(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0025 Roll No. | | | | | | | | | | |

B. Tech.

(SEMESTER-IV) THEORY EXAMINATION, 2011-12

STRUCTURAL ANALYSIS -I

Time : 3 Hours] *[Total Marks : 100*

Note : (i) This question paper has **three** sections **A, B** and **C.**
(ii) Attempt **all** questions.
(iii) Marks and number of questions to be attempted from each section is mentioned before the section.
(iv) Assume missing data suitably. Illustrate the answers with suitable sketches.

SECTION – A

1. This section has **ten** parts of short answer type questions. Attempt all parts. **10 × 2 = 20**

(a) Describe the static and kinematic indeterminacy.

(b) What do you mean by degree of indeterminacy ?

(c) Explain degree of freedom.

(d) List different types of pin jointed determinate trusses.

(e) Distinguish between plane and space trusses.

(f) What do you mean by compound and complex space trusses ?

(g) Enumerate the tension coefficient method for the analysis of space truss.

(h) State the Müller – Breslau principle of influence line.

(i) Define Bette's-Maxwell's reciprocal theorem with example.

(j) State and proof Castiglione's first theorem.

SECTION – B

2. Attempt any **five** parts of the following : **5 × 6 = 30**

(a) Analyze the plain truss as show in **Fig. 2a**. Assume that the cross-sectional area of all the members are same.

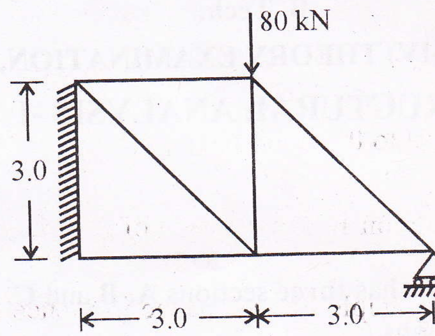

Fig. 2 (a)

(b) Find the reaction components of the space truss shown in **Fig. 2b**. Assume that the cross-sectional area of all the members are same.

