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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## July / August 2024 Semester End Main Examinations

**Programme: B.E.** **Semester: IV**
**Branch: Civil Engineering** **Duration: 3 hrs.**
**Course Code: 19CV4PCSTA** **Max Marks: 100**
**Course: Structural Analysis**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.





### UNIT - I

1 a) What are Influence Lines? **02**

b) Prove that a three hinged arch of span 'L' and rise 'h' carrying a uniformly distributed load of 'w' per unit run over the whole span has a horizontal thrust of $8h/wL^2$ at each support. **08**

c) A three hinged arch has a span of 30m and a rise of 10m. Arch carries an udl of 50kN/m in the left half of the span. It also carries two concentrated loads of 75kN and 150kN at 5m and 10m from right end. Determine the horizontal thrust at the support and BM @ a point 7.5m from the right support. **10**

### UNIT - II

2 a) Using moment area method, determine slope at supports and deflection at center for the simply supported beam shown in Fig.Q.2a Take E = $2x10^5 N/mm^2$, I = $250x10^6 mm^4$ and Span AC = EB = I & CD = DE = 2I. **10**

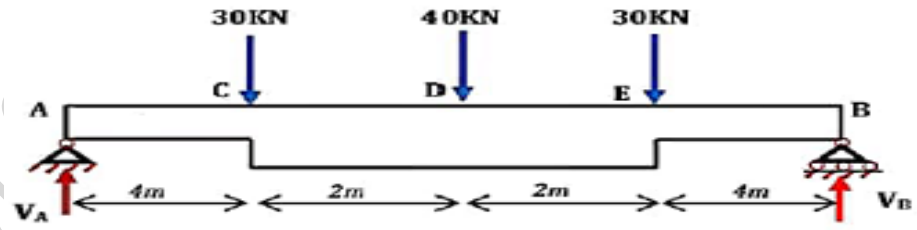


Fig.Q.2a

b) Determine the slope and deflection at the free end of cantilever as shown in Fig.Q.2b using conjugate beam method. Take E = $2x10^5 N/mm^2$ and I = $5x10^8 mm^4$. **10**

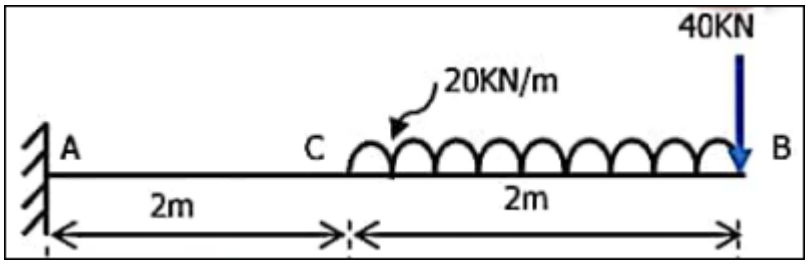


Fig.Q.2b

**OR**

3 a) Using moment area method, determine slope at supports and deflection at center for the simply supported beam shown in Fig.Q.3a. Take E = $205x10^6$ kN/$m^2$, I = $80x10^{-6}m^4$. **10**

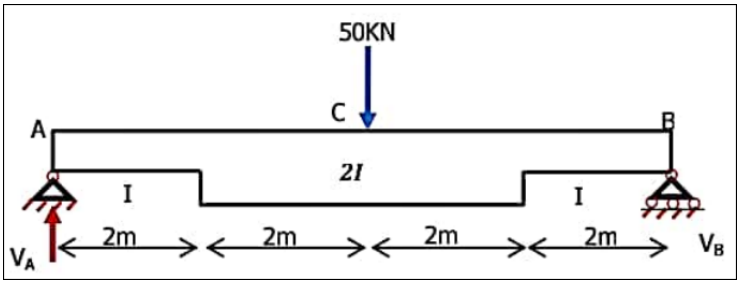


Fig.Q.3a

b) Determine the slope and deflection at the free end of cantilever as shown in Fig.Q.3b using conjugate beam method. Take E = $2x10^5$N/$mm^2$ and I = $8x10^8mm^4$. **10**

