solving of two-dimensional bending problems. 20
5. Obtain the compatibility equation for plane stress problem in Cartesian form. 20

Section-C

6. A rectangular beam of width '2a' and '2b' is subjected to torsion. Derive the equation for obtaining maximum shear stress. 20
7. Explain the application of membrane analogy in solving torsion problem, of prismatic bar of any cross section, for finding twisting moment and shear stress acting on the cross section. 20

Section-D

8. Explain the composite system of equal lengths subjected to variation of temperature with an example. Discuss any one energy method for problem. 20

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9. Explain in detail about Strain hardening and Isotropic hardening. Also explain idealized stress strain curve. 20

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M.Tech. (Structural Engg.) (CBCS Scheme)

Examination, November-2023

ADVANCED SOLID MECHANICS

Paper - 22MTSE21C2

Time allowed : 3 hours]

[Maximum marks : 100

Note : Question no. 1 is compulsory. Each question carries equal mark. Students have to attempt 5 questions in total, one question from each section. Assume suitable data if missing.

1. (i) Define Tensors.
- (ii) Discuss Saint Venant's method.
- (iii) State and prove uniqueness theorem in theory of elasticity.
- (iv) What is plane stress and plane strain?
- (v) Explain Centre of twist. 5×4=20

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Section-A

2. What are the Cartesian and Curvilinear Tensor? Also explain Stress, Strain and Elastic Moduli Tensors by the Quotient Law. 20
3. Elaborate the elementary concept of stress and strain at a point. 20

Section-B

4. Derive compatibility equation in terms of stress for the case of plane stress without body force? 20
5. (a) At a point P in a body, $\sigma_x = 12,000 \text{ N/mm}^2$, $\sigma_y = -8,000 \text{ N/mm}^2$, $\sigma_z = -8,000 \text{ N/mm}^2$, $\tau_{xy} = \tau_{yz} = \tau_{zx} = 10,000 \text{ N/mm}^2$. Determine the normal and shearing stresses on a plane that is equally inclined to all the three axes. 10
- (b) For a stress function in polar coordinates, $\Phi = r^2 \cos \theta$, determine the stress components? 10

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Section-C

6. Use Prandtl's method to derive equation for the component of stresses, the maximum value of resultant stress and torsional rigidity of a prismatic bar with elliptical cross section? 20
7. Discuss in detail the various failure theories of plasticity with its limitations? 20

Section-D

8. A straight bar of alloy 1 m long and 12.5mm X 4.8mm is section is mounted in a strut testing machine and loaded axially until it buckles. Assuming the Euler's formula to apply estimate the maximum central deflection before the material attains its yield point of 280 N/mm². Take E= 72000 N/mm². 20
9. Explain how the strain hardening of the material will occurs in detail. Also explain idealized stress strain curve. 20

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M.Tech. (Structural Engg.) 1st Semester
(w.e.f. Dec-2024) CBCS Scheme Examination,
December-2024

THEORY OF THIN PLATES AND SHELLS

Paper - 24MTSE21C3

Time allowed : 3 hours [Maximum marks : 100]

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt one question from each section.*

(iii) *All questions carry equal marks.*

1. (i) Differentiate between membrane and a plate.
(ii) What is hoop stress?
(iii) Explain about the bending theory of shells.
(iv) Differentiate between thin and thick plates.
(v) Write the assumptions made in membrane theory of shells. $5 \times 4 = 20$

Section-A

2. Elucidate the boundary conditions in rectangular and circular plates for the following support conditions
(i) Build-in edge
(ii) Simply supported edge
(iii) Free edge 20

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3. (a) Give a brief account of displacement field approximation. 10
- (b) Explain the bending and membrane theories for analysis of shells. 10

Section-B

4. Conclude an expression for the deflection under a sinusoidal loading on rectangular plates with edges simply supported with sides a and b using Navier's approach. 20
5. Find out maximum deflection using Levi's solution for rectangular plate with one pair of edges is simply supported and other pair is fixed and subjected to uniformly distributed load of intensity q . 20

