

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note: Attempt Five questions in all, selecting one question from each Section A, B, C and D. Section E is compulsory.

SECTION-A

1. i) Explain the Maxwell law of reciprocal theorem.
ii) Difference between Static Indeterminacy and Kinematic Indeterminacy with example. (10)
2. A beam ABCD 10 m long is simply supported at the ends A and D and carries a concentrated load of 20 kN at C. The parts AB, BC and CD are each 3 m long. The moment of inertia of the section for the parts AB, BC and CD are respectively 3I, 2I and I. Find
i) the slopes at A, B, C and D
ii) Deflection at B and C. Take $E = 250 \text{ kN/mm}^2$ and $I = 4.15 \times 10^7 \text{ mm}^4$. Conjugate beam method. (10)

SECTION-B

3. Find support reaction and moments by using strain energy method as shown in Fig.1 (10)

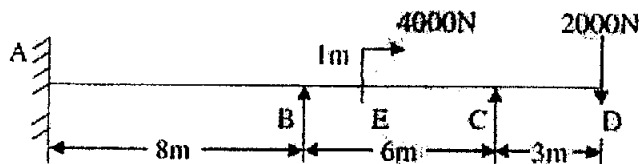


Fig.1

4. Compute the vertical deflection of joint E by unit load method as shown in Fig.2. (10)

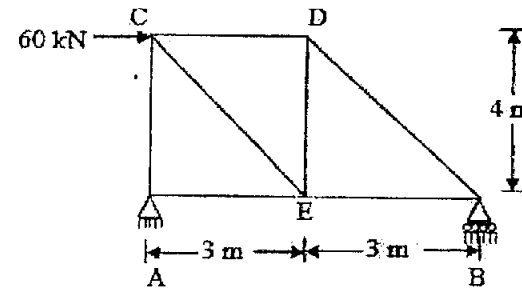


Fig. 2

SECTION-C

5. Three hinged parabolic arch rib has a span of 50 m and a rise 25 m to the central pin at the crown. The rib carries the load of intensity 3kN/m uniformly distributed horizontally on the left 4m. Calculate the (i) maximum and minimum bending moments, (ii) horizontal thrust (iii) normal thrust and radial shear at a section 15m from A. (10)
6. A suspension cable, stiffened with a three hinged girder, has 100 m span and 10 m dip. The girder carries a load of 0.4 kN/m. A live load of 10 kN rolls from left to right. Determine (i) the maximum BM, anywhere in the girder and (ii) the maximum tension in the cable. (10)

SECTION-D

7. Draw the influence line for B.M. at a point 10 m distant from the left hand abutment of a bridge girder of 25 m span. Find the maximum B.M. at that point due to a series of wheel loads 10, 20, 20, 20 and 20 tonnes at center 4, 2.5, 2.5 and 2.5 meters. The loads can cross in either direction, the 10 kN wheel load leading in each case. (10)

[P.T.O.]

8. The following system of concentrated loads roll from left to right on a span of 15 m, 4 kN load leading: Load 2, 6, 6, 5 and 4 kN: Distance 1.5, 1.5, 2 and 1 meters. For a section 4 m from the left hand support. Determine
- (a) the maximum bending moment and
 - (b) maximum shear force. (10)

SECTION-E

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- i) Define Muller Breslau Principle.
 - ii) What is a conjugate beam? Discuss its utilities.
 - iii) Discuss the concept of virtual work method.
 - iv) Explain the significance of influence line diagram.
 - v) Explain the expression for strain energy due to axial force, bending moment.

(5×4=20)