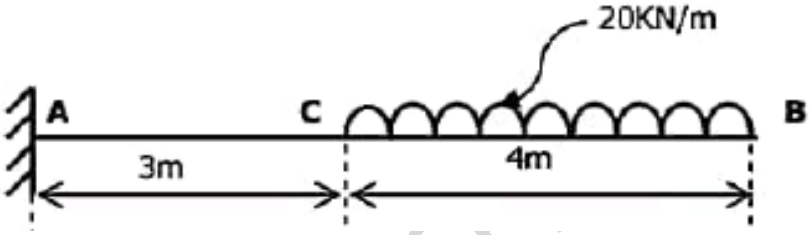


Fig.Q.3b

**UNIT - III**

4 A continuous beam, ABC of length 3l consists of span AB and BC of lengths 2l and l respectively. The beam is fixed at end A and simply supported at B and C. The beam carries a uniformly distribute load of w per unit run on the whole beam. Determine the bending moments at supports. Use theorem of three moments. Assume the beam has uniform section throughout. **20**

**UNIT - IV**

5 a) Derive an expression for strain energy due to bending of a cantilever beam of length L, carrying uniformly distributed load 'w' per meter. Refer Fig.Q.5a. Take EI is constant. **10**

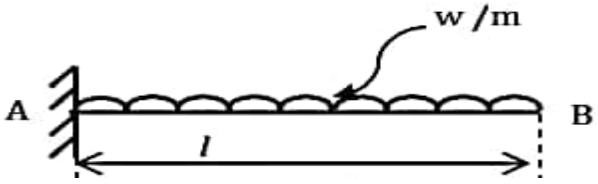


Fig.Q.5a

b) Derive the expression for strain energy due to bending. **05**

c) State and explain Castigliano's first theorem. **05**

**OR**

6 a) For the cantilever beam shown in Fig.Q.6a. Compute strain energy of the beam and the deflection below the point load. Take E = 2.1 x $10^5$MPa & I = $300x10^6mm^4$. **10**

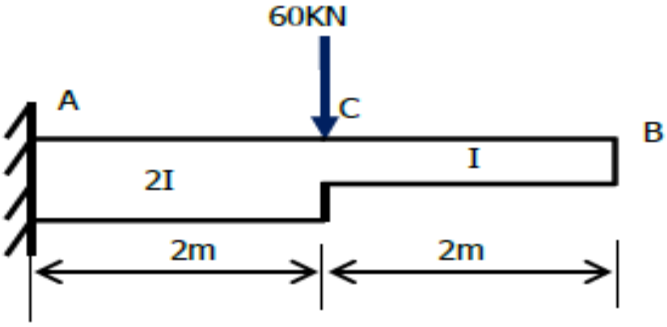


Fig.Q.6a

b) State and Prove Maxwell-bettis theorem of reciprocal deflections **10**

**UNIT - V**

7 a) Determine the vertical and horizontal deflection at joint 'C' of the truss shown in Fig.Q.7a using unit load method. E = 200GPa, A = $10^{-4}m^2$ for all the members. **10**

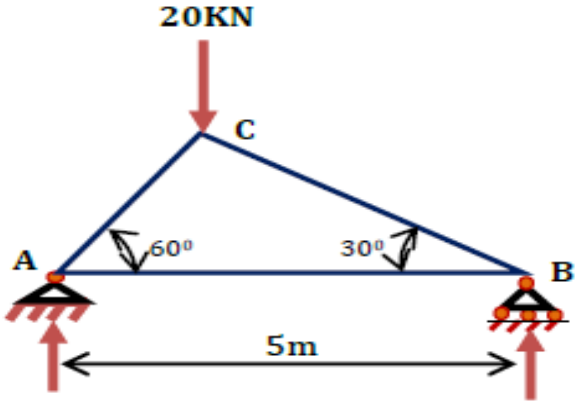


Fig.Q.7a

b) Find the deflection of the free end of the frame shown in Fig.Q.7b using unit load method. E = $2x10^5$MPa & I = 40 x $10^6mm^4$. **10**

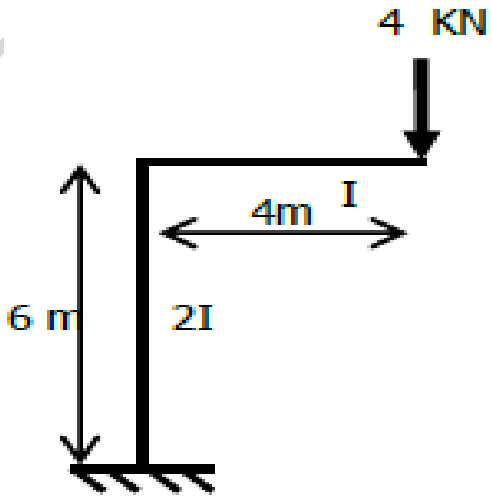


Fig.Q.7b

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