Section-C

6. A thin simply supported plate of circular cross section with clamped edges is subjected to uniformly distributed load of intensity 'p' per unit area over its entire surface. Assuming the deflection of the plate to be small in comparison to thickness determine from the fundamentals the maximum deflection and maximum bending moment in the plate. 20

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7. Obtain the expression for deflection in case of uniformly loaded circular plates with clamped edges. 20

Section-D

8. Write the structural components of cylindrical shells with neat sketch mention the various loads acting on the shell. Write the assumptions made in membrane theory of shells. 20
9. Conclude the membrane equations of equilibrium for shells of revolution. Elucidate stress resultants for spherical shells subjected to symmetrical loading. 20

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M. Tech 1st Semester (Structural Engg.)
CBCS Scheme Examination, December-2024
THEORY OF THIN PLATES AND SHELLS
Paper - 22MTSE21C3

Time allowed : 3 hours]

[Maximum marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt any five questions. All questions carry equal marks.

1. Explain the classification of plates and prove that twists are complimentary in nature. 20
2. Explain the Navier solution for simply supported rectangular plates. 20
3. Derive the relationship between bending moments and curvature in the case of pure bending. 20
4. Derive the equation for deflection in the case of cylindrical bending of uniformly loaded circular plate with simply supported edges. 20

23758-P-2-Q-8(24)

[P.T.O.]

5. Explain the design aspects of reinforced concrete folded plates. 20
6. Discuss the membrane and bending theories of shells in detail. 20
7. Explain significance of edge beams. How are these beams reinforced? Also explain the classification of shells. 20
8. Explain the design aspects of cylindrical shells. 20

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M.Tech. 1st Semester (Structural Engg.)
(CBCS Scheme) Examination, November-2023
THEORY OF THIN PLATES AND SHELLS
Paper - 22MTSE21C3

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) Principle curvature and principal plane of curvature
- (ii) Annular plates
- (iii) Edge disturbance
- (iv) Classification of plates
- (v) Membrane theory 5×4=20

Section-A

2. (a) Derive the relation between bending moments and curvature in pure bending of plates? 10
- (b) Give a brief account of displacement field approximation. 10

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3. (a) Differentiate between long shells and short shells. 10
(b) Explain the bending and membrane theories for analysis of shells. 10

Section-B

4. Derive the differential equation governing the plate. State various assumptions involved in the derivation. 20
5. Find Levy's solution for simply supported and uniformly loaded rectangular plates. 20

Section-C

6. Obtain the expression for deflection in case of uniformly loaded circular plates with clamped edges. 20
7. Derive the differential equation for deflection for the symmetrical bending of a circular plate with lateral loads of the type.

$$\frac{d^3w}{dr^3} + \frac{1}{r} \frac{d^2w}{dr^2} - \frac{1}{r^2} \frac{dw}{dr} = \frac{Q}{D} \text{ Where } Q = \text{total shear force}$$

on the plate = $\int_0^r q r dr$, q = intensity of lateral loading,

r = radius, D = Flexural rigidity of the plate. 20

23758

(3)

23758

Section-D

8. (a) Explain about the various types of shells with neat sketches? 10
(b) Explain about the advantages and disadvantages of the shells. 10
9. Write boundary conditions for simply supported cylindrical shells with the edge conditions or the end shells in a multiple group shells. 20

23758

23799

M.Tech. (Structural Engg.) 1st Semester
(w.e.f. Dec-2024) CBCS Scheme Examination,
December-2024

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,
first being compulsory and selecting one question
from each unit. All questions carry equal marks.*

1. (a) Define Absolute, Relative and Percentage Errors.
- (b) Define Intermediate Value Theorem.
- (c) Define algebraic and Transcendental equation with example.
- (d) What are the direct methods and iterative methods to solve the system of linear equations?
- (e) Define Eigen values and Eigen vectors.
- (f) Write the standard five-point formula.
- (g) Define Taylor Series Method for IVP.
- (h) Write the finite difference approximations to partial derivatives in x and y directions. 20

23799-P-4-Q-9(24)

[P.T.O.]

