CBCS SCHEME

USN | | | | | | | | | |

18CV42

# Fourth Semester B.E. Degree Examination, June/July 2023
## Analysis of Determinate Structures

Time: 3 hrs. Max. Marks: 100

**Note:** ***Answer any FIVE full questions, choosing ONE full question from each module.***





### Module-1

1 a. Determine the static degree of indeterminacy for the following structures shown in Fig.Q1(a). Neglect axial deformation.

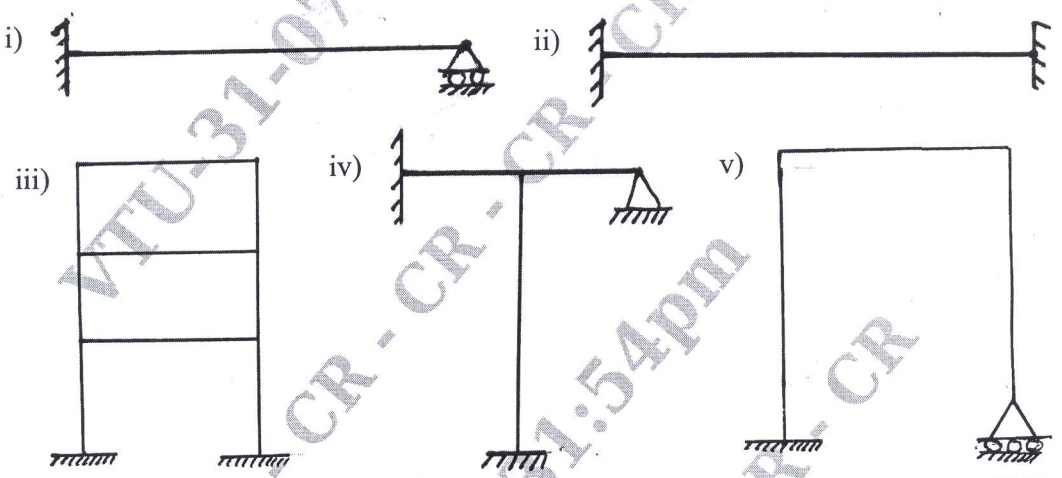


Fig.Q1(a) **(10 Marks)**

b. A simply supported beam of 15 meter span is subjected to uniform dead load of 50kN/m covering the entire span and a uniform live load 100kN/m (longer than the span). Determine the value of positive as well as negative shear force at left quarter span. **(10 Marks)**

**OR**

2 a. A simply supported beam has a span of 15m. Uniformly distributed load of 40kN/m and 5m long crosses the girder from left to right. Draw the influence line diagram for shear force and bending moment at a section 6m from left end. Use these diagrams to calculate the maximum shear force and bending moment at this section. **(10 Marks)**

b. Using influence line diagrams determine the shear force and bending moment at section 'C' in the simply supported beam as shown in Fig.Q2(b).

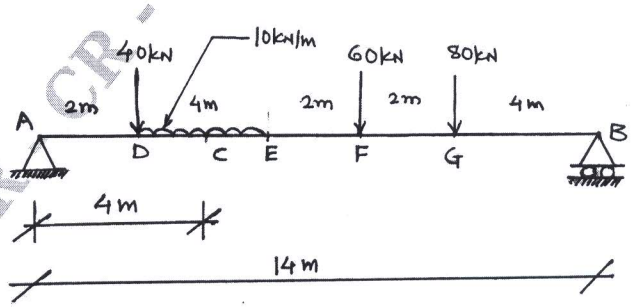


Fig.Q2(b) **(10 Marks)**

## Module-2

3 a. A uniformly distributed load of intensity 2kN/m and 5m long crosses a simply supported beam of 20 meter span from left to right. Calculate :
i) Maximum shear force and maximum bending moment at a section 8m from the left support
ii) Absolute maximum bending moment. **(10 Marks)**

b. Two wheel loads of 160kN (leading loads) and 400kN spaced 2 meters apart move on a simply supported beam girder of span 16 meters from left to right. Find the maximum positive and negative shear force at a section.
i) 4 meters from the left end
ii) 6 meters from the left end. **(10 Marks)**

**OR**

4 a. The system of concentrated loads shown in Fig.Q4(a) rolls from left to right on the girder of span 15m, 40kN load leading. For a section 4m from left support, determine :
i) Maximum bending moment
ii) Maximum shear force.

