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Question Paper Code : 50544

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Sixth Semester

Civil Engineering

CE 3602 — STRUCTURAL ANALYSIS – II

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Sketch the maximum shear force diagram for a point load W, when it rolls on a simply supported beam of span L.

2. Differentiate between BMD and influence line diagram of bending moment.

3. State Muller Breslau's principle.

4. What are the uses of influence line diagrams?

5. Distinguish the three hinged arch and the two hinged arch.

6. Under what conditions will the bending moment in an arch be zero throughout?

7. Define tension coefficient.

8. What are the main functions of stiffening girders in suspension bridges?

9. State the assumptions made in the portal frame method.

10. Compare cantilever method and portal method of lateral load analysis.

PART B — (5 × 13 = 65 marks)

11. (a) Five point loads 5kN, 10kN, 20kN, 30kN and 15kN crosses from left to right on a simply supported girder of span 25m, with 5kN leading. The spacing between successive loads is 2m. Estimate the maximum bending moment under 20kN load, the maximum bending moment at a distance of 10m from the left support and the maximum shear force in the girder.

Or

(b) Draw the influence line diagrams for shear force and bending moment at a section 4m from the left end of a simply supported beam having 16m span. Use the influence line diagram to calculate the maximum shear force and maximum bending moment at this section due to a uniformly distributed load 6m long with 6 kN/m intensity when it rolls from left end to right end. Also calculate the absolute maximum bending moment and its position.

12. (a) A two span continuous beam ABC with spans AB = BC = 4 m (Figure 1). Determine and construct the influence line diagram for shear force at a point 3 m from the support A. Compute the ordinates at 1 m intervals.

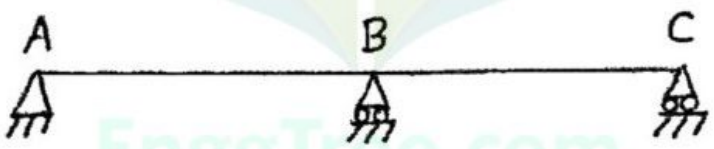

Figure 1

Or

(b) Using Muller Breslau's principle, draw the influence line diagram for the reaction at B for the propped cantilever AB of span 20 m (Figure 2). Compute the ordinates at interval of 2.5 m.

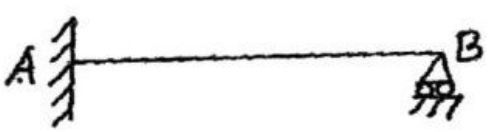

Figure 2

13. (a) A three hinged parabolic arch of span 30m and central rise 5m carries a uniformly distributed load of 5kN/m over the left half of the span. Calculate:

(i) The normal thrust and radial shear at 12m from the left support. (6)

(ii) The position magnitude of the maximum positive and negative bending moment anywhere on the arch and draw the bending moment diagram. (7)

Or

(b) (i) Discuss the effect of change in temperature on three hinged arches. (5)

(ii) A two hinged parabolic arch of span 'l' m and central rise 'y_c' carries a point load 'W' at a distance of 'a' m from the left support. The arch has a varying second moment of area, which is proportional to the secant of the slope of its rib axis. Derive an expression for the horizontal thrust on the arch. (8)

14. (a) A three hinged stiffening girder of a suspension bridge of span 120 m is subjected to two point loads of 90 kN magnitude each placed at 30 m and 50 m respectively from the left support. Supports are at same level. Determine the bending moment and shear force at a section 30 m from each end of the girder. Also determine the maximum tension in the cable which has a central dip of 12 m.

Or

(b) Explain the procedure involved in tension coefficient method for analyzing the space trusses.

15. (a) Analyze the substitute frame having three bays AB, BC and CD for maximum positive bending at mid span of AB using the following data:

Length of beam AB = 5m

Length of beam BC = 3m

Length of the beam CD = 5m

Height of columns above the beams = 4m; Height of columns below the beams = 4m; Thickness of floor slab = 120mm; size of beams = 300mm × 400mm; size of columns = 300mm × 400mm Spacing of frames = 3m. Assume the live load as 3kN/m^2. Unit weight of concrete = 25kN/m^3.

Or

(b) (i) What are the advantages of approximate method of analysis? (3)

(ii) Explain the steps involved in the computation of moment and shear in various members of the top most storey of a three bay frame using cantilever method. (10)

PART C — (1 × 15 = 15 marks)

16. (a) A three hinged symmetrical circular arch of span 18m and a central rise of 6m carries a point load of 15kN at 5m from the right support. Calculate:

(i) The normal thrust at 6m from the left support (5)

(ii) The position, magnitude of the maximum positive and negative bending moment anywhere on the arch and draw the bending moment diagram. (10)

Or

(b) Using Muller Breslau principle, draw the influence line diagram for the bending moment at D, the middle point of span AB of a continuous beam shown in figure 3. Compute the ordinates at 1m interval. Determine the maximum hogging bending moment in the beam when two concentrated loads of 8kN each and separated by a distance 1m passes through the beam from the left to right.

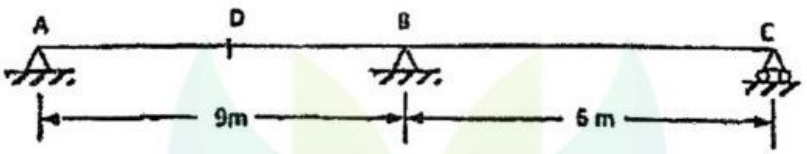

Figure 3