Total No. of Questions: 23

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

CE3CO23 Structural Analysis -I

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. Castigliano's second theorem is useful for finding: **1 1 1**

- ○ Internal forces
- ◉ Deflections
- ○ Bending moment
- ○ Axial force

Q2. Which type of support prevents movement in both horizontal and vertical directions but allows rotation? **1 1 1**

- ○ Fixed support
- ○ Roller support
- ◉ Hinged support
- ○ Free support

Q3. When a truss member is shorter or longer than designed, it is called: **1 2 2**

- ○ Temperature defect
- ◉ Lack of fit
- ○ Support settlement
- ○ Structural instability

Q4. The three-moment equation is used for: **1 1 1**

- ○ Simply supported beams
- ○ Cantilever beams
- ◉ Continuous beams
- ○ Trusses

Q5. What is the primary unknown in the slope-deflection method? **1 1 1**

- ○ Shear force
- ○ Bending moment
- ◉ Deflections and rotations
- ○ Axial forces

Q6. In moment distribution, the sum of distribution factors at a joint is always: **1 1 1**

- ◉ 1
- ○ 0.5
- ○ 2
- ○ 10

Q7. In a simply supported beam with a uniformly distributed rolling load, the maximum bending moment occurs when: **1 2 2**

- ○ The entire load covers half the span
- ○ The load is placed at one-quarter of the span
- ○ The load is symmetrically distributed
- ◉ The load covers the entire span

Q8. In a simply supported beam, the influence line for bending moment at a section is: **1 1 1**

- ○ A straight line
- ○ A parabolic curve
- ◉ A triangular shape
- ○ A rectangular shape

Q9. In a three-hinged arch, the bending moment at the hinges is always: **1 1 1**

- ○ Maximum
- ◉ Zero
- ○ Equal to the horizontal thrust
- ○ Equal to the vertical reaction

Q10. Arches are designed to resist which of the following load? **1 1 1**

- ○ Only vertical loads
- ○ Only temperature changes
- ◉ Both vertical loads and temperature changes
- ○ The shape of the arch only

Section 2 (Answer all question(s))

Marks CO BL

Q11. What do you mean by static indeterminacy? 3 2 2

Rubric	Marks
static indeterminacy-Definition	3

Q12. (a) Describe following terms- 7 2 2
(i) Degree of freedom
(ii) Strain energy

Rubric	Marks
Degree of freedom-Description	3.5
Strain energy-Description	3.5

(OR)

(b) State and prove Maxwell's Reciprocal Theorem.

Rubric	Marks
Correct Statement of Maxwell's Reciprocal Theorem.	2
Proof of Maxwell's Reciprocal Theorem.	5

Section 3 (Answer all question(s))

Marks CO BL

Q13. Explain following terms: 4 2 2
(i) Virtual work
(ii) Application of method of section for truss analysis

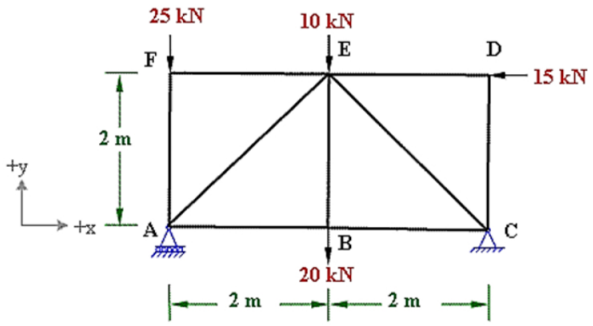
Rubric	Marks
Virtual work - Definition	2
Application of method of section for truss analysis-Definition	2

Q14. (a) A continuous beam ABC of span lengths 3m and 4m is simply supported at A, B, and C. It carries a uniformly distributed load (UDL) of 10 kN/m over the entire span BC. Determine the support moments using the Three-Moment Theorem. Assume the beam has a constant flexural rigidity (EI) throughout. **6 3 3**

Rubric	Marks
For correct answer ,The moment at support B is M_B=−11.43 kNm	6

(OR)

(b) A pin-jointed truss is shown in the figure. The truss is supported at A (roller support) and C (pinned support). The span of the truss is 4 meters, with each section being 2 meters long. The height of the truss is 2 meters. Several external forces are applied at different joints as shown in figure. Determine the support reactions at A and C. Then, using the Method of Joints, analyze the truss and find the forces in all its members, indicating whether each member is in tension or compression.



