Total No. of Questions—**12**] [Total No. of Printed Pages—**8+3**

[3762]-110

S.E. (Civil) (II Sem.) EXAMINATION, 2010

STRUCTURAL ANALYSIS–I

(2008 COURSE)

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

N.B. :— (*i*) Answer *three* questions from Section I and *three* questions 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.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain with sketches types and classification of structures based on structural forms. [4]

(*b*) Using Macaullay's method find slope and deflection at end A of the loaded beam shown in Fig. 1 (*b*). Take $I = 5 \times 10^8 \text{ mm}^4$

P.T.O.

and $E = 2 \times 10^5$ N/mm^2. [7]

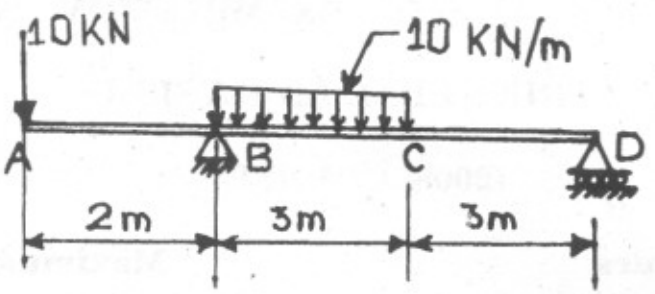

Fig. 1 (*b*)

(*c*) A cantilever beam of 4 m length is loaded as shown in Fig. 1 (*c*). Determine maximum slope and deflection using moment area method. Take EI = 6.3×10^4 kN-m^2. [7]

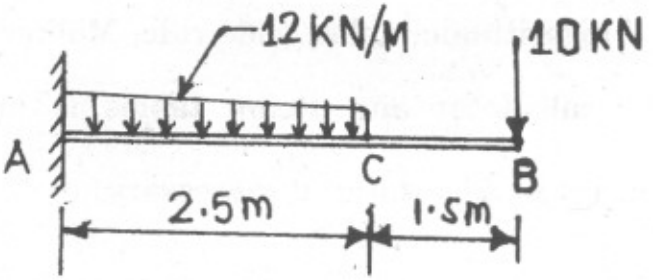

Fig. 1 (*c*)

Or

2. (*a*) Differentiate between statically determinate and statically indeterminate structure. [4]

(*b*) A beam AB of span 12 m carries a point load 120 kN at C, 6 m from A. The moment of inertia of the beam section is equal to [I] for part AC and [2I] for part BC. Find slope at A and maximum deflection. Take E = 200 kN/mm^2 and I = 1.25 × 10^9 mm^4. Use conjugate beam method. Refer Fig. 2 (*b*). [7]

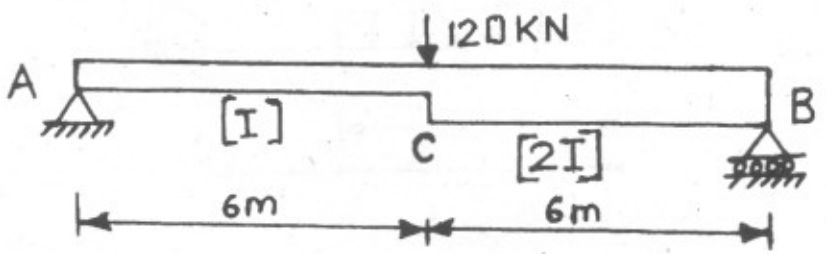

Fig. 2 (*b*)

(*c*) For a frame shown in Fig. 2 (*c*). Find horizontal deflection at roller support using Castigliano's first theorem. EI = 35 × 10^3 kN-m^2. [7]

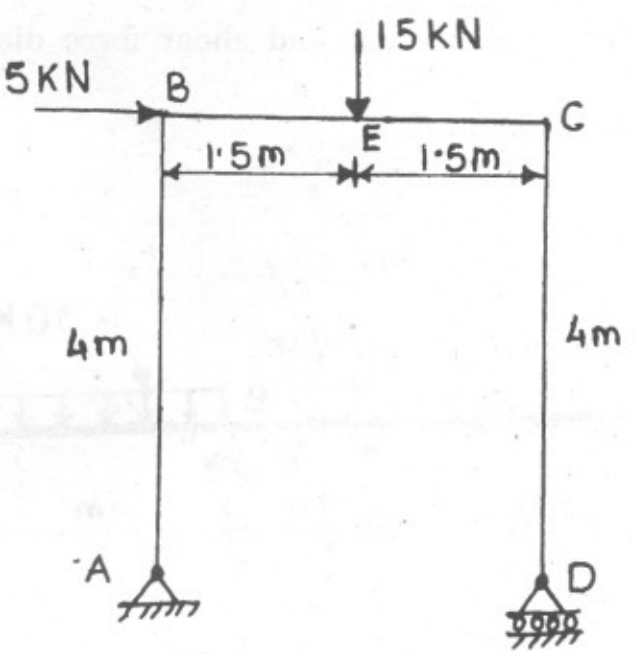

Fig. 2 (*c*)

