USN | | | | | | | | | | 18CV42

Fourth Semester B.E. Degree Examination, June/July 2024
Analysis of Determinate Structures

Time: 3 hrs.   Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume data suitably wherever necessary.

Module-1

1   a. Define : (i) Degree of freedom   (ii) Condition of equilibrium   **(06 Marks)**
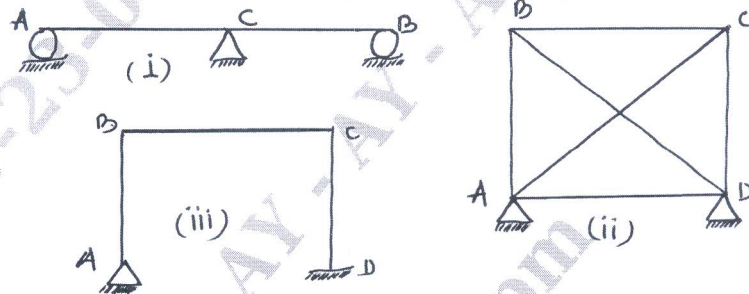   b. Find the static and kinematic, indeterminacy of the following structures shown in Fig.Q1(b).

Fig.Q1(b)   **(06 Marks)**

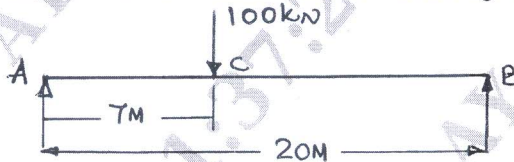   c. Determine the reaction at 'A' and 'B' for the beam shown in Fig.Q1(c) using ILD.

Fig.Q1(c)   **(08 Marks)**

OR

2   a. Briefly explain linear and non-linear analysis and ILD (Influence Line Diagram).   **(06 Marks)**
    b. A uniformly distributed load of 50 kN/m and of length 7m is rolling over a simply supported girder of span 20 m as shown in Fig.Q2(b). Determine:
       (i)   Reaction at 'B', when the head of the UDL is at 7m from left end.
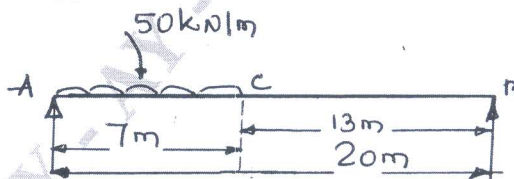   (ii) Maximum reaction at support B.

Fig.Q2(b)   **(14 Marks)**

Module-2

3   The multiple point loads of 120 kN, 150 kN, 150 kN, 100 kN and 80 kN as shown in Fig.Q3 with spacing 2m, 2.5m, 1.8m and 1.5m cross a girder of 25 m from left to right with 80 kN load leading. Calculate:
    (i) Reaction   (ii) Maximum SF and BM at a section 15 m from left
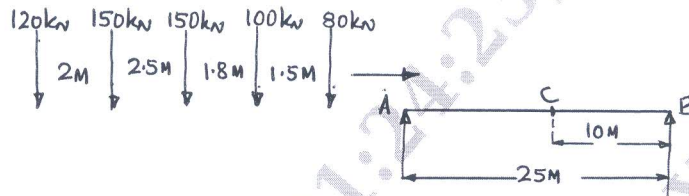
Fig.Q3   (20 Marks)

OR

4   The multiple point loads 100 kN, 120 kN, 80 kN and 150 kN as shown in Fig.Q4 with spacing of 2m crosses a girder of span 28 m from left to right with 100 kN load leading. Calculate :
(i)   Reactions
(ii)   Maximum BM at section 12M from left
(iii) Maximum SF at a section 12M from left
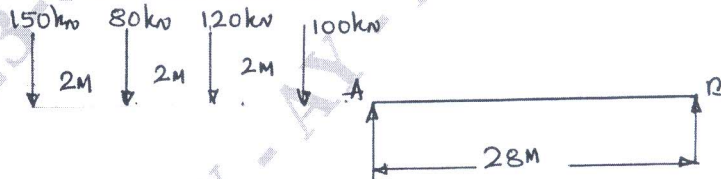

Fig.Q4   (20 Marks)

Module-3

5   a.   Determine the slope and deflection at the free end of cantilever beam as shown in Fig.Q5(a) using moment area method. Take EI as constant.
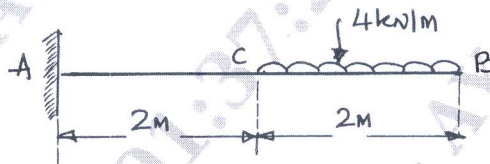

Fig.Q5(a)   (10 Marks)

b.   Determine the slope at supports and deflection under the point load for the beam shown in Fig.Q5(b). Using the conjugate beam method.
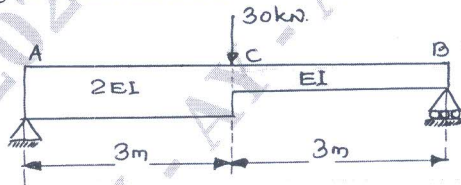

Fig.Q5(b)   (10 Marks)

OR

6   a.   A beam 'AB' of span 6m carries a point of 45 kN at a distance of 4m from left support end A as shown in Fig.Q6(a). Find: (i) Slope at A and B   (ii) Deflection under the load. Take $E = 200$ kN/mm^2 and $I = 8.325 \times 10^7$ mm^4. Using conjugate beam method.
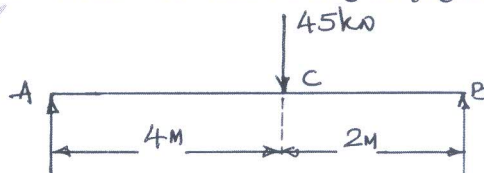

