Roll No .....

CE-505

B.E. V Semester

Examination, December 2016

Theory of Structure - I

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each question are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

v) Any missing data may be suitably assumed, if any.

Unit - I

1. a) What are the different types of the strain energies stored in the structure?

   b) State Castigliano's theorems for strain energy. Write their applications in analysis of structures.

   c) State the Maxwell's theorem of reciprocal deflections.

   d) Analyse the frame shown in figure (1) by using minimum strain energy method. Draw BMD.

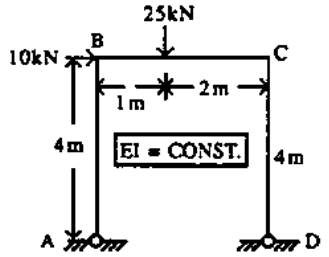

Figure 1

OR

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motion equation. Draw BMD.

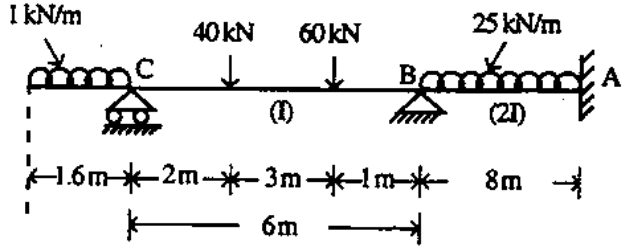

Figure 3

OR

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Analyze the portal frame shown in figure (4) by using by moment distribution method. Draw BMD and sketch the deflected shape of portal frame. EI is constant for all the members.

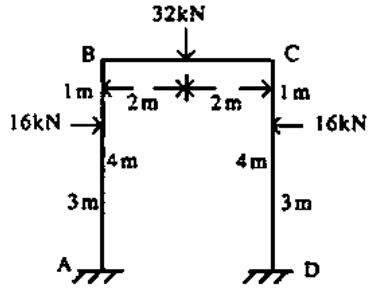

Figure 4

Unit - III

3. a) Find out the ratio of the slope and deflection at the centre of the beam, if fixed end of a fixed beam of span L settles by an amount δ.

   b) Enumerate the steps involved in determining the fixed end moments for a beam with variable moment of inertia using column analogy method.

   c) Derive the slope-deflection equation :

$$M_{AB} = M^{F}_{AB} + \frac{2EI}{L}\left(2\varphi_A + \varphi_B + \frac{3\Delta_{AB}}{L}\right)$$

   d) Analyze the portal frame shown in figure (5) using by slope-deflection method. Draw BMD.

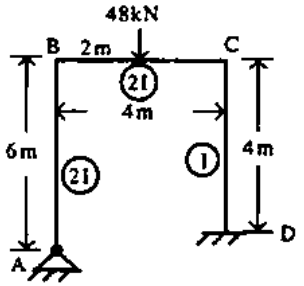

Figure 5

OR

Analyze portal frame shown in figure (6) using by column analogy method. Draw BMD.

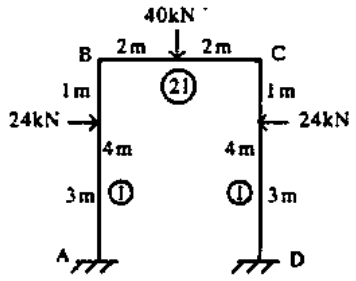

Figure 6

Unit - IV

4. a) Differentiate two hinged arch and three hinged arch.

   b) Find out the horizontal component of tension in the cable, if a cable of span L and central dip d is subjected to uniform load w per unit horizontal length.

   c) Discuss the components and functions of a suspension bridge with diagram.

   d) A two hinged parabolic arch has span of 20 m and a rise of 5 m and carries a UDL of 20 kN/m for a distance of 5 m from the left end as shown in figure (7). Determine (i) the horizontal thrust at each support and (ii) bending moment, normal thrust and radial shear at a section of the arch 5 m from the left end.

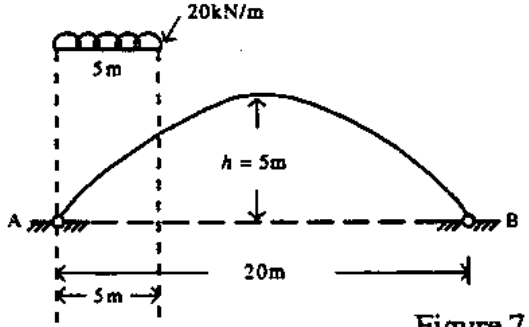

Figure 7

OR

A suspension cable 160 m span and 16 m central dip carries a load of ½ kN per linear horizontal meter. Calculate the maximum and minimum tensions in the cable. Find horizontal and vertical forces in each pier under the following alternative conditions : (i) if the cable passes over friction less rollers on the top of the piers. (ii) if the cable is firmly clamped to saddles carried on friction less roller on the top of the piers.

In each case the back stay is inclined at 30° to the horizontal.

Unit - V

5. a) What do you understand by influence line diagram? State the significance of ILD in the analysis of structures.

   b) State the Muller-Breslau principle and where is it used.

   c) Define absolute maximum shear force and absolute maximum bending moment in case of rolling/moving loads.

   d) A simply supported beam has a span of 15 m. A uniformly distributed load of 40 kN/m and 5 m long crosses the girder from left to right. Draw the influence line diagram for shear force and bending moment at a section 6 m from left end. Use this diagrams to calculate shear force and bending moment at this section. Figure (8).

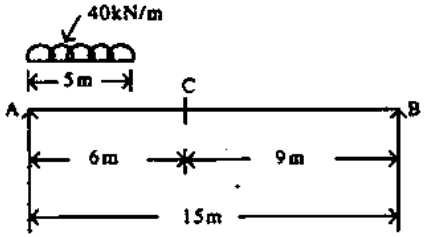

Figure 8

OR

The system of concentrated loads shown in figure (9) rolls from left to right on the girder of span 15 m, 40 kN load leading. For a section 4 m from left support, determine (i) Maximum B.M. (ii) Maximum S.F.

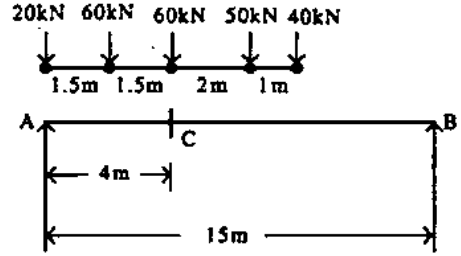

Figure 9

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