QP Code : 5386

(3 Hours) **[Total Marks: 80**

N.B. (1) Question **No.1** is compulsory.

(2) Attempt any **three** questions out of remaining five questions.

(3) Assume suitable data wherever required and state it clearly.

1. Attempt any four of the following

(a) Enlist various methods for finding deflection in structures. Also state the suitability of each method. **05**

(b) State and explain Maxwell's Reciprocal theorem and Betti's theorem. **05**

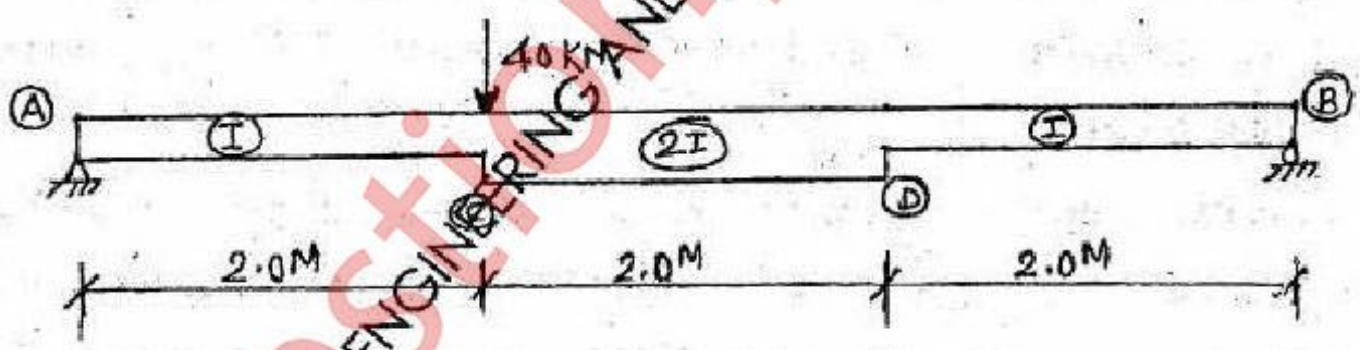
(c) In three hinged parabolic arch subjected to UDL over entire span, show that bending moment & radial shear at any section is zero. **05**

(d) A symmetrical cable of span 100m with central dip 15m is loaded with udl of 30 kN/m. Find the maximum and minimum tension in the cable. **05**

(e) Define strain energy. Write the expression for strain energy stored due to shear force, bending moment and twisting moment. **05**

(f) Define influence line diagram and give its application in civil engineering. Draw ILD for Reaction, S.F and B.M for Simply supported beam. **05**

2. (a) Using Conjugate beam method, find the vertical deflection at C and slope at B for the simply supported beam as shown in figure. **08**



(b) A three hinged symmetrical parabolic arch ABC hinged at A, B and at crown is of span 20 m with central rise 5 m. It is loaded with udl of 20 kN/m over left half portion of arch along with a point load of 50 kN at the crown. Calculate: **12**