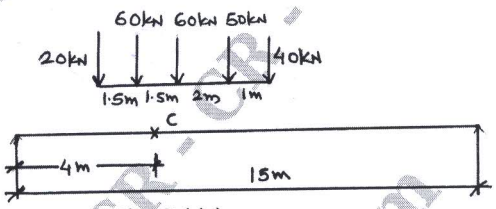


Fig.Q4(a) **(10 Marks)**



b. Draw influence line diagram for members $L_1L_2$, $U_1L_2$ and $U_1U_2$ of the truss as shown in Fig.Q4(b).

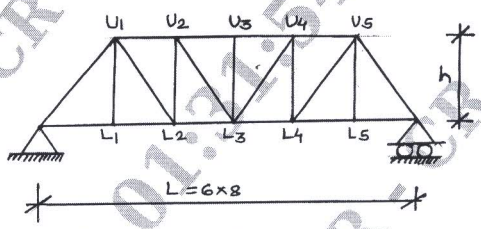


Fig.Q4(b) **(10 Marks)**

## Module-3

5 a. Write the conjugate beam theorems. **(02 Marks)**

b. Determine θA, θB, θC and deflection at 'C' in the beam shown in Fig.Q5(b) by conjugate beam method.

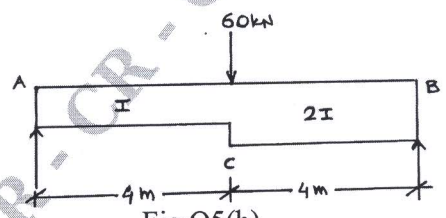


Fig.Q5(b) **(08 Marks)**

c. Determine the slope and deflections at B and C in the cantilever beam shown in Fig.Q5(c) by conjugate beam method.

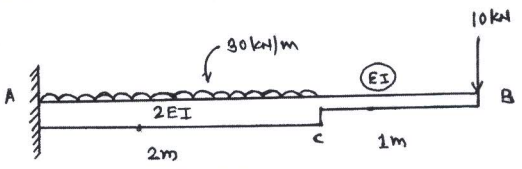


Fig.Q5(c) **(10 Marks)**

**OR**

6 a. Write the moment area theorem. **(02 Marks)**

b. Determine the slope and deflection at the free end of a cantilever beam as shown in Fig.Q6(b) by moment area method. (Take EI = 4000kN m$^2$).

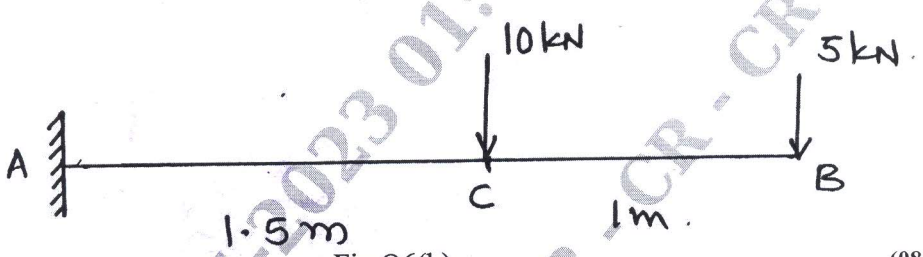


Fig.Q6(b) **(08 Marks)**

c. Determine the rotation at supports and defection at mid-span and under the loads in the simply supported beam as shown in Fig.Q6(c).

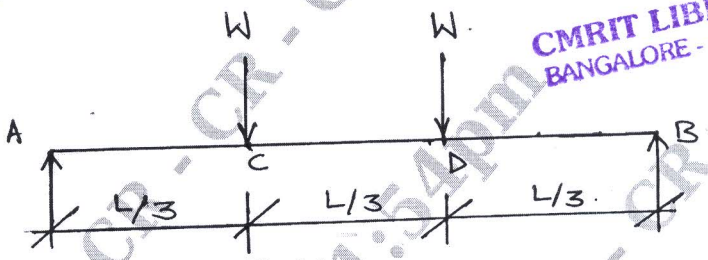




Fig.Q6(c) **(10 Marks)**

## Module-4

7 Determine the vertical and horizontal displacement at the free end 'D' in the Fig.Q7(a). Take EI = $12 \times 10^{13}$N-mm$^2$. Use Castigliano's theorem.

