Total number of printed pages: **Programme(D)/Semester 4th/DCE 401**

2023

Structural Analysis

Full Marks : 100

Time : Three hours

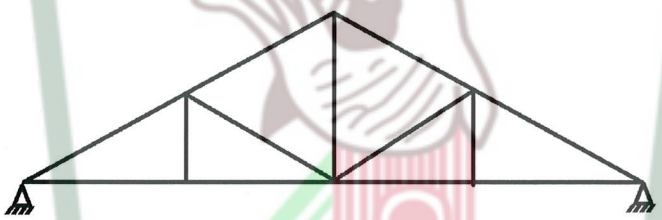
The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

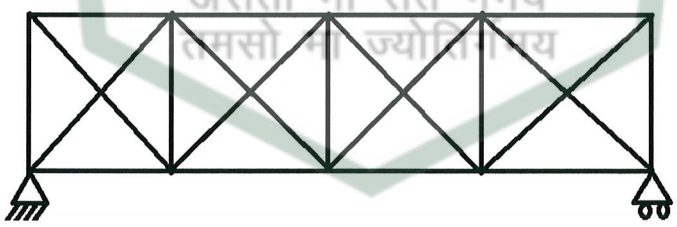
1. a) Define linear and non linear system. (4)

   b) Find whether the structure is statically determinate or indeterminate, and if indeterminate find external, internal and static indeterminacy (4x4)

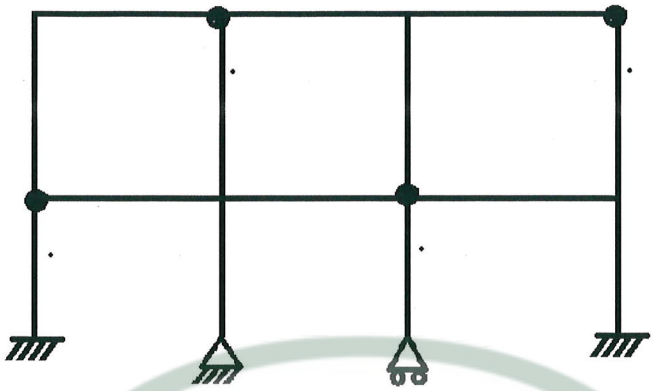
   i)



   ii)



   iii)



= internal hinge

iv)

2. A three hinged circular arch hinged at the springing and at the crown points has a span of 45m and a central rise of 7m. It carries a uniformly distributed load 30 kN/m over the left half of the span together with a concentrated load of 90 kN at the right quarter span point. If the point D is at a section 5m from the left support. Find (6+4+2+2 +2+2+2)

(i) Reactions at the supports,

(ii) R and θ

(iii) Vertical shear at D,

(iv) Moment at point D

(v) Normal thrust at D,

(vi) Radial shear at D,

(vii) Moment at the point of application of 90 kN.

3. A bridge cable is suspended from towers 80m apart and carries a load of 30 kN/m on the entire span. If the maximum sag is 8m, calculate the maximum tension in the cable. Find the followings for the cable both on pulley and on saddle, (10+10)

i) The forces transmitted to the piers,

ii) Maximum tension at support

iii) Inclination of the suspension cable with the horizontal,

vi) Total vertical load transmitted to the pier

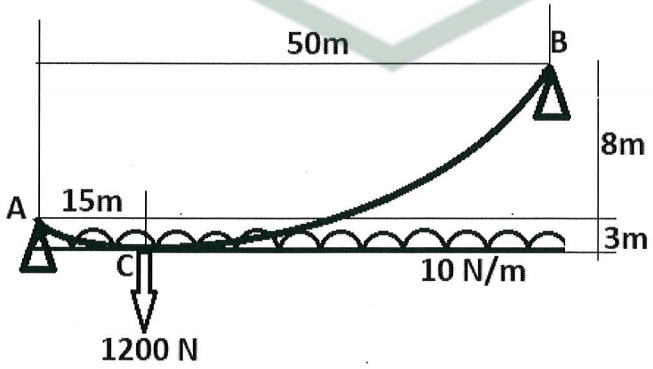
v) Total horizontal load transmitted to the pier,

vi) Maximum bending moment for the pier.

For each of the above cases the anchor cable is at a 30^0 to the horizontal and supporting pier is 20m high.

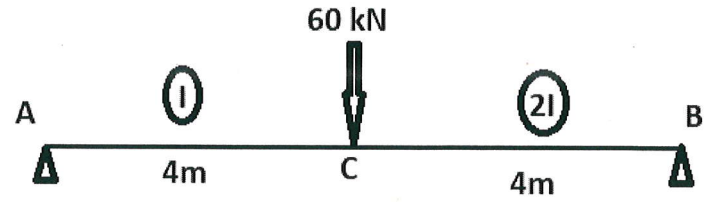
4. A light cable is supported at two points 20m apart which are at the same level. The cable supports two concentrated loads of 40 kN and 50 kN at a distance of 5m and 15m respectively from the left support. The deflection at the first point is found to be 0.8m. Determine the tension in the different segments and also find the total length of the cable. (15+5)

5. (a) A flexible cable weighting 10N/m hangs between two supports 50m horizontally apart. The left support is 8m below the right support. The cable also supports a point load of 1200 N at a point 15m horizontally from the left support and 3m below this support. Assuming that the weight of the cable is spread uniformly on the horizontal span, find the maximum tension for the cable. (12)

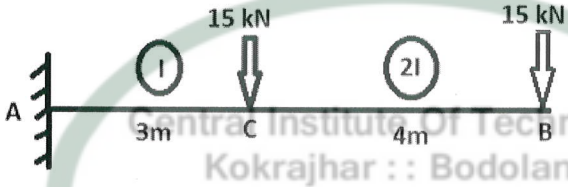


b) Determine the deflection under 60 kN load in the beam by strain energy (8)

method.



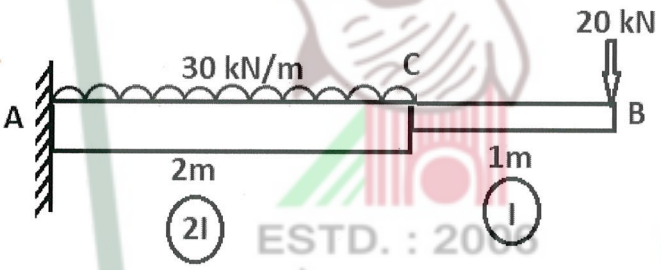
6. a) Determine the deflection and rotation at the free end of the cantilever beam. Use unit load method. (14)



b) What are internal hinges? (2)

c) Define internal work done and strain energy. (4)

7. a) Determine slope and deflection at both the points C and B in the cantilever beam by conjugate beam method. (16)



b) State the conjugate beam theorems. (4)