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Course Code

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Fourth Semester B.E. Degree Examinations, September/October 2024

STRUCTURAL ANALYSIS-I

Duration: 3 hrs

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. Missing data, if any, may be suitably assumed.

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>
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MODULE – 1

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|----|----|--|-----------|-----------------|
| 1. | a. | Define statically determinate and indeterminate structures. | 04 | (1 : 1 : 1.3.1) |
| | b. | Determine the static and kinematic indeterminacy for the following structures shown in Fig 1(b). Neglect axial deformations. | 06 | (2 : 1 : 1.3.1) |

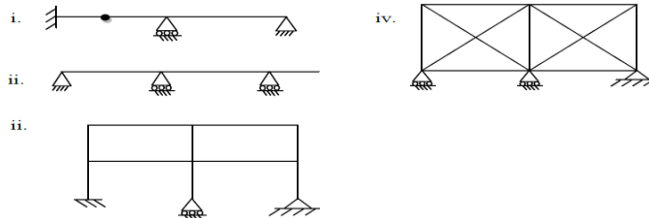


Fig. 1(b)

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|----|--|---|-----------|-----------------|
| c. | | Determine the forces in all the members of the pin jointed truss shown in Fig. 1(c) using method of joints. | 10 | (2 : 1 : 1.3.1) |
|----|--|---|-----------|-----------------|

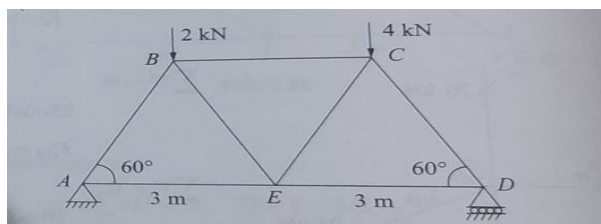


Fig. 1 (c)

OR

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|----|----|--|-----------|-----------------|
| 2. | a. | Explain the different types of structural forms | 04 | (1 : 1 : 1.3.1) |
| | b. | Determine the static and kinematic indeterminacy for the following structures shown in Fig 2(b). Neglect axial deformations. | 06 | (2 : 1 : 1.3.1) |

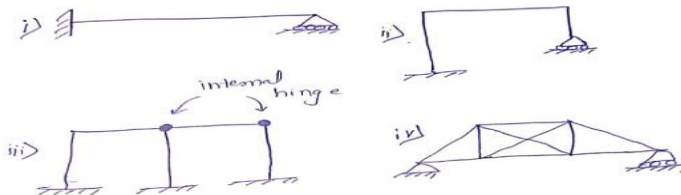


Fig. 2(b)

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|----|--|---|-----------|-----------------|
| c. | | Determine the nature and magnitude of forces in members DE, DI and HI of the truss shown in Fig.2(c). | 10 | (2 : 1 : 1.3.1) |
|----|--|---|-----------|-----------------|

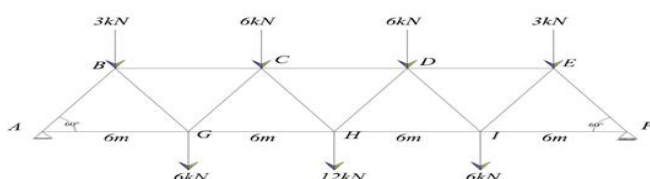


Fig. 2(c)

MODULE – 2

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|----|---|-----------|-----------------|
| 3. | a. Derive the Mohr's first theorem of moment area method. | 08 | (1 : 2 : 1.3.1) |
| | b. Find the slope and deflection at the free end of cantilever beam shown in Fig. 3(b) by moment area method. | 12 | (2 : 2 : 1.3.1) |

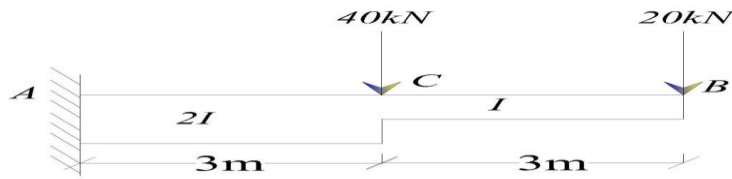


Fig. 3 (b)

OR

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|----|---|-----------|-----------------|
| 4. | a. Derive the Mohr's second theorem of moment area method. | 08 | (1 : 2 : 1.3.1) |
| | b. Determine slope at the supports and deflection under the load for simple supported beam shown in the fig by conjugate beam method. | 12 | (2 : 2 : 1.3.1) |

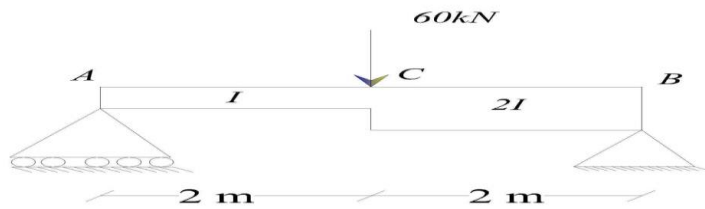


Fig. 4 (b)

