C 58176 (Pages 4) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH (ENGINEERING) DEGREE EXAMINATION, JUNE 2009

CE 04 403—STRUCTURAL MECHANICS—I

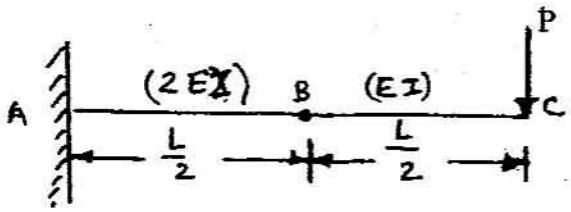
(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Assume any missing data suitably.
Question I *is* **compulsory.**
Answer **one** *each from Questions* II, III, IV *and* V.

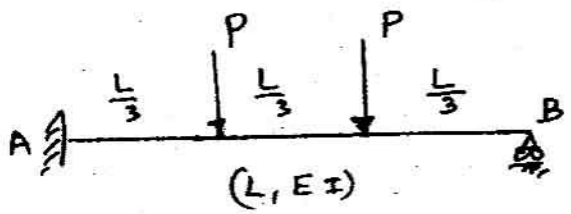
I. Answer the following questions :—

1 By energy principle find the tip deflection of the following cantilever.

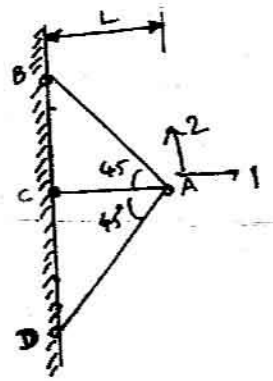


2 Derive the expressions for bending strain energy and torsional shear strain energy for a shaft.

3 Analyse the beam shown below for reaction components at A and B and rotation at B by flexibility method.

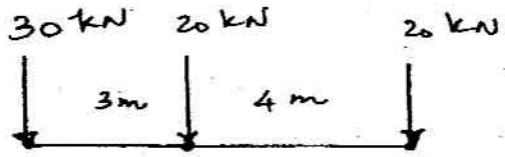


4 Derive the system flexibility matrix from element flexibility matrix for the following truss. Axial rigidity = AE



Turn over

5 A simply supported beam of span 12 m is subjected to the following series of loads.



Find the absolute maximum B.M. at a point 4 m from the L.H.S.

6 A fixed-fixed beam is of length 6 m. Draw the I.L.D. for the bending moment at left support when unit load moves from left to right.

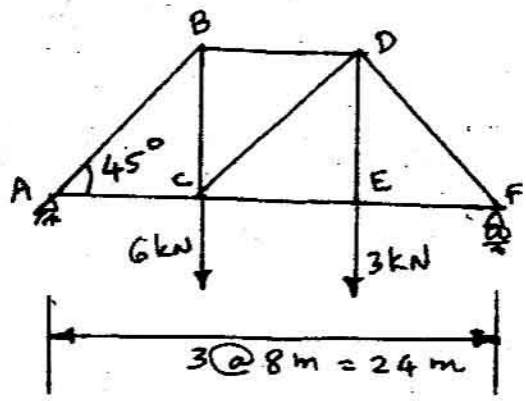
7 A cable carries a u.d.l. q_0 over a span L. If the central dip of the cable is h ; prove that max. tension

$$T_{max} = \frac{q_0 L}{2}\sqrt{1+\frac{L^2}{16h^2}}.$$

8 Discuss the two types of supports for a cable stayed bridge.

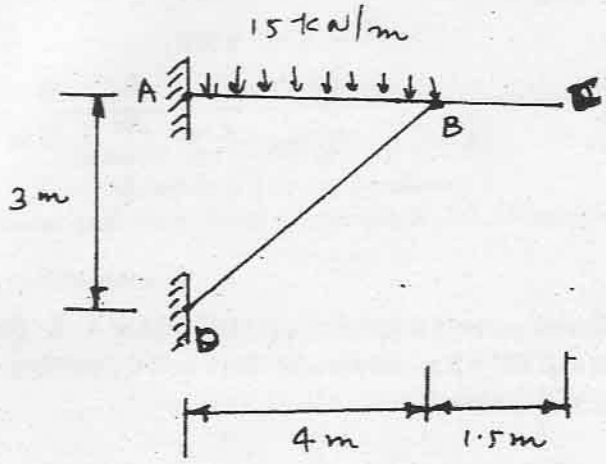
(8 × 5 = 40 marks)

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

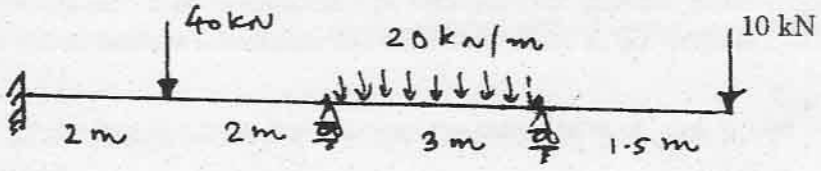


Or

(b) A beam ABC is supported at A and by the strut at B as shown in the figure. Connection A, B and D may be taken as pin joints. Find the vertical deflection at C. For A B C, area = 2500 mm^2, I = 2×10^6 mm^4, for BD, area = 1500 mm^2, E = 2×10^5 N /mm^2.



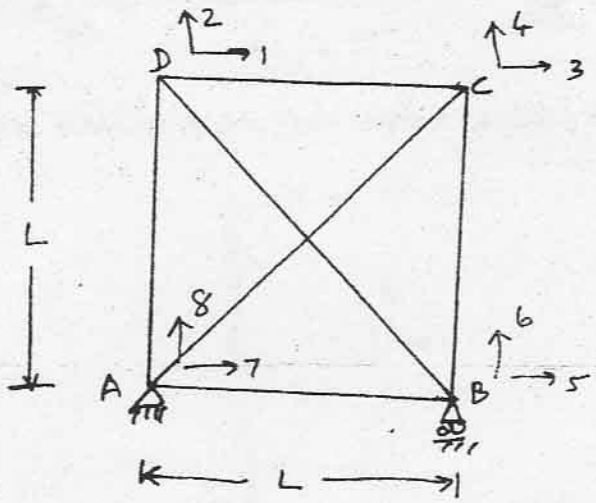
III. (a) Analyse the following continuous beam by displacement method of analysis.



EI = Constant.

Or

(b) Construct the direct stiffness matrix K for the truss shown below :

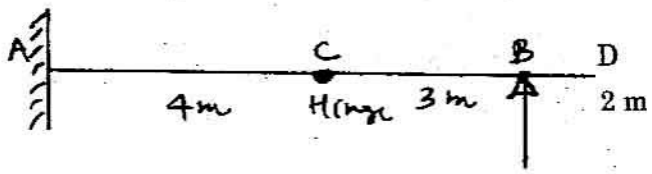


IV. (a) A live load 30 kN/m moves on the girder shown below. Find :

(i) Maximum vertical reaction at A.

(ii) Maximum vertical reaction at B.

(iii) Maximum bending moment at A.



Or

(b) Draw the influence line diagrams for reactions at A, B and C for two span continuous beam A B C, with AB = 4 m and BC = 3 m. Draw also the I.L.D for continuous moment over support B. Show ordinates at 1 m interval.

V. (a) The 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 a 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.

Or

(b) A two hinged parabolic arch of span 30 m and rise 6 m carries a u.d.l. of 40 kN/m covering a distance of 12 m from the left end. Find the horizontal thrust, reactions at the hinges and the maximum negative (hogging) moment.

(4 × 15 = 60 marks)