3. (*a*) A fixed beam AB of span L carries a uniformly distributed load for a distance '*a*' from end A as shown in Fig. 3 (*a*). Derive the expression for fixed end moments. [8]

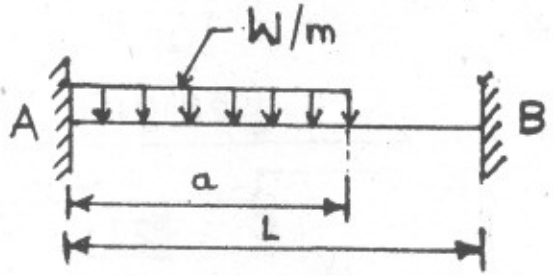

Fig. 3 (*a*)

(*b*) A continuous beam ABC is fixed at ends and is loaded as shown in Fig. 3 (*b*). Find the reactions and support moments. Draw bending moment and shear force diagram. Use theorem of three moments. [8]

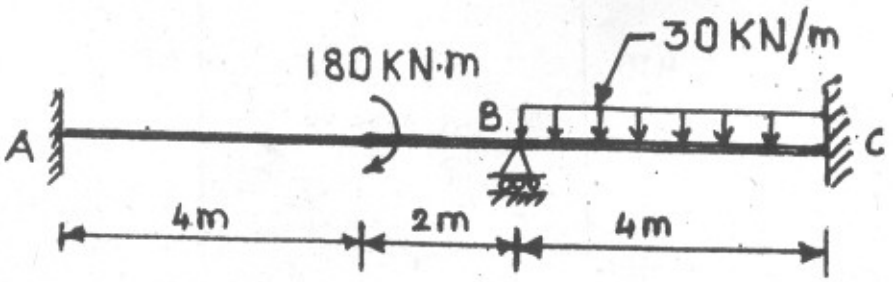

Fig. 3 (*b*)

Or

4. (*a*) A beam of span 'L' m is fixed at one end and simply supported at other end. It carries a udl of '*w*' per unit run over the entire span as shown in Fig. 4 (*a*). Find reaction at simply supported end by principle of least work. [8]

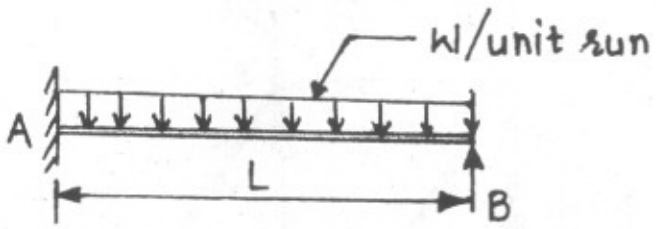

Fig. 4 (*a*)

(*b*) Determine reaction at support and bending moment at A, B, C, D and E for the portal frame shown in Fig. 4 (*b*). All members have same flexural rigidity. [8]

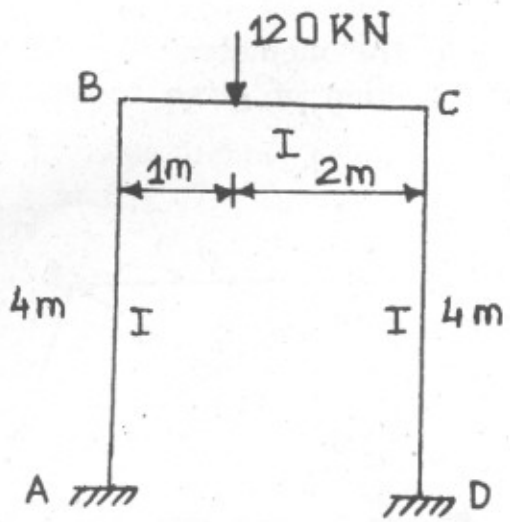

Fig. 4 (*b*)

