Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

[3862]-110

S.E. (Civil) (Second Semester) EXAMINATION, 2010

STRUCTURAL ANALYSIS—I

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

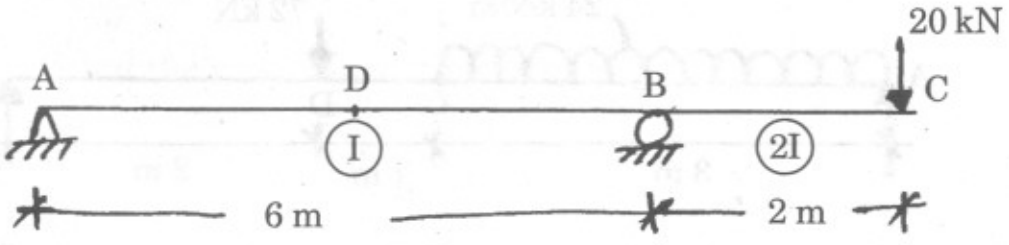
(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

SECTION I

1. (*a*) Differentiate Static and Kinematic Indeterminacy. [2]

(*b*) Determine the slope at 'C' and A and the deflection at mid-point 'D' of the overhang beam as shown, E = 200 MPa, $I = 1.2 \times 10^8$ mm^4. Use Conjugate Beam Method. [8]



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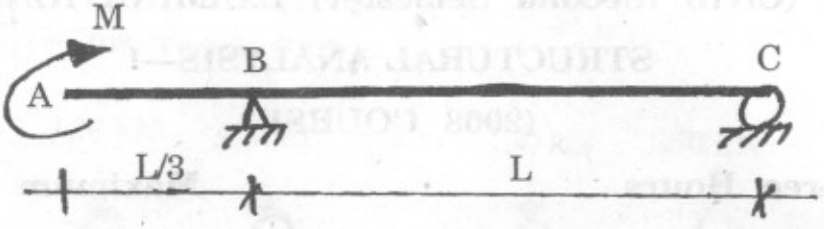
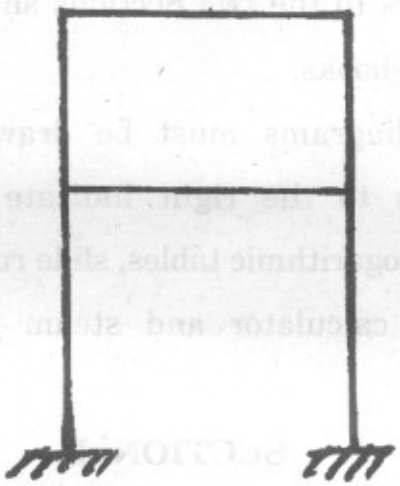
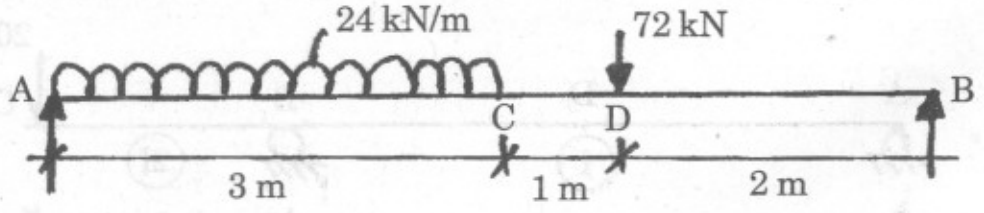
(*c*) Using Castigliano's first theorem, determine deflection of overhang end 'A' of the beam loaded as shown below. [8]



2. (*a*) Find degree of static and kinematic indeterminacy. [2]

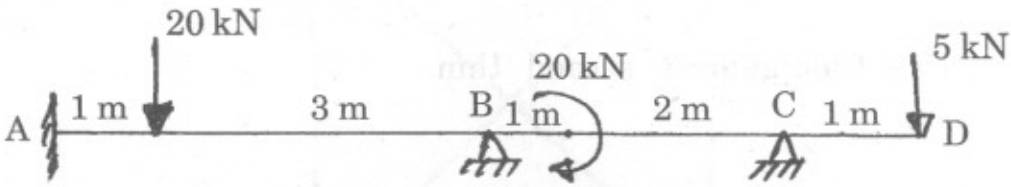


(*b*) Find slope at 'C' and maximum deflection. Take flexural rigidity = 4×10^4 kNm^2. [8]



(c) Calculate the central deflection and the slope at ends of simply supported beam carrying udl over whole span using Castigliano's first thm. [8]

