

**FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION  
JULY 2012**

CE 04 403—STRUCTURAL MECHANICS—I

Time : Three Hours

Maximum : 100 Marks

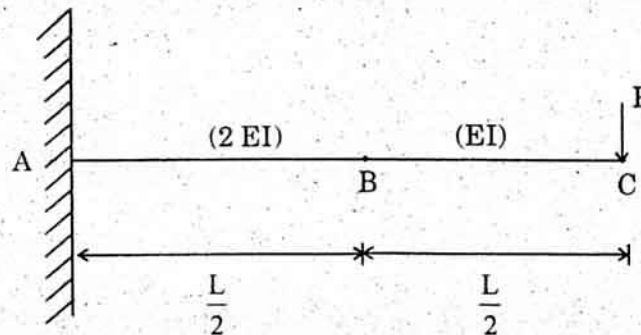
*Assume any missing data suitably.*

**Question I is compulsory.**

*Answer one each from question II, III, IV and V.*

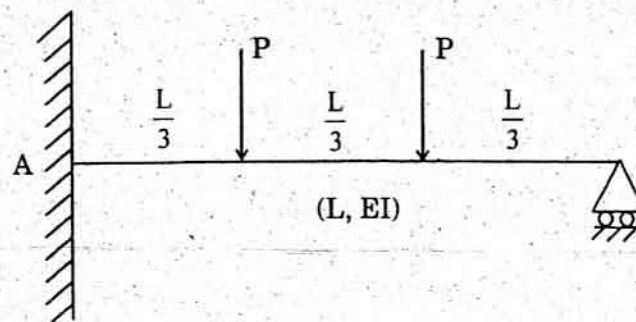
I. Answer the following questions :

(a) By energy principle, find the tip deflection of the following cantilever.



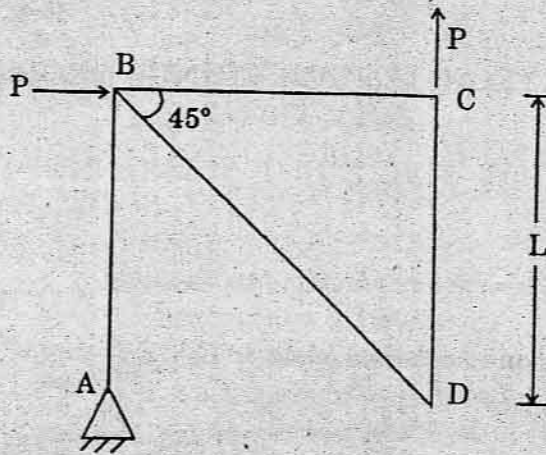
(b) A cantilever beam is subjected to a u.d.l.  $q_0$  per unit length. Find the deflection and slope at the tip of the cantilever by energy method.

(c) Analyze the beam shown below for reaction components at A and B and rotation at B by flexibility method.

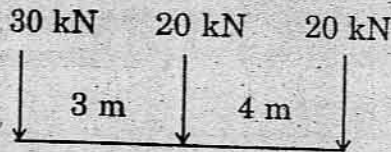


Turn over

- (d) Find the strain energy of the following truss. Axial rigidity = EA.



- (e) A simply supported beam of span 12 m is subjected to the following series of loads.

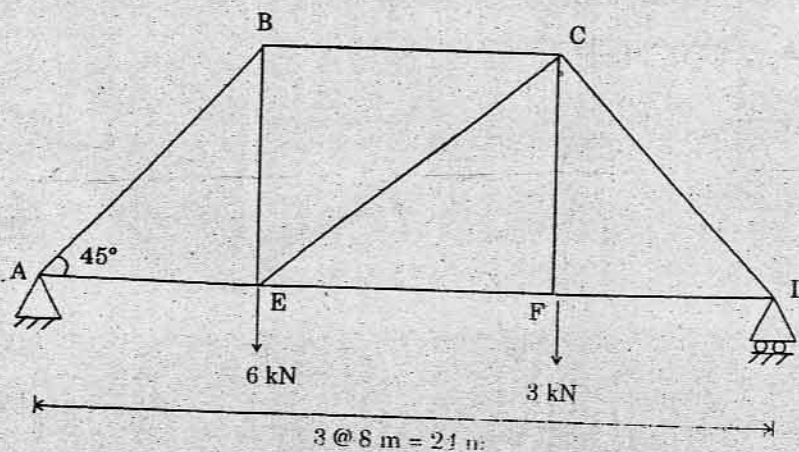


- (f) A propped cantilever is of span 8 m. It is damped at left and S.S. at right. Draw the I.L.D. for the B.M. at the left if a unit load moves from left to right.  
 (g) A cable carries a u.d.l.  $q_0$  over a span  $L$ . If the central dip of the cable is  $h$ , prove that max tension.