MODULE – 3

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|----|---|-----------|-----------------|
| 5. | a. A three hinged parabolic arch has a span of 20 m and central rise of 5 m. It carries a concentrated load of 100 kN at a distance of 5 m from the left Support. Determine the maximum bending moment and plot the bending moment diagram. | 10 | (2 : 3 : 1.3.1) |
| | b. A cable is of uniform section is suspended between two supports 100 m apart. It carries a uniformly distributed load of 10 kN/m spread over the horizontal span. The lowest point of cable sags 10 m below the supports. Find
(i) Maximum and minimum tension in the cable and its inclination.
(ii) Minimum required cross sectional area of cable of the allowable stress is 280 MPa.
(iii) Length of cable | 10 | (2 : 3 : 1.3.1) |

OR

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|----|--|-----------|-----------------|
| 6. | a. A three hinged parabolic arch hinged at the supports and at the crown has a span of 24 m and a central rise of 4 m. It carries concentrated loads of 75 kN at 18 m from the left support and uniformly distributed load of 45 kN/m over the left half of the portion. Determine the bending moment, normal thrust and radial shear at a section 6 m from the left support. | 10 | (2 : 3 : 1.3.1) |
| | b. A bridge cable is suspended from towers 80 m apart and carries an udl of 45 kN/m on the entire span. If the maximum sag is 8 m, calculate the maximum tension in the cable. Determine the forces acting on the towers
(i) If the cable is supported by saddles which are stayed by wires inclined at 30° to the horizontal and (ii) If the same inclination of back stay passes over pulley. | 10 | (2 : 3 : 1.3.1) |

MODULE – 4

7. a. Derive the expression for strain energy stored in a member due to bending. 05 (2 : 4 : 1.3.1)
 b. Find the vertical deflection at point C for the frame shown in Fig. 7(b) using Castigliano's method. Assume $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 2 \times 10^8 \text{ mm}^4$. 15 (2 : 4 : 1.3.1)

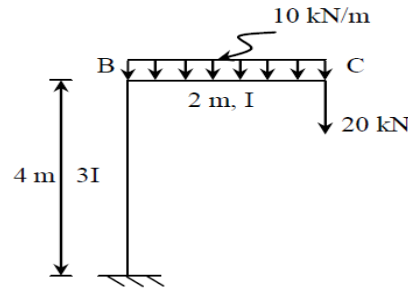


Fig. 7(b)

OR

8. a. Derive the expression for strain energy stored in a member due to axial force. 05 (2 : 4 : 1.3.1)
 b. Determine the vertical deflection of joint E for the Warren truss shown in fig by unit load method. Take $A = 645 \text{ mm}^2$ and $E = 200 \text{ kN/mm}^2$ for all the members. 15 (2 : 4 : 1.3.1)

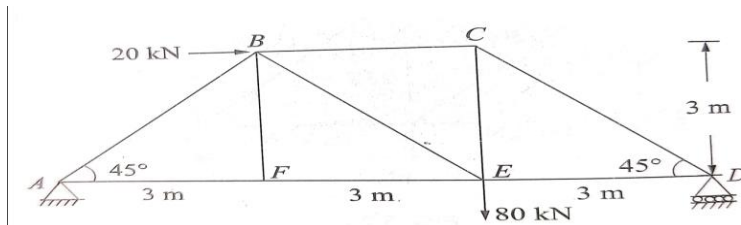


Fig. 8(b)

MODULE – 5

9. a. A single rolling load of 80 kN rolls over a simply supported girder of 15 m span from left to right. calculate (i) maximum reaction (ii) Shear force and bending moment at 6 m from left support. 10 (2 : 5 : 1.3.1)
 b. Draw the influence line diagram for members X, Y and Z of the truss shown in Fig 9 (b) . 10 (2 : 5 : 1.3.1)

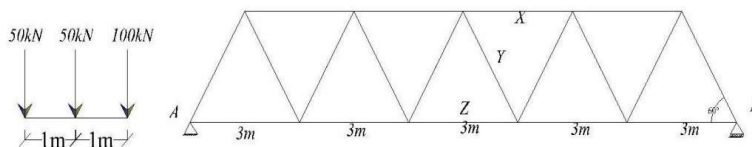


Fig. 9(b)

OR

10. a. A moving UDL of 50 kN/m and 6m long cross over a simply supported beam of span 25m. Determine 10 (2 : 5 : 1.3.1)
 (i) Maximum +ve SF, -ve SF and BM at 6m from left support.
 (ii) Absolute maximum SF and BM anywhere on the beam.
 b. Multiple point loads of 100 kN, 120 kN, 80 kN and 150 kN spaced 2 m apart cross a girder of span 28 m from left to right with the 100 kN load leading. Calculate (i) maximum reaction (ii) Maximum shear force and bending moment at 12m from left support. 10 (2 : 5 : 1.3.1)
 Also, find the absolute maximum moment due to the given load system.

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