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

Seat No.	

[4757]-109

S.E. (Civil) (Second Semester) EXAMINATION, 2015

STRUCTURAL ANALYSIS–I

(2008 PATTERN)

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

N.B. :— (*i*) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** from Section I.

(*ii*) Answer Q. **7** or Q. **8**, Q. **9** or Q. **10**, Q. **11** or Q. **12** from Section II.

(*iii*) Answers to the two sections should be written in separate answer-book.

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

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

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

(*vii*) Use of non-programmable electronic scientific calculator is allowed.

SECTION I

1. (*a*) State Castigliano's First Theorem and its use in structural analysis. [4]

P.T.O.

(*b*) A simply supported beam of 5 m span is subjected to central point load of 20 kN. Determine the maximum slope and deflection of the beam. [7]

(*c*) Using Moment area method, find the slope and deflection at free end and point C for a cantilever beam with uniform cross section shown in Fig. 1(*c*).

Take E = 2 × 10^5 MPa, I = 2 × 10^8 mm^4. [7]

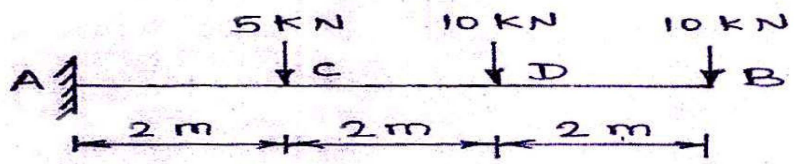

Fig. 1(*c*)

Or

2. (*a*) Calculate the deflection at free end C of beam ABC beam shown in Fig. 2(*a*). Using Castigliano's first theorem. [7]

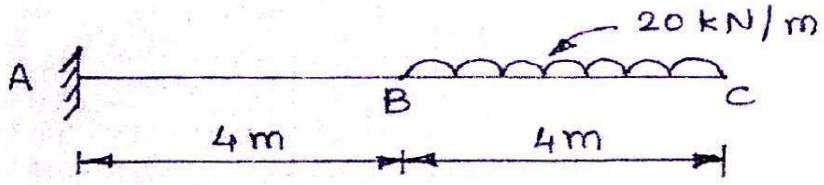

Fig. 2(*a*)

(*b*) Determine the deflection and slope at quarter point C of simply supported beam of span 'L' subjected to an uniformly distributed load w per unit length. Use Conjugate Beam Method. [7]

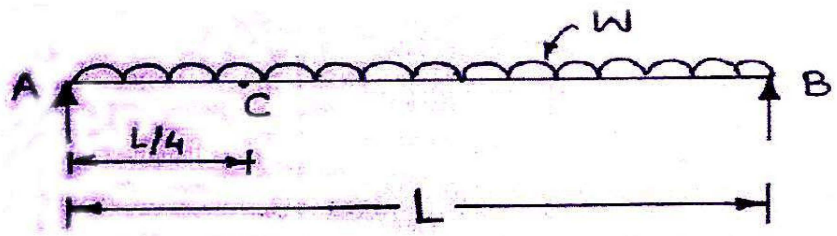

Fig. 2(*b*)

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

3. (*a*) Analyse the two span continuous beam as shown in Fig. 3(*a*), using three moment theorem. [8]

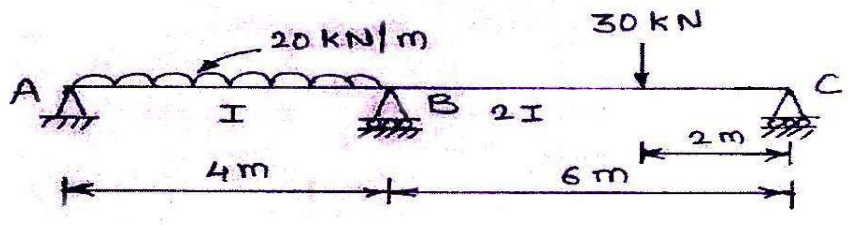

Fig. 3(*a*)

(*b*) A fixed beam AB of span 8 m carries uniformly distributed load of 60 kN/m over span of 2 m from A. Find fixed end moments from first principle. Draw SFD and BMD. [8]

Or

4. (*a*) Analyze prop cantilever beam of span L subjected to udl w/m throughout the span and draw SFD and BMD. [8]

(*b*) A fixed beam of span 8 m carries two point loads of 40 kN and 50 kN acting at 2 m and 4 m from left support. Find fixed end moments by First principal and check the values with standard formula. [8]