(2)

23799

Unit-I

2. (a) Define the relative and absolute error and show that if decimal based real number $x = (0.d_1d_2d_3\dots d_nd_{n+1}\dots)$ is chopped to n digits, then show that $0 \leq \frac{x-f(x)}{x} \leq \frac{1}{2} \times 10^{-n}$. 10
- (b) Find the least squares approximation of a second degree for the discrete data :

x :	-2	-1	0	1	2
$f(x)$:	15	1	1	3	19

3. (a) Explain the Interpolation and Extrapolation. Find the form of the Lagrange interpolating function, given

x :	0	1	2	3	4
$f(x)$:	3	6	11	18	27

- (b) If $f(-4) = 1245$, $f(-1) = 33$, $f(0) = 5$, $f(2) = 9$, $f(5) = 1533$, Prepare Newton's Divided Difference Table and find the interpolating polynomial. 10

23799

(3)

23799

Unit-II

4. (a) Find the real root $xe^x - 2 = 0$ correct to three decimal places using Newton-Raphson method. 10
- (b) Solve system of linear equations using Iterative method
 $2x + y + z = 5$, $3x + 5y + 2z = 15$, $2x + y + 4z = 8$. 10

5. (a) By Gauss-elimination method, solve the system of linear equations

$$2x + 2y + z = 6, 4x + 2y + 3z = 4, x - y + z = 0. \quad 10$$

- (b) Determine the absolutely largest eigenvalue and the corresponding eigenvector of the matrix

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}; \text{ taking } x_0 = [1, 0, 0]^T. \quad 10$$

Unit-III

6. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by taking number of subinterval $n = 5$
 (i) Trapezoidal rule (ii) Simpson 1/3 rule (iii) Simpson 3/8 Rule. Also find the error in each case with exact solution. 20

23799

[P.T.O.]

7. (a) Given $\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$. Using Euler's method find $y(0.5)$ taking $h = 0.1$. 10
- (b) Using Runge-Kutta method of fourth order, find y , for $x = 0.1$ given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$; taking step length $h = 0.1$. 10

Unit-IV

8. (a) Discuss the solution of One dim heat flow $\frac{du}{dt} = c^2 \frac{\partial^2 u}{\partial x^2}$ by Schmidt method and Crank-Nicolson Method. 10
- (b) Solve the boundary value problem $y'' = y + x$, $y(0) = 1$ and $y(1) = 0$ using the method of finite difference with $h = 0.25$. 10
9. Describe in brief of Fuzzy logic and Neural Network and their application in various Structural problems. 20

23759

M.Tech. 1st Semester (Structural Engg.) CBCS Scheme
Examination, December-2024

**ANALYTICAL AND NUMERICAL METHODS FOR
STRUCTURAL ENGINEERING**

Paper-22MTSE21C4

Time allowed : 3 hours] [Maximum marks : 100

*Note : The students have to attempt five questions in total,
first being compulsory and selecting one question
from each unit. All questions carry equal marks.*

1. (a) Define the truncation and inherent error.
- (b) Write the name of direct and iterative methods to solve linear system of equation.
- (c) Define Euler's Method and Taylor Series Method.
- (d) Find Iterative formula of cube root of unity by Newton-Raphson Method.
- (e) Define the interpolation and extrapolation along with suitable example.
- (f) What is Crank-Nicolson Method ? Why is it known as implicit method ?

23759-P-4-Q-9 (24)

[P.T.O.]

(2)

23759

- (g) Write the classification of one dimension of Heat and Wave equations.
- (h) Write the finite difference approximations to partial derivatives in x and y directions. 20

Unit-I

2. (a) Round off $\sqrt{29}$ and $\sqrt{\pi}$ correct to four significant figures and compute absolute, Relative and percentage errors in each case. 10
- (b) If $f(-4) = 1245$, $f(-1) = 33$, $f(0) = 5$, $f(2) = 9$, $f(5) = 1533$, prepare Newton's Divided Difference Table and find the interpolating polynomial. 10
3. (a) Solve the non-linear equation $x \log_{10} x = 1.2$ by Newton-Raphson Method. 10
- (b) Given that
- | | | | | | |
|----------|----------|--------|--------|--------|--------|
| x | : 1.96 | 1.98 | 2.00 | 2.02 | 2.04 |
| y = f(x) | : 0.7825 | 0.7739 | 0.7651 | 0.7563 | 0.7473 |
- Find the first and second derivative of y with respect to x at $x = 2.03$. 10