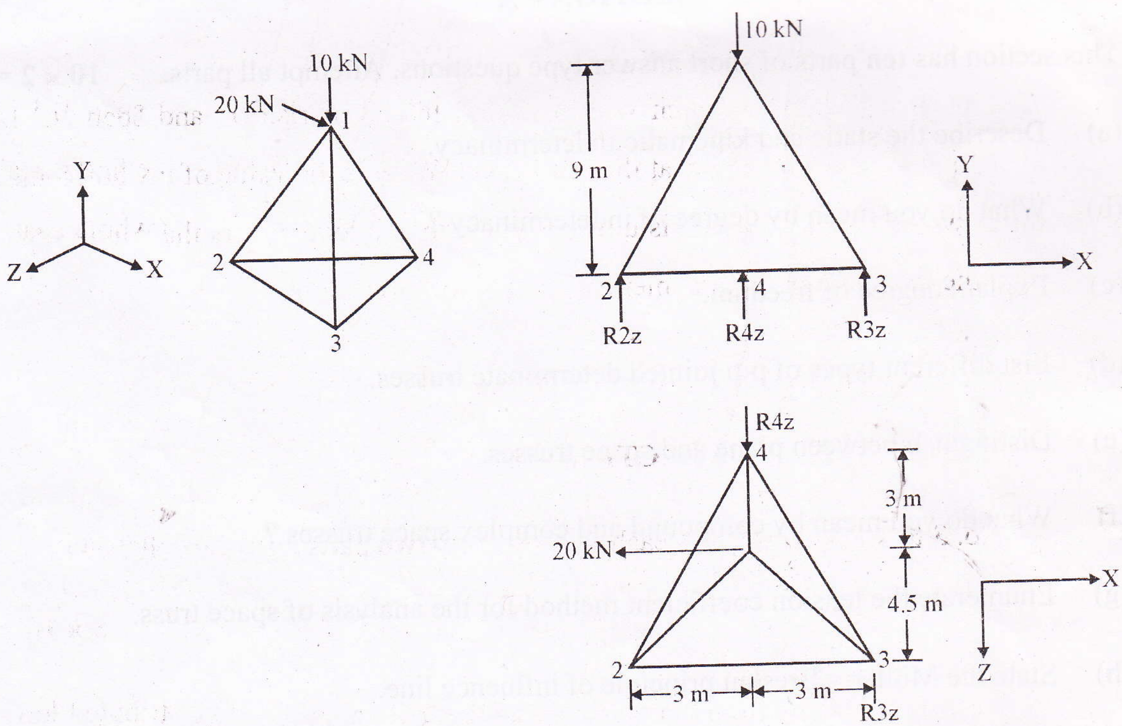

Fig. 2 (b)

(c) A uniformly distributed load of 1 kN/m run 6 m long crosses a girder of 16 m span. Construct the maximum shear force and bending moment diagrams and calculate the values at sections 3 m, 5 m and 8 m from the left hand support.

(d) A beam ABC is supported at A, B and C; and has a hinge at D distant from A. AB = 7 m and BC = 10 m. Draw the influence line for:

Reactions at A, B and C

Shear force at a point just to the right of B

Bending moment at a section 1 m to the right of B

(e) Using Müller-Breslau principle determine the influence line for R_A, R_B; V_C and M_C of singly supported beam AB of 8 m long. Section C is chosen at 5 m from left end A.

(f) Describe the concept of linear arch. State and explain the Eddy's theorem with suitable diagrams.

(g) A symmetrical parabolic arch with a central hinge, of rise 'r' and span 'L' is supported at its ends on pins at the same level. What is the value of the horizontal thrust when a load w, which is uniformly distributed load covers the whole span. Find the value of bending moment at any section of the arch.

SECTION – C

Question No. 3 to 7 has **three** parts each. Attempt any **two** parts from each question.

5 × 10 = 50

3. (a) A three-hinged semi-circular arch of radius R carries a uniformly distributed load of intensity w per unit length over its entire horizontal span. Determine the reactions at supports and amount of maximum bending moment in the arch.

(b) A three-hinged symmetric parabolic arch of span 16 m and rise 3 m, subjected to two rolling loads 40 kN and 80 kN at a gap of 2 m distance. The loads move from left to right. Determine the maximum positive moment and negative moment at a section 4 m from the left support.

(c) A three hinged segmental arch of a circle has a span of 50 m and a rise of 8 m. A load of 100 kN acting at 15 m from right support. Find the horizontal thrust developed at the supports.

4. (a) A vertical load W is applied to the right cantilever frame shown in **Fig. 4a.** Assume constant flexural rigidity throughout the frame, using this theorem determine the horizontal and vertical displacements of point C. Neglect the axial deformations.

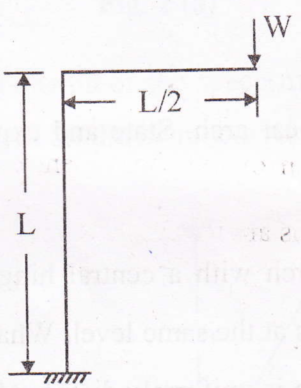

Fig. 4 (a)

(b) A circular bar is bent into the shape of a half circular ring and supported in a vertical plane as shown in **Fig. 4b.** Determine the horizontal movement of point C and the vertical movement of point B. Use the strain energy method. Assume flexural rigidity being constant throughout.

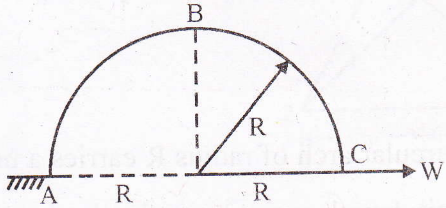

Fig. 4 (b)

(c) A steel bar bent to the shape of **Fig. 4c** is fixed at A and carries a vertical load W at C. Calculate the vertical deflection of C. Assume constant EI throughout.