5. Find the forces of the truss supported and loaded as shown in Fig. 5. The cross-section area of vertical and horizontal members is 4000 mm^2 and that of diagonals is 6000 mm^2. [16]

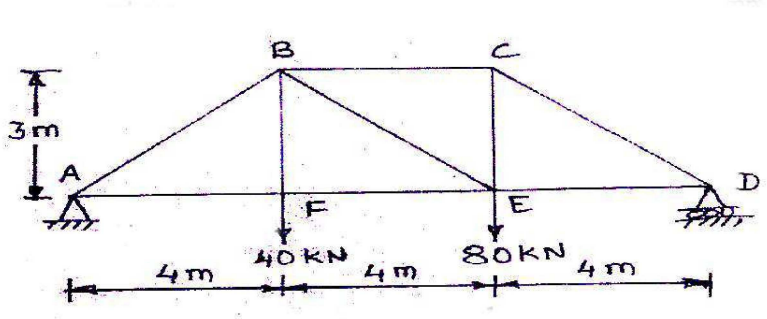

Fig. 5

Or

6. The truss shown in figure 6. Find central deflection. Take E = 200 kN/mm^2, if : [16]

(*a*) Area of all lower horizontal members = 2500 mm^2

(*b*) Area of all upper horizontal members = 4000 mm^2

(*c*) Area of all vertical members = 2000 mm^2

(*d*) Area of diagonal members = 4250 mm^2

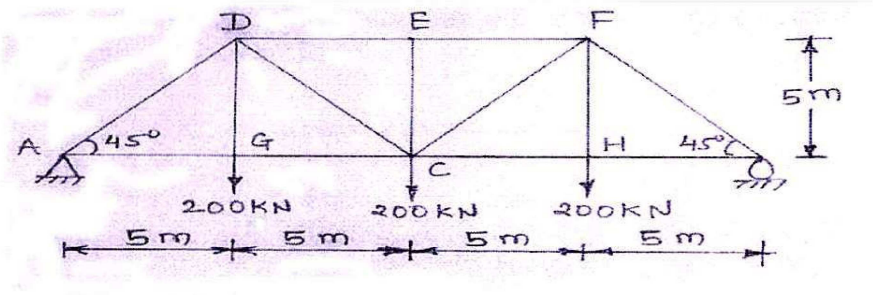

Fig. 6

SECTION II

7. (*a*) What is shape factor ? Obtain shape factor for solid rectangular section. [4]

(*b*) Find shape factor for unsymmetrical I–section as shown in Fig. 7(*b*). [7]

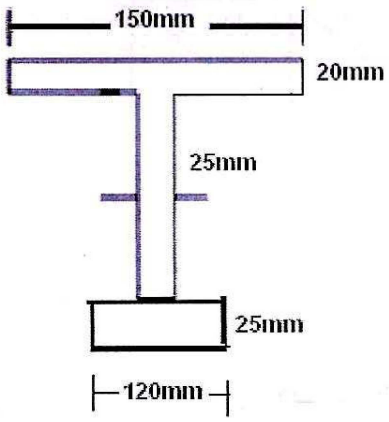

Fig. 7(*b*)

(*c*) Find the collapse load for a continuous beam ABCD loaded as shown in Fig. 7(*c*). [7]

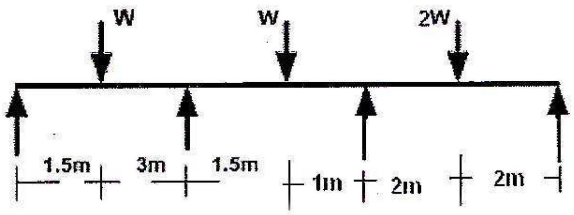

Fig. 7(*c*)

Or

8. (*a*) State and explain the concept of plastic hinge. Explain step by step, how plastic hinge is developed in beams under gradually applied load. Draw various shapes of stress diagram. [9]

(*b*) The frame loaded with a point load of 10 kN is as shown in Fig. 8(*b*). Determine the values of plastic moment of the frame when loaded up to collapse. [9]

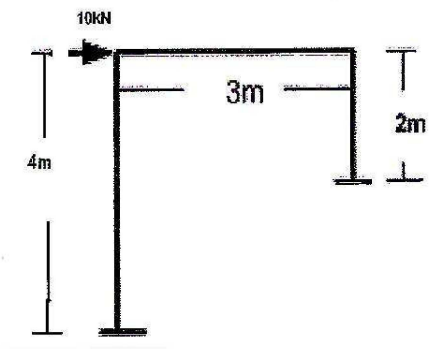

Fig. 8(*b*)