23759

(3)

23759

Unit-II

4. (a) Solve the following equations using UV Factorization Method:
 $3x + 2y + 7z = 4$, $2x + 3y + z = 5$, $3x + 4y + z = 7$
 10
- (b) Transform the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$ to tridiagonal form by Given Method. 10
5. (a) Solve system of linear equations using Gauss-Seidal Iterative method:
 $-8x + y + z = 1$; $x - 5y + z = 16$; $x + y - 4z = 7$
 taking initial solution vector $x_0 = [0, 0, 0]^T$. 10
- (b) Determine the eigenvalue and the corresponding eigenvector of the given matrix $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ by Jacobi's Method. 10

23759

[P.T.O.]

Unit-III

6. (a) Using Runge-Kutta method of fourth order, find approximate value of y for $x = 0.2$ taking $h = 0.1$, if $\frac{dy}{dx} = x + y^2$, given that $y(0) = 1$. 10
- (b) Using modified Euler's method to find the value of y satisfying the equation $\frac{dy}{dx} = \log(x + y)$ for $x = 1.2$ and $x = 1.4$ correct up to four decimals placed by taking $h = 0.2$, given that $y(1) = 2$. 10
7. Discuss the Solution of One dim Heat flow $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ by Schmidt method and Cranck-Nicolson Method. 20

Unit-IV

8. Derive standard five-point formula and diagonal five-point formula for Laplace equation using finite difference approximations. 20
9. The deflection of a beam is governed by the $\frac{d^4 y}{dx^4} + 81y = 243x$, $y(0) = y'(0) = y''(1) = y'''(1) = 0$. Evaluate the deflection at the pivot points of the beam using $h = \frac{1}{3}$. 20

23759

M.Tech (Structural Engg.) CBCS Scheme
1st Semester Examination, November-2023
ANALYTICAL AND NUMERICAL METHODS FOR
STRUCTURAL ENGINEERING

Paper-22MTSE21C4

Time allowed : 3 hours]

[Maximum marks : 100

*Note : The students have to attempt **five** questions in total, **first being compulsory** and selecting **one** question from each unit. All questions carry equal marks.*

1. (a) Define Absolute, Relative and Percentage Errors.
- (b) Define Interpolation and Extrapolation.
- (c) Define Algebraic and Transcendental equation with example.
- (d) What are the direct methods and iterative methods to solve the system of linear equations ?
- (e) Define Eigenvalues and Eigenvectors.
- (f) Write the standard five-point formula.
- (g) What is Crank-Nicolson Method ? Why is it known as implicit method ?
- (h) Write the finite difference approximations to partial derivatives in x and y directions 20

23759-P-4-Q-9 (23)

[P. T. O.]

(2)

23759

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 $x = y = z = 1$. 10
- (b) Fit a second-degree parabola to the following data : 10

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	1.1	1.3	1.6	2.0	2.7	3.4	4.2

3. (a) Find the iterative formula of cube root of 24 by Newton-Raphson method. Also find the smallest positive root of this. 10
- (b) Using Newton's divided difference, find $f(x)$ from the following data : 10

x	-1	0	3	6	7
f(x)	3	-6	39	822	1611

Hence determine the value of $f(x)$ when $x=1.5$.

23759

(3)

23759

Unit-II

4. (a) Solve system of linear equations using Jacobi iterative method : 10
 $2x + y + z = 5, 3x + 5y + 2z = 15, 2x + y + 4z = 8$
- (b) By Gauss-elimination method solve the system of linear equations : 10
 $2x + 2y + z = 6, 4x + 2y + 3z = 4, x - y + z = 0$

5. Determine the absolutely largest eigenvalue and the

corresponding eigenvector of the matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$

taking $x_0 = [1, 0, 0]^T$ 20

Unit-III

6. Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y+x}{y-x}$ $y(0) = 1$, at $x = 0.2, 0.4$ taking step length $h = 0.2$. 20
7. Derive standard five-point formula and diagonal five-point formula for Laplace equation using finite difference approximations. 20

23759

[P. T. O.]