5. Find vertical deflection of the joint C of the loaded truss shown in Fig. 5. The sectional area of members are as follows :

Horizontal members — 3000 mm^2
Vertical members — 4000 mm^2
Inclined members — 5000 mm^2
Take E = 200 kN/mm^2. [16]

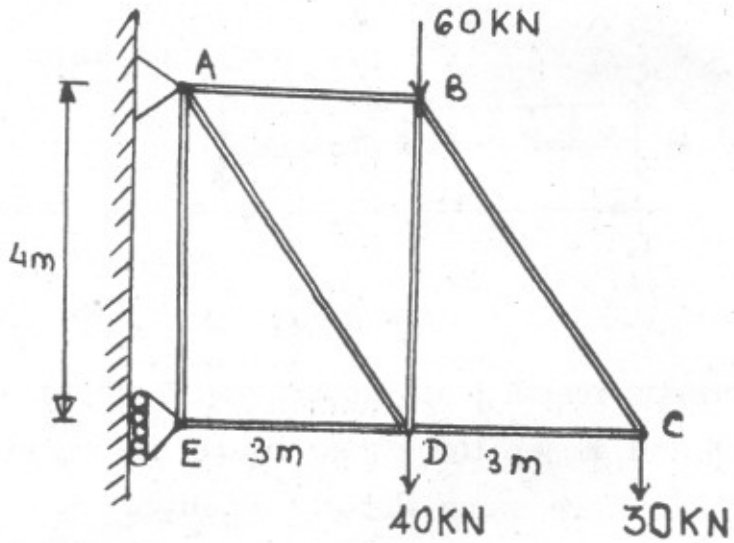

Fig. 5

Or

6. Find the forces in the members of the redundant truss shown in Fig. 6 under the action of given forces. Value of L/A = 0.16/mm for all members. [16]

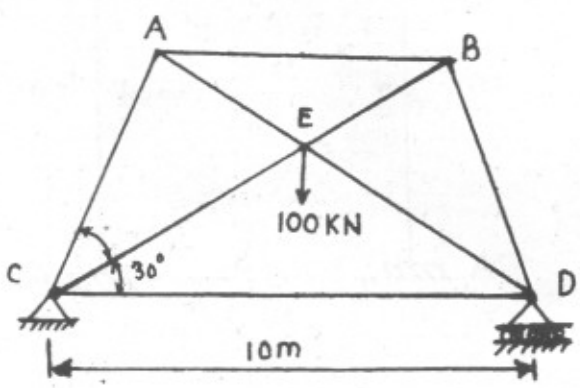

Fig. 6

SECTION II

7. (*a*) What are the conditions that the structure should satisfy before complete collapse ? [4]

(*b*) For a beam section shown in Fig. 7 (*b*), determine shape factor and the fully plastic moment. Take *fy* = 250 MPa. [7]

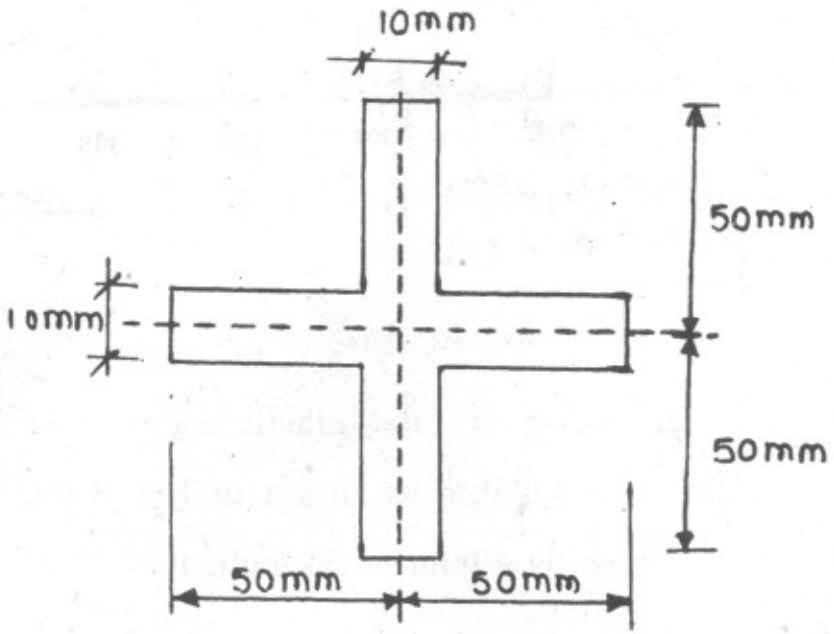

Fig. 7 (*b*)