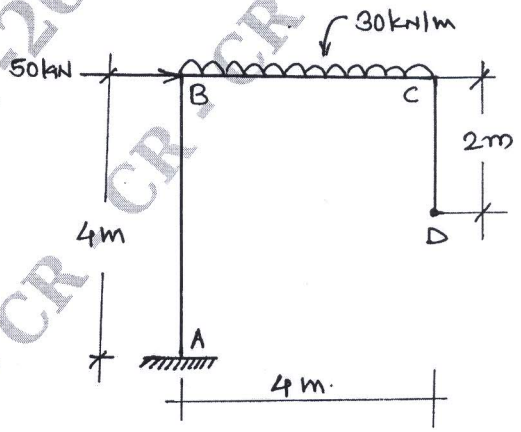


Fig.Q7(a) **(20 Marks)**

**OR**

8 a. Find the vertical deflection of the joint B in the truss loaded as shown in Fig.Q8(a). The cross-sectional area of the members in mm are shown in brackets. Take E = 200kN/mm$^2$.

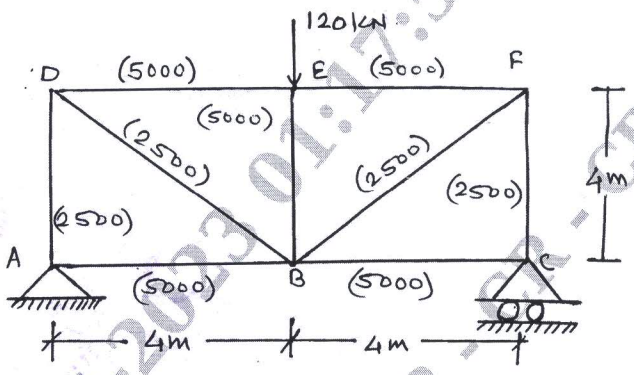


Fig.Q8(a) **(10 Marks)**

b. Determine the vertical deflection of point 'D' in the truss shown in Fig.Q8(b). The cross-sectional areas of members AD and DE are 1500mm$^2$ while those of the other members are 1000mm$^2$. Take E = 200kN/mm$^2$.

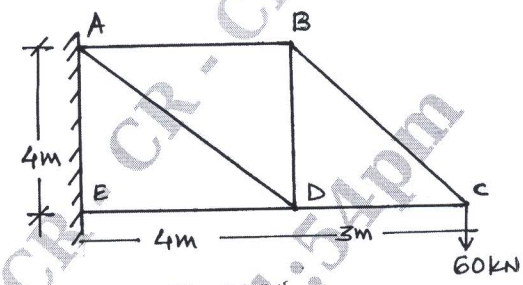


Fig.Q8(b) **(10 Marks)**



## Module-5

9 a. A three hinged circular arch hinged at the springing and crown points has a span of 40m and a central rise of 8m. It carries a uniformly distributed load 20kN/m over the left-half of the span together with a concentrated load of 100kN at the right quarter span point. Find the reactions at the supports, normal thrust and shear at a section 10m from left support. **(10 Marks)**

b. A light cable 18m long is supported at two ends at the same level. The supports are 16m apart. The cable supports 120N load dividing the distance into two equal ports. Find the shape of the cable and tension in cable. **(10 Marks)**

**OR**

10 a. A circular arch of span 25m with a central rise 5m is hinged at the crown and springing. It carries a point load of 100kN at 6m from the left support. Calculate :

i) The reactions at the supports
ii) The reactions at crown
iii) Moment at 5m from the left support. **(10 Marks)**

b. A light flexible cable 18m long is supported at two ends at the same level. The supports are 16m apart. The cable is subjected to uniformly distributed load of 1kN/m of horizontal length over its entire span. Determine the reactions developed at the support. **(10 Marks)**

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