Unit-IV

8. Describe in brief of Fuzzy logic and Neural Network and their application in various Structural problems. 20
9. Solve the boundary value problem $y'' = y + x$, $y(0) = 1$ and $y(1) = 0$ using the method of finite difference with $h=0.25$. 20

23800

M.Tech. (Structural Engg) 1st Semester

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

Examination, December - 2024

ADVANCED STEEL DESIGN

Paper - 24MTSE21C5

Time allowed : 3 hours]

[Maximum marks : 100

Note : (i) **Q. No. 1 is compulsory.**

(ii) *Each question carries equal mark (15 marks).*

(iii) *Students have to attempt five questions in total at least one question from each section.*

(iv) *Assume suitable data if missing.*

(v) *IS: 800 & IS : 808 is allowed.*

1. (i) Write short notes on biaxial bending.

(ii) Explain the methods of plastic analysis.

(iii) Write short notes on stability against overturning and sway.

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

23800-P-3-Q-9(24)

[P.T.O.]

(2)

23800

- (v) Explain the two main types of moment-resistance connections. $5 \times 4 = 20$

Section - A

2. What are the design criteria for stability of steel structure? Also discuss drift and strength criterion. 20
3. An I-section beam is fabricated with plates of following dimensions :

Flange : 380×20 mm, Web : 1600×15 mm.

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 laced column with two channels back-to-back of length 08 m to carry an axial factored load of 1200 kN. The column may be assumed to have restrained in position but not in direction at both ends. 20

23800

(3)

23800

5. 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

Section - C

6. (a) Write short notes on column splices. 10
(b) Write short notes on Bracing connections. 10
7. Design a stanchion 3 m long, in a building, subjected to a factored load of 500 kN. Both ends of the stanchion are effectively restrained in direction and position. Use steel of grade Fe 410. 20

Section - D

8. Define : 20
(i) Design life
(ii) Fabrication tolerance
9. Explain the following in detail : 20
(a) Derive the moment curvature relationship in plastic analysis.
(b) Joint Panel zones

23800

23760

M.Tech. 1st Semester (Structural Engg.) CBCS Scheme
Examination, December-2024

ADVANCE STEEL DESIGN

Paper-22MTSE21C5

Time allowed : 3 hours] [Maximum marks : 100

- Note :
- Question No. 1 is Compulsory.
 - Each question carries equal mark (1.5 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) Draw the moment rotation curve for different types of connections.
- (ii) Write the formula for finding the b/t ratio for load determination.
- (iii) State the condition to be satisfied in order to use plastic method of analysis as per IS 800.

23760-P-4-Q-9 (24)

[P.T.O.]

(2)

23760

- (iv) What is the significance of shear lag?
(v) Discuss P-effect.

Section-A

2. (a) Discuss Hysteresis, Ductility properties of steel. 10
(b) Explain about Drift Analysis. 10
3. What are the design criteria for stability of steel structure? Also discuss drift and strength criterion. 20

Section-B

4. A conference hall $8\text{m} \times 18\text{m}$ is provided with a 120 mm RCC slab over rolled steel beams spaced 3m c/c. A wearing coat of 100 mm average thickness is provided over the roof. Design the beam section, if the compression flange of the beam is laterally supported throughout. 20

23760

(3)

23760

5. Describe in detail about the following : 20
- (i) Lateral buckling of web
(ii) Compression member
(iii) Flange Curling
(iv) Wall Studs

Section-C

6. Differentiate between load and resistance factor design. 20
7. A tie of a roof truss consists of double angles ISA $100 \times 75 \times 10\text{mm}$ with its short legs back-to-back and long legs connected to the same side of a gusset plate, with 16mm diameter rivets. Determine the strength of tie in axial tension, taking $f_t = 150 \text{ N/mm}^2$. take Rivets have been provided at suitable pitch. 20

Section-D

8. Explain the following in detail : 20
- (a) PM interaction
(b) Moment magnification

23760

[P.T.O.]

