



## Term Evaluation (Even) Semester Examination March 2025

Roll no.....

Name of the Course: B.Tech-Civil Engineering

Semester: IV

Name of the Paper: Structural Analysis

Paper Code: TCE- 402

Time: 1.5 hour

Maximum Marks: 50

**Note:**

- (i) Answer all the questions by choosing any one of the sub-questions
- (ii) Each question carries 10 marks.

**Q1.**

CO 1 (10 Marks)

- a. Using moment area method, determine the mid-span deflection in a simply supported beam of span 'L', when it is subjected to a udl throughout the span.

**OR**

- b. A fixed beam with a span of L carries a central concentrated load P. Derive the expression for the fixed-end moments at both supports and determine their values for  $P=30\text{ kN}$  and  $L=4\text{ m}$

**Q2.**

CO 1 (10 Marks)

- a. A cantilever of length L is carrying a point load of W KN at a distance of 'a' from the fixed end. Calculate Slope at the free end and deflection at the free end.

**OR**

- b. A simply supported beam AB of span 4m carries a point load of 100KN at its center C. The values of I for the left half is  $1 \times 10^8 \text{ mm}^4$  and for the right half portion I is  $2 \times 10^8 \text{ mm}^4$ . Find the slopes at the two supports and deflection under the load using conjugate beam method. Take  $E=2 \times 10^5 \text{ N/mm}^2$

**Q3.**

CO 1 / CO 2 (10 Marks)

- a. A fixed beam of span L is subjected to a uniformly distributed load (UDL) of intensity 'w' over its entire span. Determine the fixed-end moments at both supports and determine their values for  $L=6\text{ m}$  and  $w=10\text{ kN/m}$ .

**OR**

- b. Compare the strain energies of the following two shafts subjected to the same maximum shear stress in torsion:

- i) A hollow shaft having outer diameter n times the inner diameter
- ii) A solid shaft

Masses, lengths and materials of the two shafts are the same.

**Q4.**

CO 2 (10 Marks)

- a. A beam 4m in length is simply supported at the ends and carries a uniformly distributed load of  $6\text{ kN/m}$  length. Determine the strain energy stored in the beam. Take  $E=200\text{ GN/m}^2$  and  $I=1440 \text{ cm}^4$

**OR**

- b. A beam of length l simply supported at the ends is loaded with a point load W at a distance 'a' from one end. Assuming that the beam has constant cross-section with moment of inertia I and young's modulus E, find the strain energy of beam and hence find the deflection under the load. Strain energy due to shearing is neglected.



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CO 2 (10 Marks)

Q5.

- a. A cantilever of length L is carrying a point load of W KN at a distance of 'a' from the fixed end. Calculate Slope at the free end and deflection at the free end using Castiglano's method.  
OR  
b. A steel bar 4cm by 4cm in section, 3m long is subjected to an axial pull of 128kN. Taking  $E=2\times 10^5$  N/mm<sup>2</sup> calculate the alteration in the length of the bar. Calculate also the amount of energy stored in the bar during the extension.