(i) Support reactions

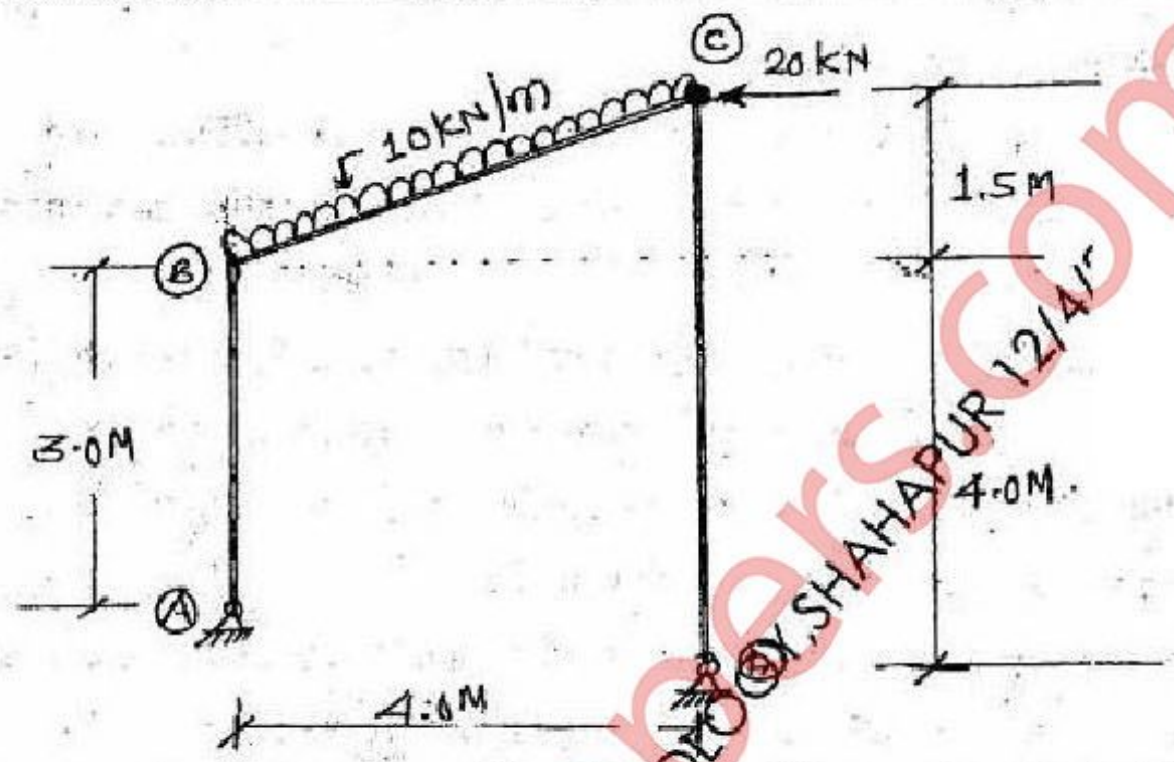
(ii) Maximum bending moment in the portion AC and BC (Draw neat sketch).

(iii) Normal thrust and radial SF at left quarter span point.

[TURN OVER

3. (a) Draw the stress distribution diagram at the base of a column of hollow circular section with external diameter 200 mm and thickness 20 mm. The column is 6 m long having both ends fixed. It carries a load of 80 kN at an eccentricity of 25 mm from the column axis. Take E = 200 Gpa. **07**

(b) For the plane frame as shown in fig. Draw free body diagram of each member and construct AFD, SFD and BMD. Note that there is internal hinge at 'C'. **13**



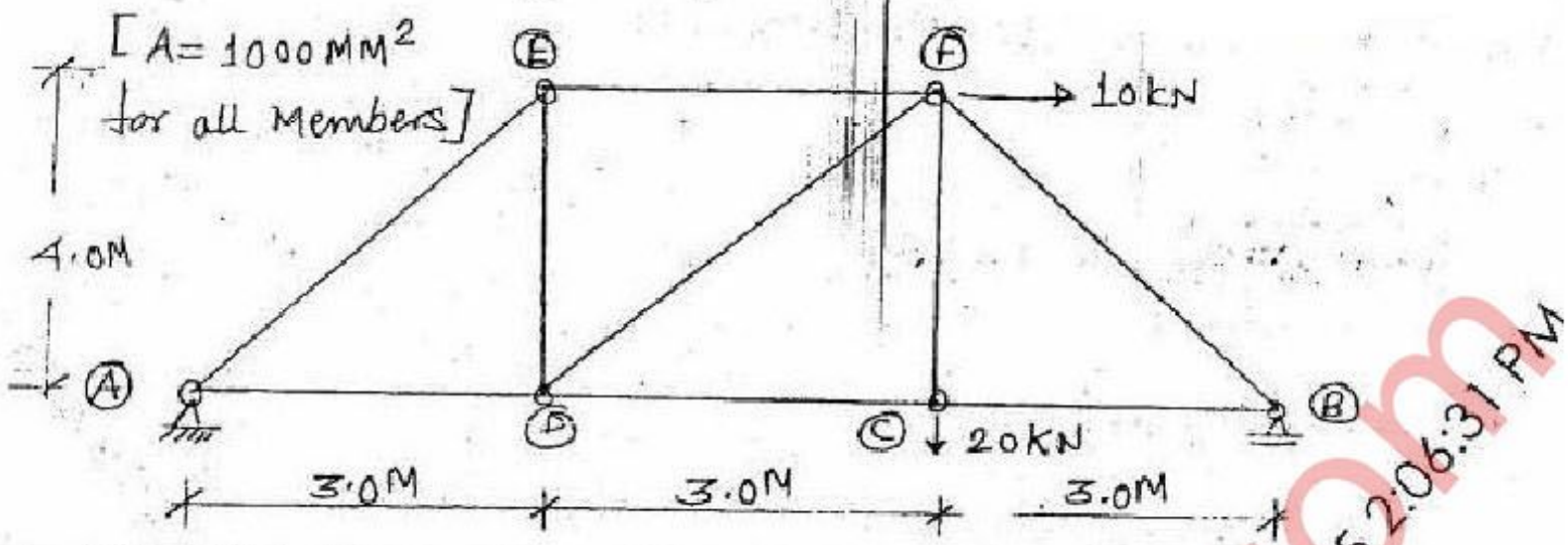
4. (a) A simply supported girder of span 30 m is traversed by a series of wheel loads 80 kN, 50 kN, 120 kN, 100kN and 60 kN spaced at distances 1.5 rn, 2 m, 1m and 2 m respectively from 80 kN. The load system moves from left to right with 60 kN load leading. Find the location and magnitude of absolute maximum bending moment anywhere in the girder. **10**