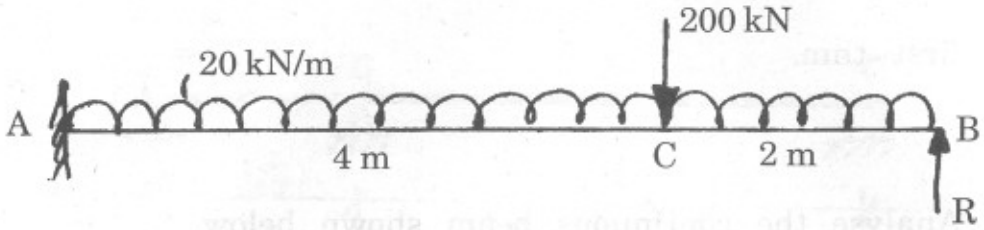
3. (a) Analyse the continuous beam shown below. [8]



(b) A horizontal prismatic beam AB of span 'l' m is fixed at its ends A & B. If the right end B of the beam settles down by 'δ', find the reacting force and reacting moments of each end of beam. Use Castigliano's second thm. [8]

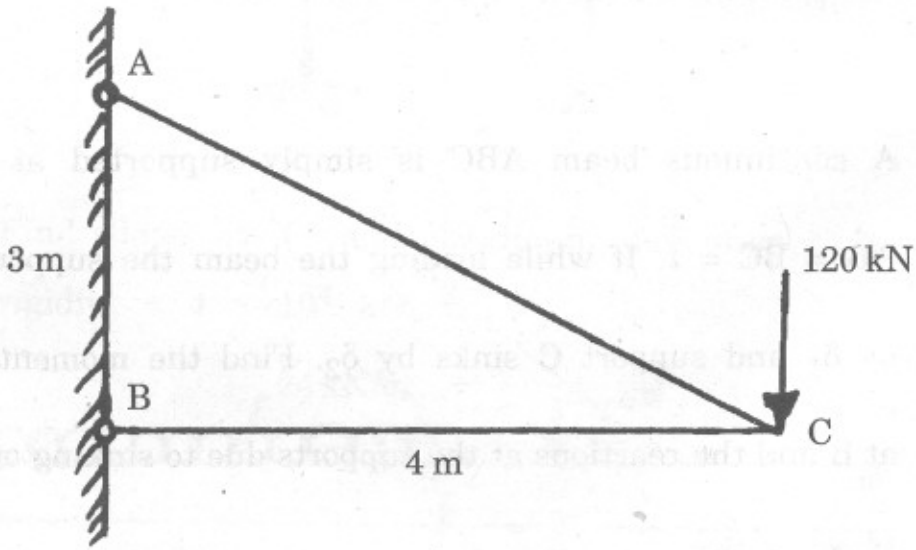
4. (a) A continuous beam ABC is simply supported at A, B, C. AB = BC = l. If while loading the beam the support B sinks by δ_1 and support C sinks by δ_2. Find the moment produced at B and the reactions at the supports due to sinking of supports. If $\delta_1 > \delta_2$. [8]

(*b*) Find the reaction at the prop for the loaded propped cantilever shown below :

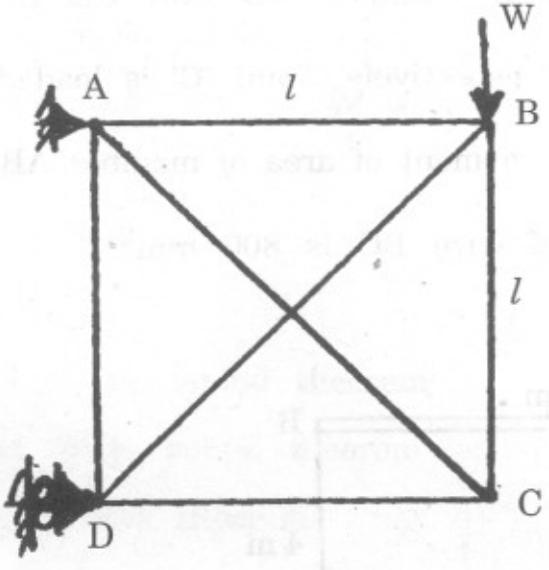


Use Castigliano's second thm. [8]

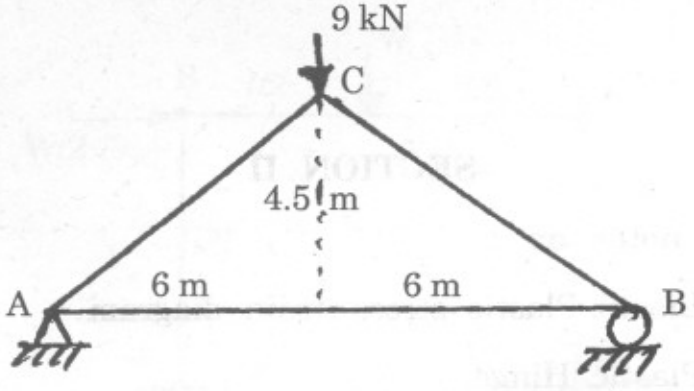
5. (*a*) Find the vertical and horizontal deflections of joint 'C' of the truss shown below. The area of inclined tie is 2000 mm^2, while the area of horizontal member is 1600 mm^2. Take E = 200 kN/mm^2. [8]