Rubric			Marks
Member	Force (kN)	Nature (Tension/Compression)	6
AF	21.2	Tension	
AB	2.5	Compression	
BF	17.7	Tension	
FE	25.0	Compression	
BE	14.14	Tension	
BC	20.0	Compression	
EC	17.7	Tension	
ED	15.0	Compression	
CD	15.0	Tension	

Section 4 (Answer any 2 question(s))

Marks CO BL

Q15. Define following terms: **5 2 2**
(i) Distribution Factor
(ii) Carry over moment
(iii) Carry over factor
(iv) Stiffness
(v) Fixed end moment

Rubric	Marks
provide 1 marks to each point.	5

Q16. A continuous beam ABC is supported at A (fixed), B (roller), and C (fixed) with equal spans AB = 4m and BC = 4m. The beam carries a point load of 20kN at the center of span AB and a uniformly distributed load (UDL) of 10kN/m over the entire span BC. Using the Slope Deflection Method determine the support moments at A, B, and C. **5 3 3**

Rubric	Marks
Step Marking for each correct steps Correct Answers Moment at A (M_A) = +17.78 kN·m Moment at B (M_B) = -7.78 kN·m Moment at C (M_C) = +21.33 kN·m	5

Q17. A continuous beam ABC is supported at A (fixed), B (roller), and C (fixed), with spans AB = 4m and BC = 4m. The beam carries a uniformly distributed load (UDL) of 10 kN/m over the entire span AB and a point load of 20 kN at the center of span BC. Using the Moment Distribution Method (MDM), determine the fixed-end moments (FEMs), distribute the unbalanced moments at each joint, and compute the final moments at A, B, and C. **5 3 3**

Rubric	Marks
Fixed-End Moments (FEMs) Calculation	1
Distribution Factors (DFs) Calculation	1
Moment Distribution Process	2
Final Moments	1

Section 5 (Answer any 2 question(s))

Marks CO BL

Q18. State Muller's Breslau principle. Write down its applications. **5 3 3**

Rubric	Marks
Statement of Muller's Breslau principle	2.5
Applications of Muller's Breslau principle	2.5

Q19. A simply supported beam of span 8m carries a UDL of 5 kN/m moving across its span. Determine the maximum bending moment and positive negative shear force using influence lines at 3 m distance from left end support. **5 3 3**

Rubric	Marks
Maximum Bending Moment at 3m = 75 kNm	2.5
Maximum Positive Shear Force at 3m = 4.69 kN Maximum Negative Shear Force at 3m = -4.69 kN	2.5

Q20. A simply supported beam with a span of 10 meters is subjected to two moving point loads of 15 kN and 20 kN, which are spaced 3 meters apart. The 15 kN load leads the 20 kN load as they traverse from left to right across the span. Using the influence line method, determine the maximum shear force at a section 4 meters from the left support. **5 3 3**

Rubric	Marks
Step Marking for each correct steps Correct Answers The maximum positive shear force at 4m is 15 kN.	5

Section 6 (Answer any 2 question(s))

Marks CO BL

Q21. Differentiate between two hinged arch and three hinged arch. **5 3 3**

Rubric	Marks
for each correct difference award one mark	5

Q22. What do you mean by suspension bridge? Explain its part by detailed diagram. **5 3 3**

Rubric	Marks
Definition of suspension bridge	2
Bridge diagram with all notation	3

Q23. A two-hinged parabolic arch with a span of 10 meters and a rise of 3 meters at the crown is subjected to a point load of 20 kN at the center of the span. The arch is symmetrical, and the supports are hinged. Using the principles of static equilibrium, determine the horizontal thrust at the supports and the vertical reaction forces at each support. **5 3 3**

Rubric	Marks
Vertical reactions at A and B: 10 kN each	2.5
Horizontal thrust at supports: 8.33 kN	2.5

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