(b) A cantilever beam of cross section 300mm × 600mm and span 3 m is loaded with udl of 12 kN/m over its entire span. Find the maximum bending stresses induced in the cross section if the plane of loading is inclined at 35° with minor axis in clockwise direction. Also locate the neutral axis position. **10**

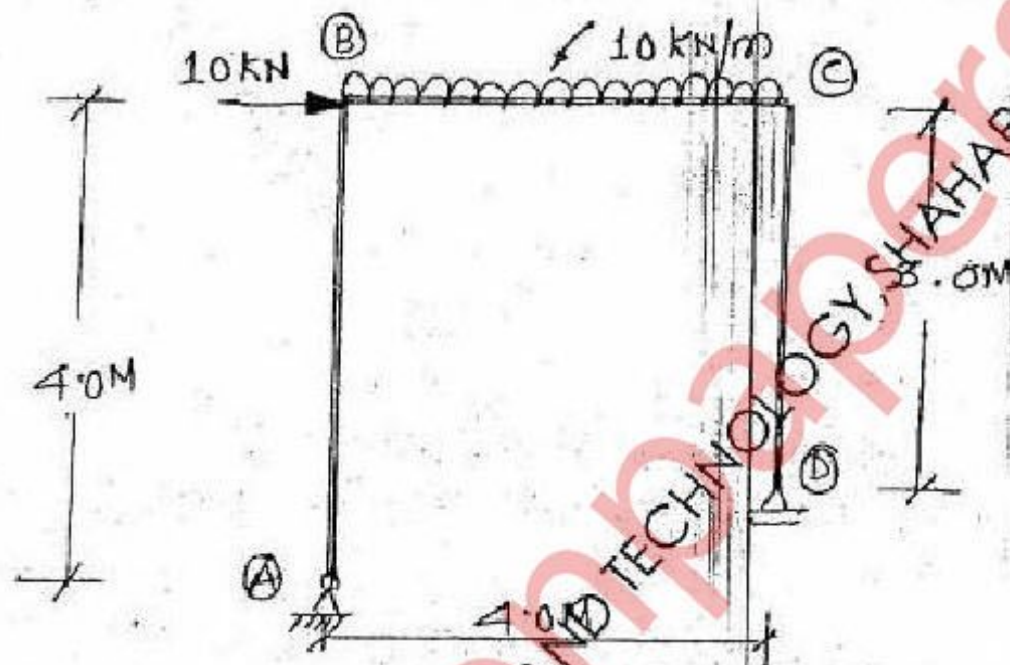
5. (a) A cantilever beam ABC is fixed at A and free at C carries udl of 20 kN/m over its entire span and a point load of 30 kN at B. AB = 2.5 m (2I) and BC = 2 m (I). Determine the maximum deflection of the cantilever beam by Moment Area Method in terms of EI. **10**

[TURN OVER

(b) Find the vertical deflection in the frame as shown in fig. by Unit Load Method or any other Energy Method at point C. (EI = constant) 10



6. (a) Using Virtual Work Method, for rigid jointed frame as shown in fig. Find horizontal displacement of roller support. Take EI = Constant. 10



(b) Explain Concept of Shear Centre 03

(c) Using Macaulay's Method determine maximum deflection and slope at supports for the beam loaded as shown in fig. 07