(*c*) A propped cantilever beam is subjected to eccentric point load as shown in Fig. 7 (*c*). Determine collapse load for the beam. [7]

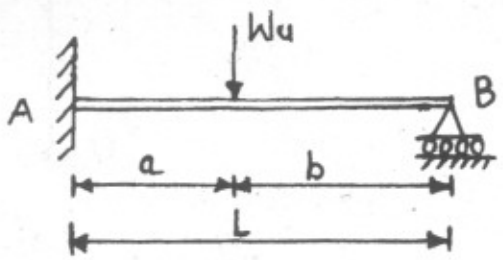

Fig. 7 (*c*)

Or

8. (*a*) Enlist the assumptions made in plastic theory. [3]

(*b*) Find value of 'W' at collapse for the continuous beam shown in Fig. 8 (*b*). [7]

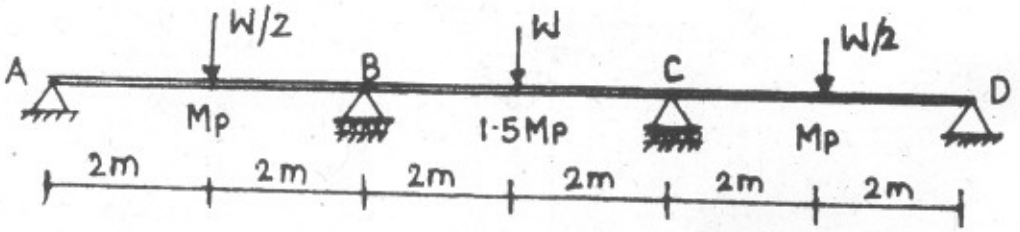

Fig. 8 (*b*)

(*c*) Determine the value of fully plastic moment of the frame, when loaded upto collapse as shown in Fig. 8 (*c*). The plastic moment of frame is uniform throughout. [8]

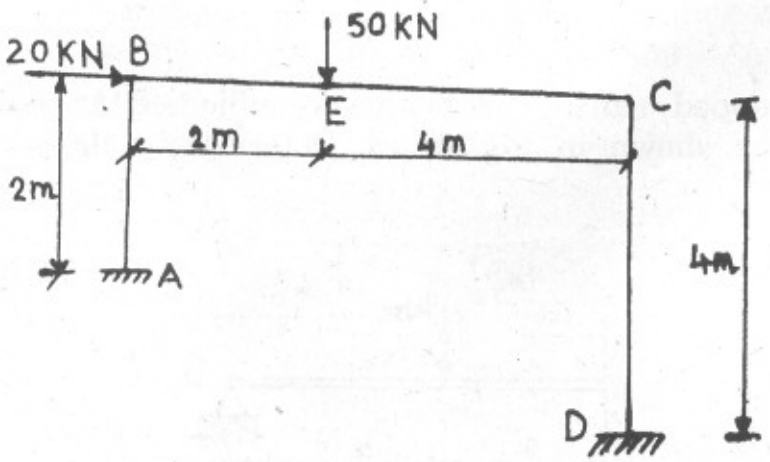

Fig. 8 (*c*)

9. (*a*) A simply supported beam AB of length 9 m is loaded with udl of 10 kN/m upto 3 m from A and a point load of 20 kN is acting at 6 m from A as shown in Fig. 9 (*a*). Find reactions at support using influence line diagram. [8]

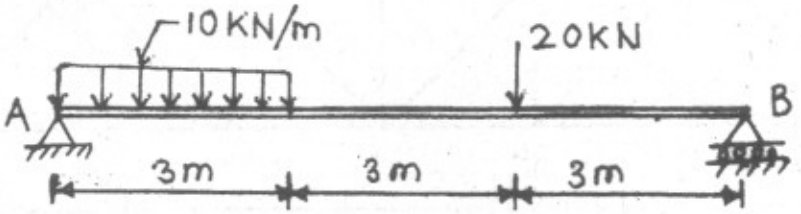

Fig. 9 (*a*)

(*b*) For the pratt truss shown in Fig. 9 (*b*), construct influence line for the force in members : [8]

$L_0\ U_1$, L_1U_1, U_1L_2, U_1U_2 and L_1L_2.