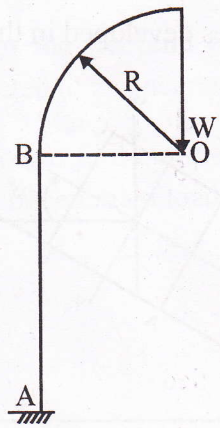

Fig. 4 (c)

5. (a) Determine the position of the shear Centre of the section of a beam shown in **Fig. 5a**. All dimensions are in mm.

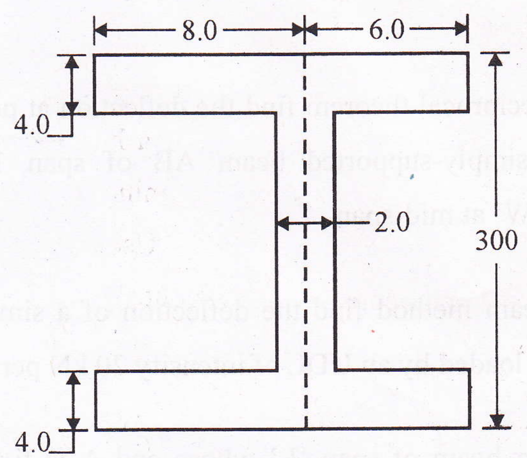

Fig. 5 (a)

(b) A wooden beam of cross-section 100 mm × 150 mm is used as shown in **Fig. 5b** to support a sloping Mangalore Tiled Roof. It has an effective span of 4 m and carries a uniformly distributed load of 3 kN/m acting vertically downward. Determine the maximum stresses developed in the beam.

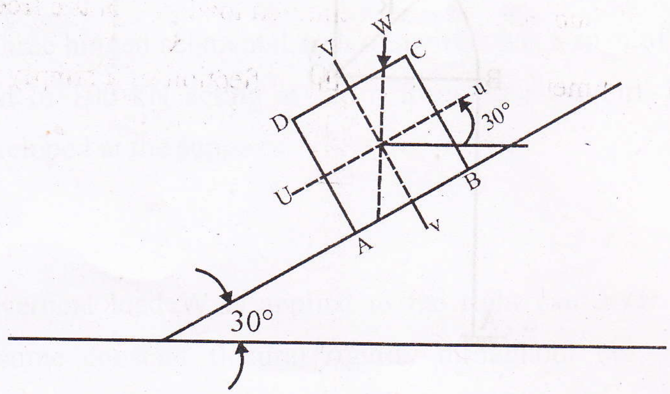

Fig. 5 (b)

(c) A 60 mm × 40 mm × 6 mm unequal angle is placed with the longer leg vertical and is used as a beam simply supported at the ends, over a span of 2 m. If it carries a uniformly distributed load of such magnitude as to produce the maximum bending moment of 0.12 kN-m, determine the maximum deflection of the beam. Take $E = 2.1 \times 10^5$ N/mm^2.

6. (a) Using Maxwell's reciprocal theorem find the deflection at point D, 4 m from left support A, of a simply-supported beam AB of span 10 m, loaded by a concentrated load 'W' at mid-span.

(b) Using conjugate beam method find the deflection of a simply supported beam, AB of length 10 m, loaded by an UDL of intensity 20 kN per unit run.

(c) ABC is a cantilever beam of span 'L' whose end A is fixed, and loaded by a concentrated load 'W' at B at 'L/2' distance from left end A. Find the deflection at free end C. Use unit load method.

7. (a) Distinguish between symmetrical and un-symmetrical bending. Describe the analytical method of location of neutral axis in the case of un-symmetrical bending.

(b) Determine the rotation of the free end of a cantilever curved beam of quarter circle of radius 'R' subjected to a concentrated load 'W' at the free end.

(c) Explain the energy method to find out the deflection of a simply supported beam of span 'L', loaded by a concentrated load 'W' at mid span.