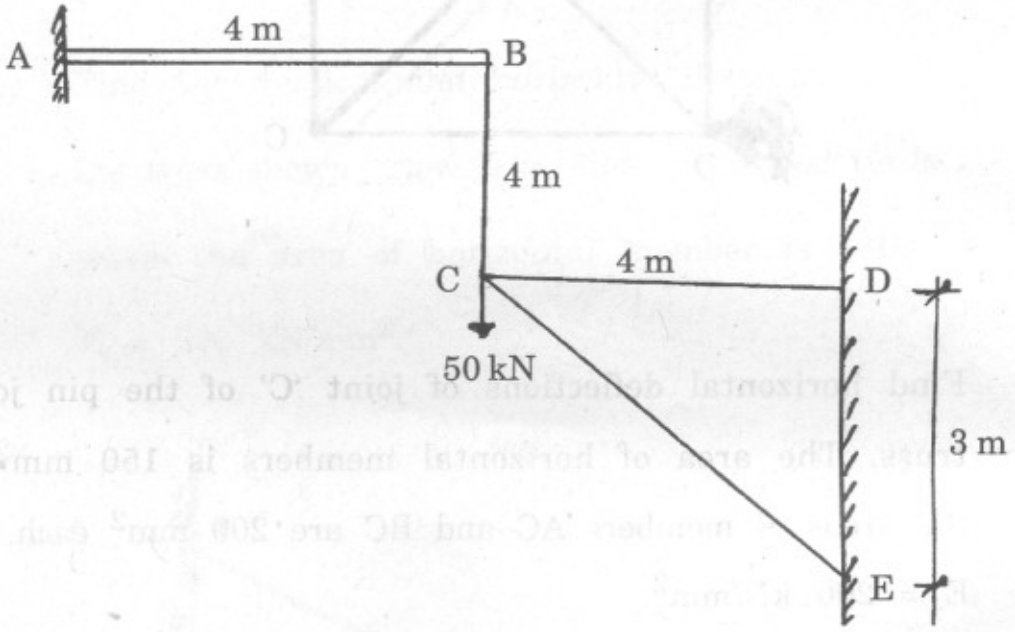
(*b*) Find forces in members of the frame. C/S area and material of all members is same. [8]



6. (*a*) Find horizontal deflections of joint 'C' of the pin jointed truss. The area of horizontal members is 150 mm^2 and the areas of members AC and BC are 200 mm^2 each. Take E = 200 kN/mm^2. [8]



(*b*) Find the force in wire rope BC if member AB is made of Aluminium and that of member CD and CE are of mild steel. C/S areas of member CD and CE are 1600 mm^2 and 2400 mm^2 respectively. Joint 'C' is loaded by a 50 kN load. The second moment of area of member AB is 2.5×10^8 mm^4. C/S area of wire BC is 800 mm^2. [8]



SECTION II

7. (*a*) Write notes on : [6]

(*i*) Elastic-Plastic stress-strain diagram

(*ii*) Plastic Hinge.

(*b*) Write assumptions in Plastic theory. [6]

(*c*) A fixed beam of uniform section and length '*l*' and fully plastic moment M_P is subjected to a total udl '*w*' together with a concentrated load 'P' at a dist. *l*/3 from left end of beam. Find the value of W which would cause collapse for P = 0.25 W. [6]

8. (*a*) Write notes on : [9]

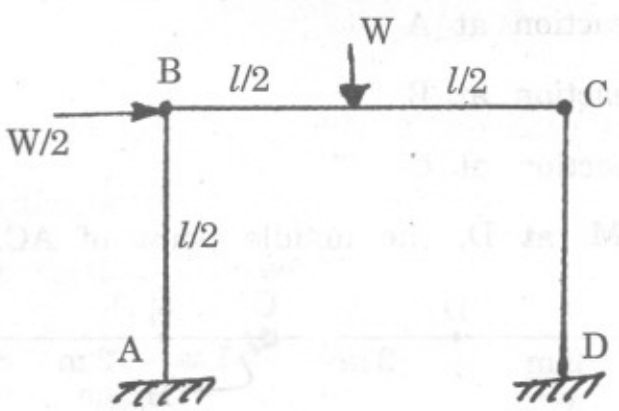
(*i*) The upper bound theorem

(*ii*) The lower bound theorem

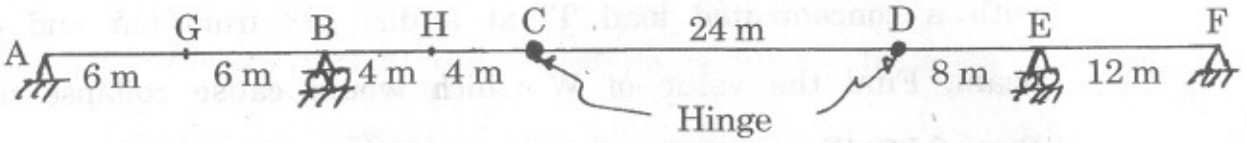
(*iii*) Uniqueness theorem

(*iv*) Mechanism conditions.