$$T_{\max} = \frac{L}{2} \sqrt{1 + \frac{L^2}{16h^2}}$$

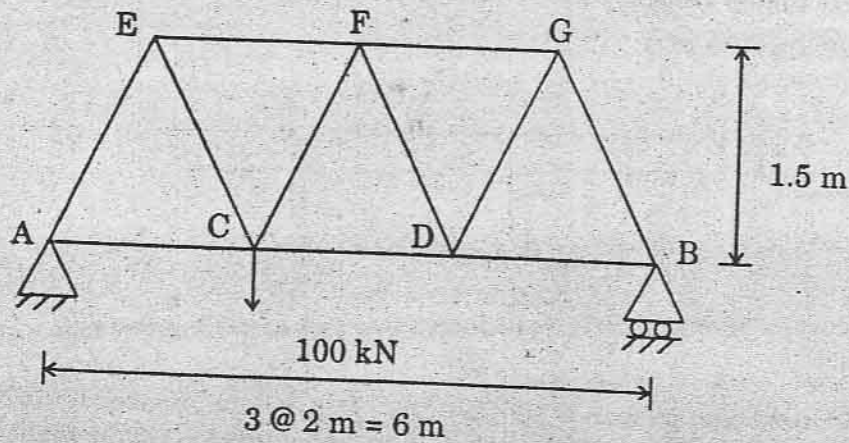
- (h) Find the expression for thrust of a three hinged arch subjected to u.d.l.  $q_0$ . Length =  $L$ , rise of the arch =  $h$ .  
 (8 × 5 = 40 marks)

- II. (a) For the truss shown below, calculate the change in length of diagonal BE due to applied loading. The area of upper and lower chords =  $400 \text{ mm}^2$  web members =  $300 \text{ mm}^2$  and  $E = 2 \times 10^5 \text{ N/mm}^2$ .



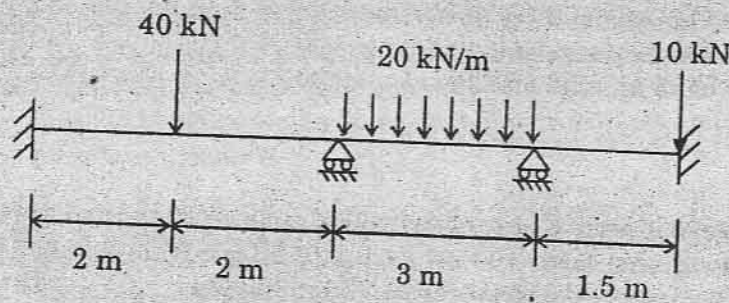
(15 marks)

- (b) Determine the changes in lengths of members EF and FG of the truss shown in the figure. The structure is loaded as shown in the figure. All areas =  $1000 \text{ mm}^2$ ,  $E = 2 \times 10^5 \text{ N/mm}^2$ .



(15 marks)

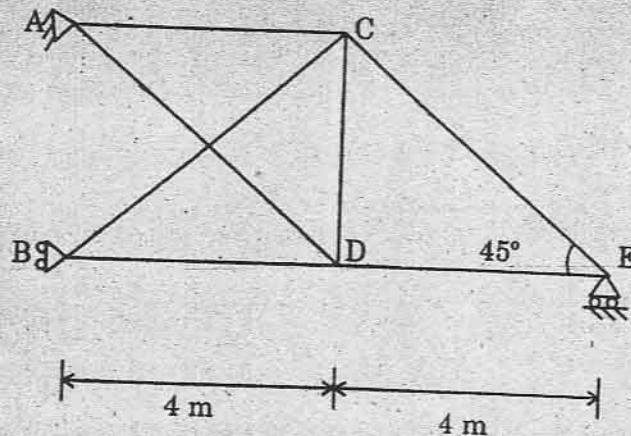
- III. (a) Analyze the following continuous beam by displacement method of analysis.



(15 marks)

Or

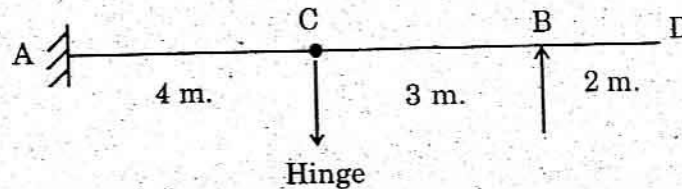
- (b) Calculate the forces in the members of the truss shown in the figure below if the roller support at E sinks by 1 mm. Assume  $A = 5000 \text{ mm}^2$  for all members and  $E = 2 \times 10^5 \text{ N/mm}^2$ . Choose  $AD = X_1$  and reaction at E =  $X_2$  as redundants.



(15 marks)

Turn over

- IV. (a) A live load 30 kN/m moves on the girder shown below. Find
- the maximum vertical reactions at A and B.
  - maximum B.M. at A.



(15 marks)

*Or*

- (b) For a fixed-fixed beam of span 6 m, draw the I.L.D. for the moments and reactions at the supports when unit load moves from left to right. Get ordinates at 1 m interval.

(15 marks)

- V. (a) Three hinged stiffening girder of a suspension bridge of span 180 m is subjected to point loads of 250 kN and 360 kN at distances of 30 m and 120 m from the left end. Find the shear force and bending moment for the girder at distance of 45 m from the left end. The supporting cable has a central dip of 18 m. Find also the maximum tension in the cable.

(15 marks)

*Or*

- (b) A two hinged parabolic arch A C B of span 50 m and rise 20 m carries a u.d.l. of 50 kN/m on AC and two concentrated loads 100 kN each at 5 m and 10 m from B. Find the horizontal thrust; the bending moment, normal thrust and radial shear at a section D, 15 m from A.

(15 marks)

[4 × 15 = 60 marks]