Total No. of Questions: 20

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

CE3CO25 Structural Analysis -II

Programme	:	B.Tech.	**Branch/Specialisation**	:	CE
Duration	:	3 hours	**Maximum Marks**	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

Section 1 (Answer all question(s))

		Marks	CO	BL
Q1.	Which of the following is a primary advantage of the Column Analogy Method? ○ Simplicity in calculations ○ Applicable only for determinate structures ◉ Provides accurate results for indeterminate structures ○ Requires no boundary conditions	1	1	1
Q2.	In the analysis of beams with varying cross-sections, which property significantly affects the stiffness? ○ Length of the beam ○ Modulus of elasticity only ◉ Moment of inertia variation along the span ○ Load type only	1	1	1
Q3.	Which of the following is a characteristic of the Flexibility Method? ◉ The number of unknowns is equal to the number of redundant ○ Displacements are taken as primary unknowns ○ It requires the direct computation of the global stiffness matrix ○ It is always more efficient than the Stiffness Method	1	1	1
Q4.	Which of the following statements is true about the Stiffness Method? ○ It is suitable only for determinate structures ○ It is based on force equilibrium equations ◉ It directly calculates displacements as primary unknowns ○ It is less suitable for computer-based structural analysis	1	2	2
Q5.	Which of the following methods is commonly used for the approximate analysis of tall frames under lateral loads? ○ Kani's Method ◉ Portal Method ○ Column Analogy Method ○ Flexibility Method	1	2	2
Q6.	Which of the following assumptions is made in the Cantilever Method for lateral load analysis of tall frames? ○ The inflection points occur at mid-height of columns ○ The total lateral force is resisted equally by all stories ○ The axial force in columns is neglected ◉ The frame behaves as a vertical cantilever with distributed stiffness	1	2	2
Q7.	The shape of a cable in a suspension bridge under uniformly distributed load follows which curve? ◉ Parabolic ○ Circular ○ Elliptical ○ Linear	1	1	1
Q8.	Which of the following structures is considered indeterminate? ○ Simply supported beam ○ Three-hinged arch ◉ Two-hinged arch ○ Cantilever beam	1	1	1

Q9. In plastic analysis, the load factor is defined as the ratio of- **1 1 1**

- (●) Ultimate load to yield load
- ( ) Working load to ultimate load
- ( ) Elastic moment to plastic moment
- ( ) Shear force to bending moment

Q10. In the stress-strain curve of mild steel, the plastic region begins after which point? **1 2 2**

- ( ) Elastic limit
- ( ) Proportional limit
- (●) Yield point
- ( ) Ultimate strength

Section 2 (Answer all question(s))

Marks CO BL

Q11. What is the basic principle of the Column Analogy Method? Define the term "Analogous Column" in the Column Analogy Method. **4 2 2**

Rubric	Marks
Principle of the Column Analogy Method	2
Analogous column-Definition	2

Q12. (a) Analyze a two-span continuous beam ABC using Kani's Method, where span AB is 6 m and span BC is 4 m. The flexural rigidity (EI) is constant for all spans. The beam is subjected to a uniformly distributed load of 20 kN/m over span AB and a point load of 40 kN at the center of span BC. Both A and C are fixed supports, while B is a continuous joint. Determine the final moments at supports A, B, and C using Kani's Method. **6 4 4**

Rubric	Marks
Identify the Degrees of Indeterminacy	1
Calculate Fixed-End Moments (FEMs)	1
Assign Stiffness Values	1
Kani's Iteration Process	2
Final Moments at Supports MA=−48 kNm, MB=12 kNm, MC=38 kNm	1

(OR)

(b) Analyze a propped cantilever beam of 6 m span, which is fixed at support A and simply supported at B, using the Column Analogy Method. The beam is subjected to a point load of 50 kN at mid-span. The flexural rigidity (EI) is constant throughout the beam. Determine the fixed-end moments and the reaction at support B using the Column Analogy Method.