9. A column 6.5 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 P effect design if rolled steel beams and 16 mm plates are only available.

23760

M. Tech (Structural Engg.) 1st Semester
CBCS Scheme Examination,
November-2023

ADVANCED STEEL DESIGN

Paper-22MTSE21C5

Time allowed : 3 hours]

[Maximum marks : 100

*Note : * Question no. 1 is compulsory.*

** Each question carries equal marks (15 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. (a) What are the points at which a plastic hinge is likely to form ? $5 \times 4 = 20$
- (b) Discuss buckling strength of web.
- (c) Draw the various sections available in light gauge steel structural members.
- (d) State the condition to be satisfied in order to use plastic method of analysis as per IS 800.
- (e) What is the significance of shear lag ?

23760-P-3-Q-9 (23)

[P. T. O.]

(2)

23760

Section-A

2. (a) Discuss mechanical properties of steel. 10
(b) Explain slenderness ratio. 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 ISLB 350 considering the beam to be laterally supported. Assume low shear case and take the grade of steel Fe 410. 20
5. (a) What are the various possible mode or failure for compression member? 10
(b) What advantages do hollow sections have above open sections with respect to corrosion protection and maintenance? 10

Section-C

6. Differentiate between allowable stress design and plastic design. 10
7. Suggest & design beam-column welded connection for ISMB500 & ISSC200 to carry 120 KNm. B.M. & 100 KN shear. 10

23760

(3)

23760

Section-D

8. Explain the following in detail :
(a) PM interaction 10
(b) Biaxial bending 10
9. A column 7 m long is to support a load 2800 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

23760

23431

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

Examination, December-2024

ADVANCED STEEL DESIGN

Paper-CE-616

Time allowed : 3 hours] [Maximum marks : 100

Note : Attempt any five questions. All questions carry equal marks. Use of relevant IS Code is permitted.

1. Design a simply supported gantry girder to for the following data :

Crane capacity : 160 kN Self weight of crane girder :
200 kN

Self-weight trolley, electric motor, hooks etc. : 50 kN

Min. approach of crane hook to the gantry girder
: 1.6 m

Wheel base : 2.8 m c/c distance between gantry rail
: 12m

c/c distance between column : 6m Self weight of rail
section : 300 N/m. 20

23431-P-3-Q-8 (24)

[P.T.O.]

(2)

23431

2. (a) Discuss in detail design procedure of self-supporting stack along with codal provisions. 10
- (b) Write merits and demerits of bunker and silo. 10
3. Design a roof truss, rafter bracing, purlin for an industrial building with a span of 20m and a length of 50m. The roofing is galvanized iron sheeting. Basic wind speed is 50m/s and the terrain in an open industrial area Building is class B with a clear height of 8m at the eaves. 20
4. An upper story column ISHB 300 @ 577 N/m carries a factored load of 1200 kN and a factored moment of 12 kN-m. It is to be spliced with lower story column ISHB 400 @ 806 N/m. Design a suitable splice. 20
5. (a) Write the step wise procedure followed in the design of bridges. 10
- (b) Discuss design procedure of continuous beams as per plastic analysis. 10

23431

(3)

23431

6. (a) Elaborate about the items that are to be considered while planning and designing an industrial building. 10
- (b) Explain various steps involved in the design of steel tanks. 10
7. Design a column to support a factored load of 1200 kN. The column has an effective length of 8m with respect to z-axis and 4m with respect to y-axis. Use steel grade Fe410. 20
8. An industrial building located at Surat is to be designed for the following data span of truss 15m, spacing of truss 3.5m and pitch of truss is $\frac{1}{4}$. Design the frame for dead, live and wind loads as per IS 875. 20

23431

23431

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

Examination, November-2023

ADVANCED STEEL DESIGN

Paper - CE-616

Time allowed : 3 hours]

[Maximum marks : 100

Note : Attempt any five questions. All questions carry equal marks. Use of Steel Table is allowed. Use of IS 800-1984 or 2007, IS 875-1987 and IS 801-1975 is allowed. Assume suitable data whenever necessary.