Fig.Q6(a)   (10 Marks)

b. For the beam shown in Fig.Q6(b), determine the slope at left support, and deflection at 100 kN load. Using moment area method. Take EI as constant.
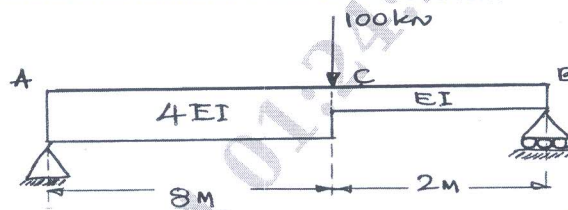

Fig.Q6(b)   (10 Marks)

Module-4

7 a. Derive the expression for the strain energy stored in a member due to bending.   (10 Marks)
   b. A simply supported beam 'AB' of span 5m is as shown in Fig.Q7(b). Calculate the deflection under the point load by the strain energy method. Take $EI = 6 \times 10^3$ kN-m^2.
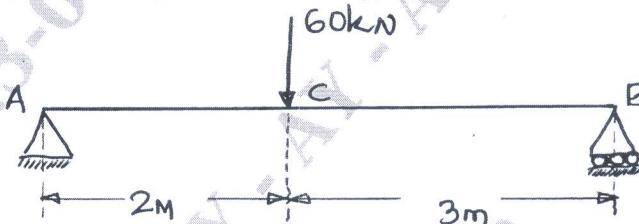

Fig.Q7(b)   (10 Marks)

OR

8 a. Determine the vertical deflection at the free end 'D' for the frame as shown in Fig.Q8(a) by using Castigliano's theorem. Take $EI = 16 \times 10^4$ kN-m^2.
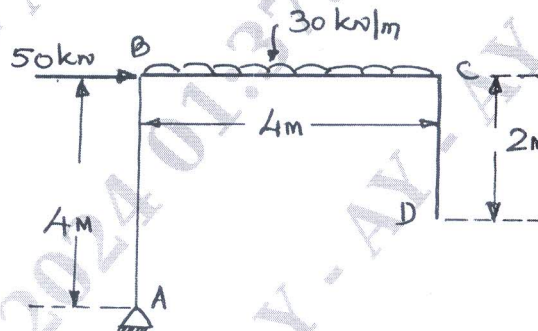

Fig.Q8(a)   (10 Marks)

   b. Determine the horizontal deflection at point 'C' for the bent up bar as shown in Fig.Q8(b) using unit load method. Take EI = 6000 kN-m^2.
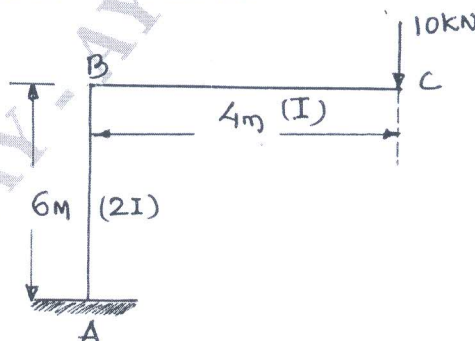

Fig.Q8(b)   (10 Marks)

Module-5

9   a.   Determine the bending moment, normal thrust and radial shear at a section 4 metres from the left support for a three hinged parabolic arch as shown in Fig.Q9(a).
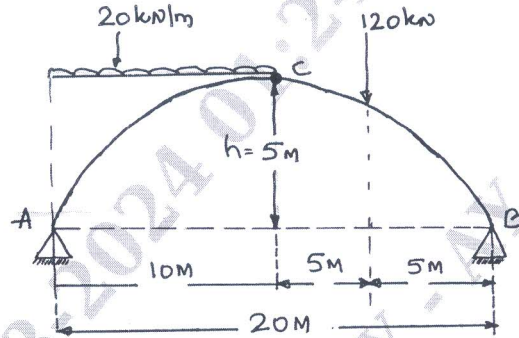

Fig.Q9(a)   (10 Marks)

b.   A cable of 20 meters and dip 4m carries a UDL of 20 kN/m over the whole span. Find:
(i)   Maximum and minimum tension in the cable
(ii)   Length of the cable   (10 Marks)

OR

10   a.   A three hinged parabolic arch is loaded as shown in Fig.Q10(a). Determine the reactions at supports, normal thrust, radial shear and bending moment at left quarter span of the arch.
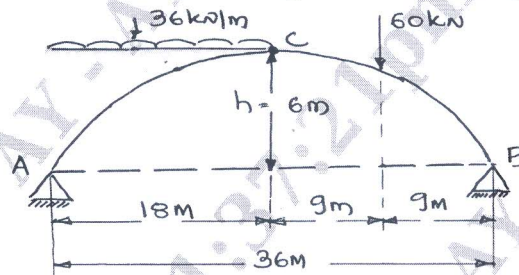

Fig.Q10(a)   (10 Marks)

b.   A cable of span 120 meters and dip of 10 metre carries a load of 6 kN/m of horizontal span. Determine the maximum tension in the cable; and the inclination of the cable at the support. Also determine the forces transmitted to the supporting pier if the cable passes over smooth pulley on top of the pier. The anchor cable is at 30° to the horizontal.   (10 Marks)

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