9. (*a*) Draw ILD for the reaction at A, B and C. Also draw ILD for shear force at midpoint of AB and BC for the beam shown in Fig. 9(*a*). [8]

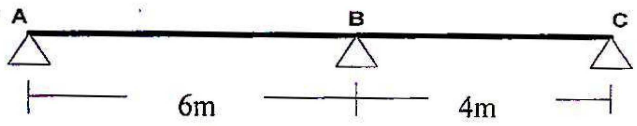

Fig. 9(*a*)

(*b*) Construct ILD for the forces in the members : [8]

U2U3, U3L3, L2L3 and U2L3

for the truss shown in Fig. 9(*b*).

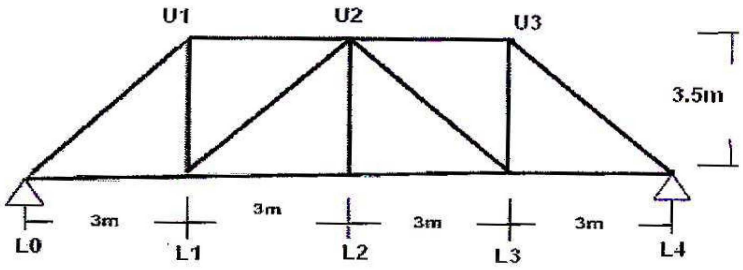

Fig. 9(*b*)

Or

10. (*a*) Using influence lines, obtain then reactions at support A and B for the beam ABC with an overhang BC . AB = 6 m, BC = 1 m. It is loaded with udl of intensity of intensity 50 kN/m on span AB and 20 kN/m on span BC. [8]

(*b*) Plot ILD for reactions at A and B supports and S.F. and B.M. at point 'E' and 'D' for the beam shown in Fig. 10(*b*). 1(CE) = 1(EA) = 0.5, 1(AE) = L/3, 1(EB) = 2 L/3. [8]

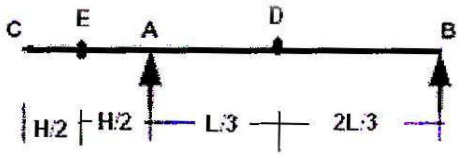

Fig. 10(*b*)

11. (*a*) A uniformly distributed load of 185 kN/m of 7 m long crosses a girder AB of span 15 m. Calculate maximum shear force and maximum bending moment at a section 9 m from end A. [8]

(*b*) The train of loads crosses the girder AB as shown in Fig. 11(*b*). Find the maximum positive and negative end shear for the girder. Assume 90 kN load leading the train : [8]

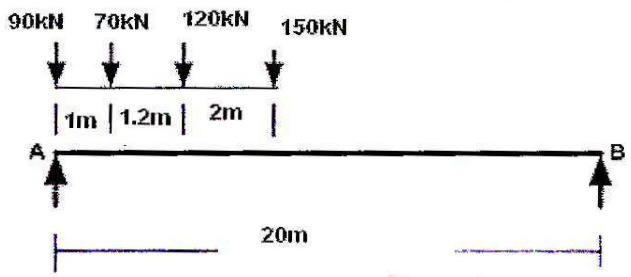

Fig. 11(*b*)

Or

12. (*a*) Two wheel loads 350 kN and 125 kN are spaced 2.2 m apart and are moving on a girder AB of 12 m span. Any wheel can lead the other. Find : [8]

(*i*) Max. Positive and max. negative shear force at 7 m from 'A'

(*ii*) Maximum end shears.

(*b*) Find absolute maximum bending moment under leading load 100 kN for the girder shown in Fig. 12(*b*). [8]

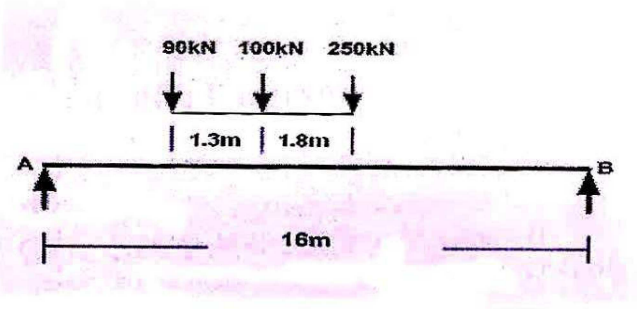

Fig. 12(*b*)