Rubric	Marks
Fixed-End Moments (FEM) for Fully Fixed Beam	2
Equivalent Analogous Column Properties	2
Solve for Reaction at B & Final Fixed-End Moment at A (Reaction at B: RB=31.25 kN Moment at A: MA=0 kNm Moment at B: MB=37.5 kNm)	2

Section 3 (Answer all question(s))

Marks CO BL

Q13. Write a short note on energy approach method. **4 3 3**

Rubric	Marks
Energy approach method-Descriptions	4

Q14. (a) Analyze a simply supported beam with a span of 6 m using the Flexibility Matrix Method. The beam is subjected to a point load of 30 kN at a distance of 2 m from the left support (A). Assume that the flexural rigidity (EI) is constant throughout the beam. Determine the flexibility matrix for the structure and use the Flexibility Method to calculate the redundant reactions. **6 4 4**

Rubric	Marks
Identify the Redundant	1
Compute the Flexibility Coefficients	2
Form Flexibility Matrix and solution	3

(OR)

(b) Analyze a fixed beam of span 6 m using the Stiffness Matrix Method. The beam is fixed at both ends (A and B) and is subjected to a uniformly distributed load (UDL) of 20 kN/m over the entire span. Assume that the flexural rigidity (EI) is constant throughout the beam. Determine the stiffness matrix for the beam, calculate the fixed-end moments, and find the nodal displacements and reactions at the supports using the Stiffness Method.

Rubric	Marks
Fixed-End Moments (FEM)	1
Stiffness Matrix Formulation	2
Solve for Rotations (θA and θB) $\theta A=\theta B=90/EI$	1.5
Compute Final Moments MA=MB=90 kNm	1.5

Section 4 (Answer all question(s))

Marks CO BL

Q15. Describe the effects of wind and earthquake loads on tall buildings and their structural implications. **4 2 2**

Rubric	Marks
Effects of wind and earthquake loads on tall buildings	2
Structural implications	2

Q16. (a) Explain the codal provisions for wind and earthquake loads and how they influence the design of multi-story buildings. **6 3 3**

Rubric	Marks
codal provisions for wind loads	3
codal provisions for earthquake loads	3

(OR)

(b) How is seismic analysis performed for buildings according to IS code? Provide key steps and considerations.

Rubric	Marks
For correct considerations	3
For correct steps	3

Section 5 (Answer all question(s))

Marks CO BL

Q17. What is the difference between a two-hinged and a three-hinged arch in terms of structural behavior? **4 2 2**

Rubric	Marks
2- Difference between a two-hinged and a three-hinged arch in terms of structural behavior	4

Q18. (a) Describe Müller-Breslau Principle and using the Müller-Breslau Principle. Explain the qualitative influence lines for moments and shear forces in indeterminate frames. **6 4 4**

Rubric	Marks
Müller-Breslau Principle -Statement	2
Müller-Breslau Principle explanation for influence line and shear force	4

(OR)

(b) A three-hinged stiffened suspension bridge has a span of 120 meters, with hinges located at both ends, A and B, and an internal hinge at the midspan C. The stiffening girder is simply supported at A and B, while the main cable follows a parabolic shape under loading. Determine the Influence Line Diagram (ILD) for the vertical reaction at support A, showing how the reaction varies as the unit moving load traverses the span also Construct the Influence Line Diagram (ILD) for the bending moment at the midspan (C) and explain its significance.

Rubric	Marks
ILD for Bending Moment at Midspan C (The ILD for bending moment at C follows a trapezoidal shape with maximum value at A.)	3
Maximum Bending Moment at C for a 10 kN Load (Thus, the maximum bending moment at midspan C due to a 10 kN moving load is 600 kNm, occurring when the load is at A.)	3

Section 6 (Answer all question(s))

Marks CO BL

Q19. What is the difference between elastic and plastic bending? **3 2 2**

Rubric	Marks
Elastic Bending- Definition	1.5
Plastic Bending- Definition	1.5

Q20. (a) Derive the equation for plastic moment (Mp) in a rectangular section. **7 3 3**

Rubric	Marks
Assumptions in Plastic Bending	2
Plastic Stress Distribution	2
Plastic Moment Calculation	2
Final Expression for Plastic Moment (Mp)	1

(OR)

(b) Describe a short note on the following terms:
(i) Static and Kinematic method of Analysis
(ii) Assumptions of plastic bending theory

Rubric	Marks
Static and Kinematic method of Analysis-Explanation	3.5
Assumptions of plastic bending theory-Explanation.	3.5

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