1. A through type Pratt truss girder of pedestrian bridge span 20m, width 3m subjected to UDL 3kN/m^2 is subjected to uniform wind pressure 2kN/m^2 . The walk way constructed with RCC slab is 150mm thick. Design the following elements and detail with neat sketch? 20
 - (i) Longitudinal truss girder
 - (ii) Bottom bracing system
2. Design a circular steel Silo of height 16m and internal diameter 6m to store cement of bulk density of 18kN/m^3 and angle of internal friction 25° ? 20

23431-P-3-Q-8(23)

[P.T.O.]

(2)

23431

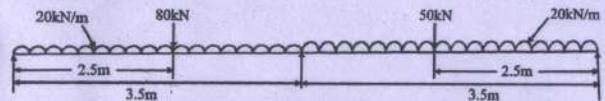
3. (a) Classify types of bins and explain the factors affecting design of bins. 10
- (b) Write the procedure followed in the design of Bunkers and explain bin storage and bulk storage. 10
4. Design a strut in a roof truss for the following data:
- Length of strut = 2.234m
- Factored compressive force = 50 kN (due to DL and LL)
- Factored tensile force = 17.8 kN (due to DL and WL)
- Grade of steel = Fe 410, Grade of bolts = 4.6,
Bolt diameter = 20mm. 20
5. A steel column is of 4m 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 420×20mm 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

23431

(3)

23431

6. (a) Design a lug angle to be provided with the tie member subjected to a load of 400 kN. The length of the member is 3.5m. 10
- (b) Design a lap joint to connect two plates 16 mm thick using high strength friction grip bolts. 10
7. Design a continuous beam of uniform cross section with a load factor of 1.5 and working load as shown in figure and design its section. 20



8. A plate girder with Fe415 steel plates is having 12×1500 mm web plate and 56×500mm flange plates. Determine the design flexural strength, if the compression flange is supported laterally. 20

23431

Roll No.

23431

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

Examination – January, 2023

ADVANCED STEEL DESIGN

Paper : CE-616

Time : Three Hours]

[Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

- Note :**
- Attempt any *five* Questions. All questions carry equal marks.
 - Use of Steel Table is allowed.
 - Use of IS 800-1984 or 2007, IS 875-1987 and IS 801-1975 is allowed.
 - Assume suitable data whenever necessary.
1. (a) Two plates of thickness 16 mm each are joined by a triple bolted lap joint. Use ordinary bolts of property class 5.6. Design the joint and calculate the efficiency. Grade of steel is Fe 490. Sketch the details. Can the joint be made economical ? Justify with numerical. 10

23431-200-(P-4)(Q-8)(23)

P. T. O.

- (b) Discuss the assumptions in the design of HSFG bolted connections as a non slip joint. 10
2. Design a rectangular steel bunker 12m length 6m width supported on eight columns (four along each side of length) to store coal density 8 kN/m^3 , angle of internal friction 35° . Height of vertical portion 6m and height of hopper 2m. Provide $600 \times 600 \text{ mm}$ hopper. Detail the elements and connections? 20
3. (a) With the help of neat sketch explain the types of truss bridges. 10
 (b) Mention different type of forces to be considered in the design of bins? 10
4. Design the most critical section of a welded plate girder of constant depth to carry a superimposed load of 130 kN/m in addition to its self weight over a span of 30 m with two equal overhangs of 2.5 m on each side. thus making total length of the girder 26 m. Design the following : 20
 (i) Cross section
 (ii) Bearing stiffener
 (iii) Intermediate stiffener

23431- (P-4)(Q-8)(23) (2)

5. (a) A member transmits a moment of 600 kNm and an axial force of 1200 kN . Design the section by plastic method. 10
 (b) A I-section beam is fabricated with plates of following dimensions. Flange: $380 \times 20 \text{ mm}$, Web : $1600 \times 15 \text{ mm}$. 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. 10
6. Design the following for an elevated rectangular water tank to store 3×10^5 liters water. 20
 (i) Bottom plates
 (ii) Side plates
 (iii) Tee covers
 (iv) Upper tier beams
 (v) Lower tier beams

23431- (P-4)(Q-8)(23) (3)

P. T. O.