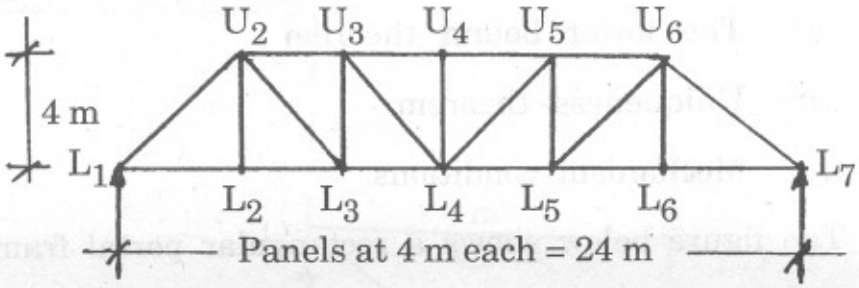
(*b*) The figure below shows a rectangular portal frame whose legs are fixed at base. The frame carries a point load W at mid-span and a horizontal sway load $\frac{W}{2}$. Find the value of W at which the frame will collapse. All the members are of the same section. [9]



9. (*a*) For the balanced cantilever beam, draw ILD for reactions at supports A and B, S.F. and B.M. at G and S.F. and B.M. at H. [8]



(*b*) Draw the influence line diagrams for the forces in members L_1U_2, U_2L_2, U_2L_3 and L_1L_2 for the truss shown below. [8]



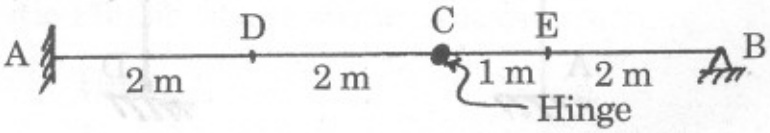
10. (*a*) A beam ABC 7 m long fixed at 'A' and is simply supported at 'B' and is provided with an internal hinge at 'C', 4 m from A. Draw influence line diagrams for the following :

(*i*) Reaction at A

(*ii*) Reaction at B

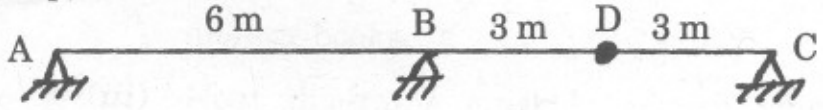
(*iii*) Reaction at C

(*iv*) B.M. at D, the middle point of AC. [8]

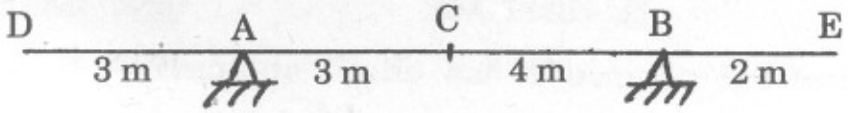


(*b*) Draw the influence line diagrams for the forces in members U_3U_4, L_3L_4, U_3L_3 and U_3L_4 for the truss shown in Fig. Q. No. 9 (*b*). [8]

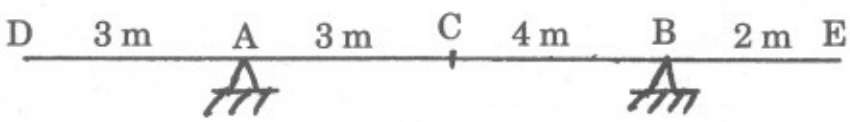
11. (*a*) Draw the influence lines for reactions at supports A, B, C and bending moment at support B for the beam shown. There is a hinge provided at 'D'. Find their maximum values when a travelling load of 60 kN per meter may cover any part of span. [8]



(*b*) Two wheel loads 200 kN and 80 kN spaced 0.8 m apart roll on the girder shown below. Find the maximum positive and negative bending moments that can occur at the section 'C'. [8]



12. (*a*) A distributed load of 80 kN/m run may occupy any part of span on the beam. Find maximum positive and negative shear force at section marked 'C'. [8]



(*b*) The wheel load system shown below can move on a girder of span 5 m. Find the maximum positive and negative shear force for the girder. [8]