

**B.TECH.**  
**(SEM IV) THEORY EXAMINATION 2018-19**  
**STRUCTURAL ANALYSIS-I**

Time: 3 Hours

Total Marks: 70

**Note:** 1. Attempt all Sections. If you require any missing data, choose suitably.

**SECTION A**

1. Attempt *all* questions in brief.

2 x 7 = 14

- a. Explain degree of freedom of a structure.
- b. Give an example for a structure which is externally as well as internally indeterminate.
- c. State Maxwell's law of reciprocal deflections.
- d. Give an expression for strain energy stored in a beam due to bending.
- e. List the assumptions made in truss analysis.
- f. What is the shape of the influence line diagram for maximum bending moment in a simply supported beam?
- g. State Eddy's theorem.

**SECTION B**

2. Attempt any *three* of the following:

7 x 3 = 21

- a) Determine the forces in the members by method of joints. See Fig.1

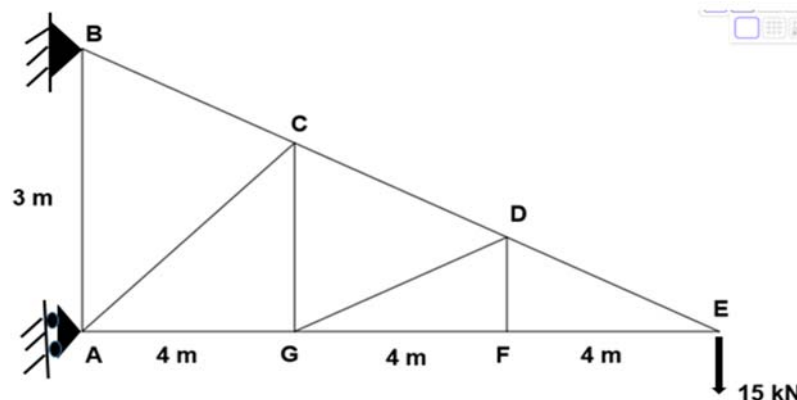


Fig.1

- b) Three hinged parabolic arch of span 10 m and central rise 2.5 m supports a point load of 100 kN at left quarter span and a UDL of 20 kN/m over the right half of the span. See fig.2.
  - a) Draw the influence line diagram.
  - b) Determine the reactions, normal thrust and radial shear at right quarter span point.

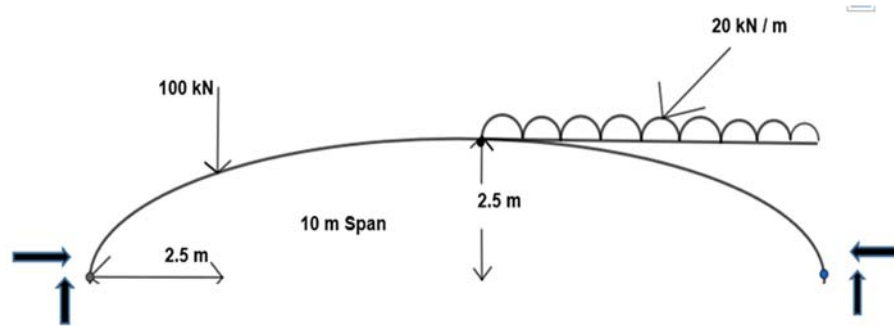


Fig.2

- c) A train of four concentrated loads crosses a simply supported girder of 10 m span with 30 kN leading. See fig3. Determine
- The maximum bending moment at 6 m from the left support.
  - Absolute maximum bending moment anywhere in the girder.

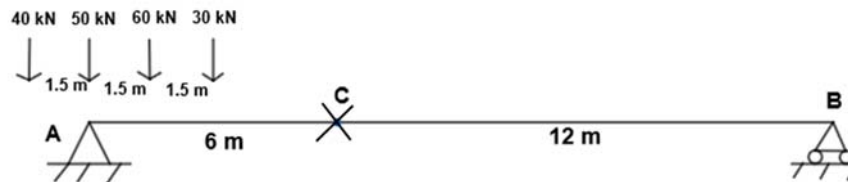


Fig.3

- d) State and prove Betti's law.
- e) A cord supported at its ends 60 m apart carries loads of 30 kN, 15 kN, 18 kN at 15, 30 and 45 m respectively from the left end. If the point on the cord where the 15 kN load is supported is 15 m below the level of end supports determine.
- The reactions at the supports,
  - Tension in different parts of the cord
  - The total length of the cord.

### SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

- a) Find static indeterminacy and kinematic indeterminacy of the given structure. See fig.4.

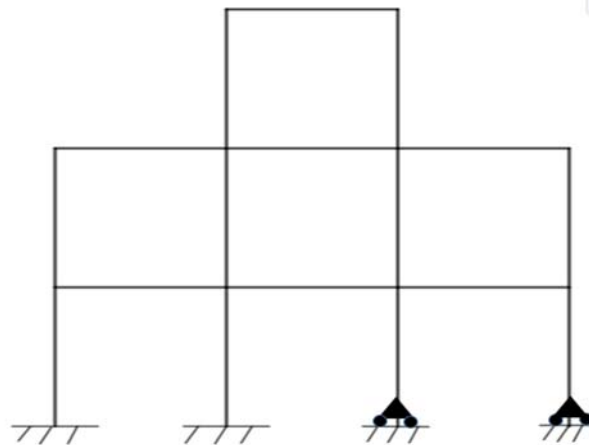


Fig.4

b) Find static indeterminacy and kinematic indeterminacy of the given structure. See fig5.

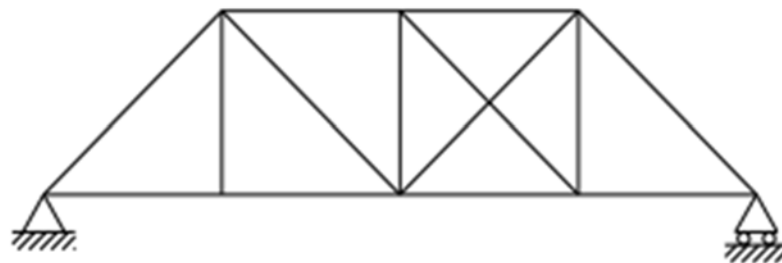


Fig.5

4. Attempt any *one* part of the following:

7 x 1 = 7

a) Determine the forces in all the members using method of substitution, for the below given Fig.6

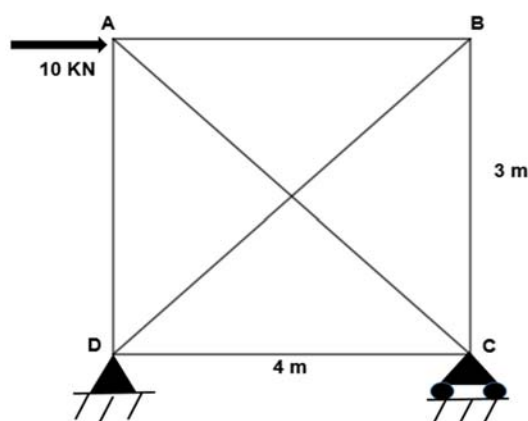


Fig.6

b) The Fig.7 shows a warren type cantilever truss along with the imposed loads. Determine the forces in all the members using tension coefficients.

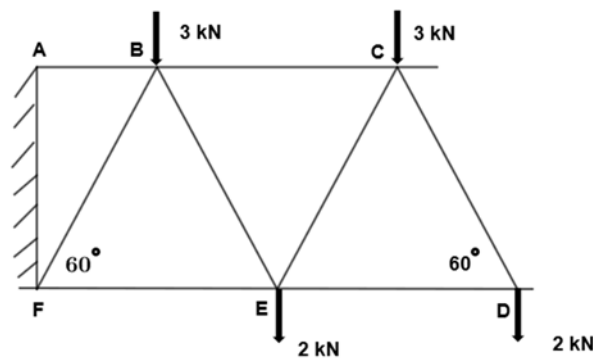


Fig.7

5. Attempt any *one* part of the following:

7 x 1 = 7

- a) A beam ABCD is simply supported at its ends A and D over a span of 30 m. It is made three portions AB, BC and CD each 10 m in length. The moment of inertia of the section of these lines are I, 3I and 2I respectively. The beam carries a point load 150 kN at B and point load of 300 kN at C. neglecting the weight of the beam calculate the slopes and deflection at A, B, C and D

Where  $E = 200 \text{ kN/mm}^2$ ,  $I = 2 \times 10^{10} \text{ mm}^4$ .

- b) Find the horizontal movement of the roller end D of the portal frame shown in Fig.8 Take  $E = 2 \times 10^8 \text{ kN/m}^2$  and  $I = 3 \times 10^4 \text{ m}^4$ . The moment of inertia of the column section is I while that of beam is 2I.