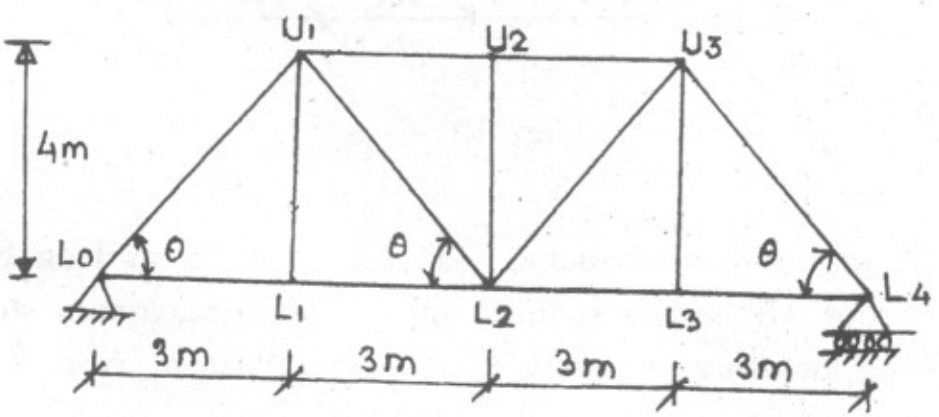

Fig. 9 (*b*)

Or

10. (*a*) Construct influence line diagram for the forces in members U_1L_1, U_1U_2, U_1L_2, and L_1L_2 of the through type bridge truss shown in Fig. 10 (*a*). [8]

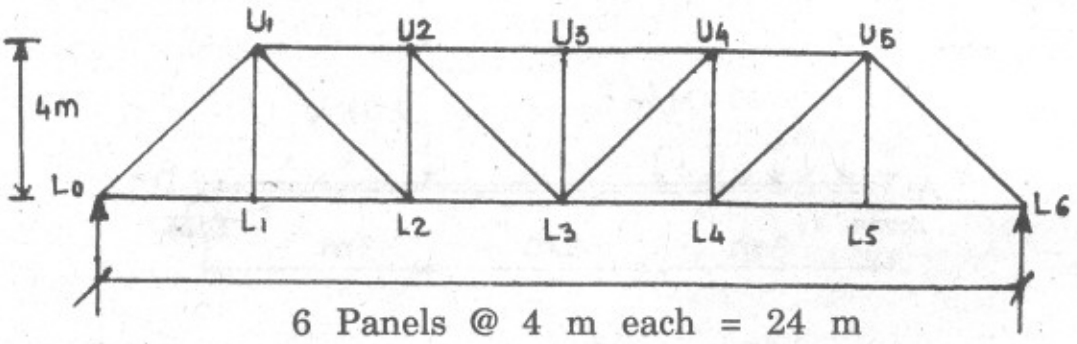

Fig. 10 (*a*)

(*b*) Draw influence line for reaction at support A, B and C for beam shown in Fig. 10. (*b*). There is an internal hinge at D. [8]

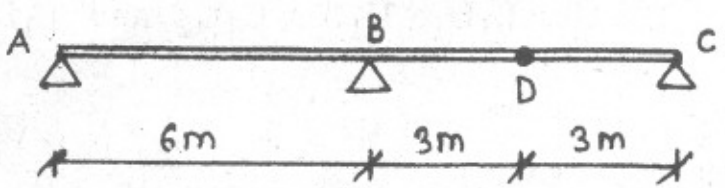

Fig. 10 (*b*)

11. (*a*) A uniformly distributed load 50 kN/m, 8 m long crossed a girder AB having span 25 m. Calculate maximum shear force and bending moment at a section 10 m from left hand support A. [8]

(*b*) Two wheel loads 20 kN and 10 kN, 3 m apart crosses a girder of 10 m span with the 10 kN load leading from left to right. Draw maximum shear and moment diagram. [8]

Or

12. (*a*) A uniformly distributed load 100 kN/m and 20 m length crosses a girder of 15 m span. Find maximum shear force and the bending moment at 5 m from left hand support. [8]

(*b*) A girder of span 20 m is supported at its ends. Four wheel loads 150 kN, 150 kN, 250 kN and 100 kN traverse the girder from left to right with 100 kN lead leading. The distance between each wheel load is 3 m.

Determine :

(1) Maximum shear force at 5 m from L.H.S.

(2) Maximum bending moment at 5 m from L.H.S.

(3) Absolute maximum bending moment. [8]