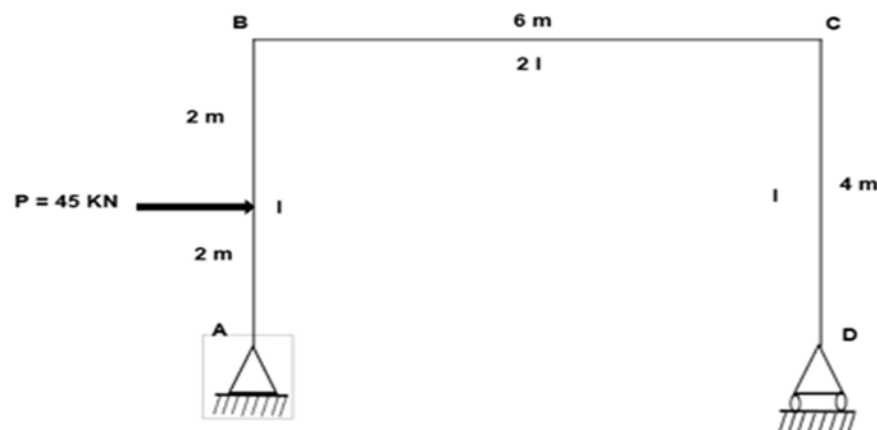


Fig.8

6. Attempt any *one* part of the following:

7 x 1 = 7

- a) By using Muller – Breslau's principle Construct influence line diagram for the beam as shown in Fig 9.

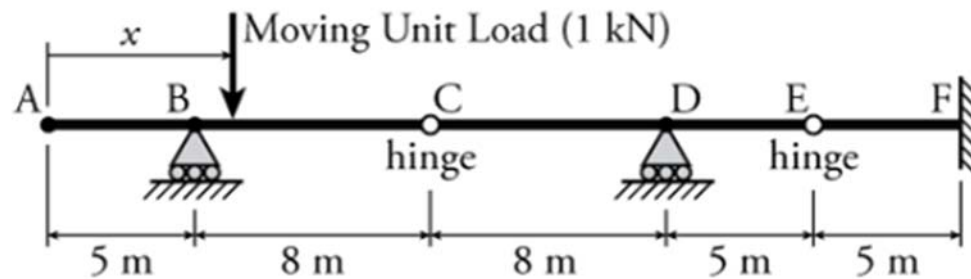


Fig.9

- b) Assume a unit point load is rolling along the bridge deck from points A to D in a simple truss as shown in Fig.10. The distance  $X$  is the distance of the moving load from point A. Construct the influence line diagram for the three members EF, BF and BC.

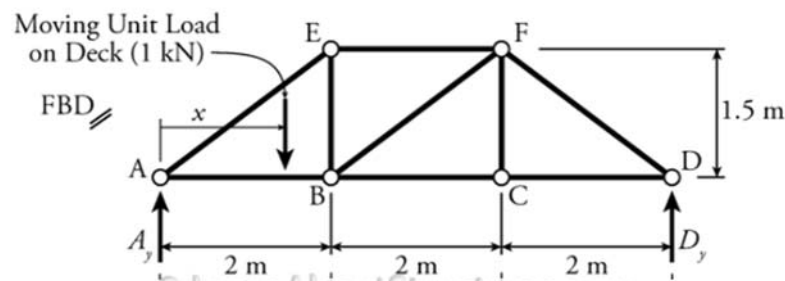


Fig.10

7. Attempt any *one* part of the following:

7 x 1 = 7

- a) A three hinged parabolic arch of span 30 m and central rise of 5m. It is subjected to a concentrated load of 40 kN at 6 m span. Calculate the normal thrust, shear force and bending moment at 6 m from the left support. See fig.11.

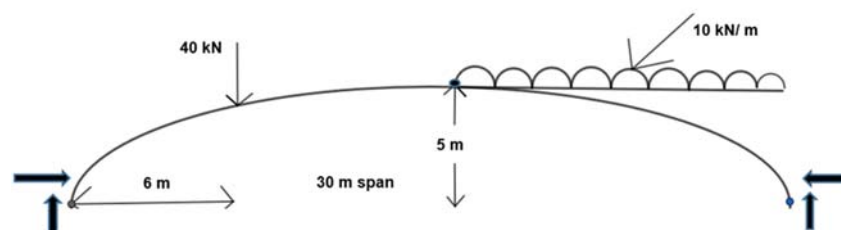


Fig.11

- b) Classify the arches based on materials, shapes and structural systems with the help of neat sketch. Also, distinguish between two hinged and three hinged arches.