

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

Paper ID : 100401

Roll No.

B.TECH.

Theory Examination (Semester-IV) 2015-16

STRUCTURAL ANALYSIS-I

Time : 3 Hours

Max. Marks : 100

Section-A

1. Attempt all parts. (2×10 = 20)

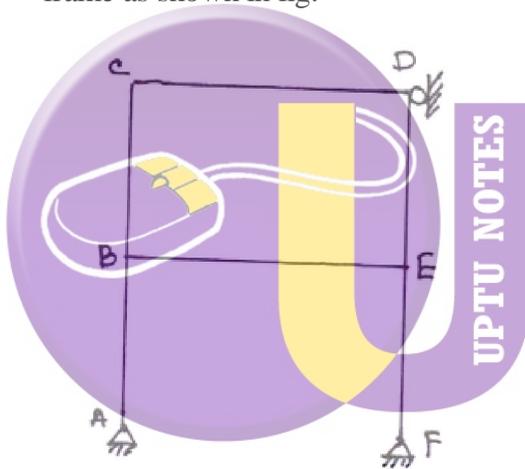
- (a) Give Classification of Pin jointed determinate trusses.
- (b) Differentiate between determinate and indeterminate structures?
- (c) What is the influence line diagram?
- (d) Differentiate between static and kinematic indeterminacy.
- (e) What is a linear arch?
- (f) What are the types of arches according to their shapes?
- (g) State Castigliano's first theorem.
- (h) Define the term strain energy.

- (i) Define shear centre.
- (j) What do you mean by unsymmetrical bending?

Section-B

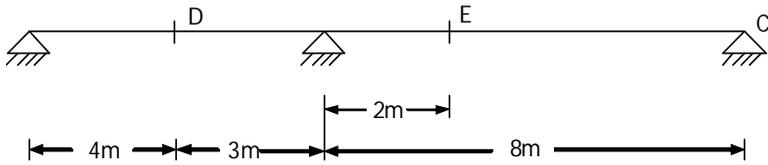
2. Attempt any five questions : (10×5=50)

- (a) i. Find the degree of kinematic indeterminacy of the frame as shown in fig.



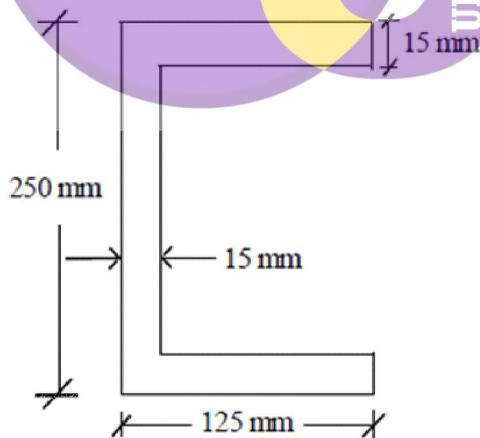
- ii. Explain static indeterminacy with an example.
- (b) A beam ABC is supported at A, B and C as shown in Fig. It has the hinge at D. Draw the influence lines for:
 - (i) reactions at A, B and C
 - (ii) shear to the right of B

(iii) bending moment at E



(c) A curved bar is formed of a tube 40mm outside radius and 5mm thickness. The centre line of this beam is a circular arc of radius 150mm. A bending moment of 2kNm tending to increase curvature of the bar is applied. Calculate the maximum tensile and compressive stresses setup in the bar.

(d) Determine the shear centre for the channel section shown in Fig.



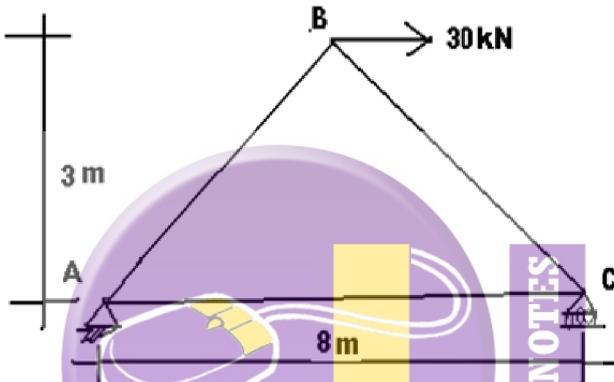
- (e) A steel bar 38mm in diameter is bent into a curve of mean radius 31.7mm. If a bending moment of 4.6Nm tending to increase the curvature, acts on the bar find the intensities of maximum tensile and compressive stresses.
- (f) A three hinged circular arch of span 16m and rise 4m is subjected to two point loads of 100 kN and 80 kN at the left and right quarter span points respectively. Find the reaction at the supports. Also find the bending moment, radial shear and normal thrust at 6m from left support.
- (g) A beam of angle section 150mm x 100mm x 10mm is simply supported over a span of 1.6m with 150mm leg vertical. A uniformly distributed load of 10kN/m is applied throughout the span. Determine:
- Maximum bending stress
 - Direction of neutral axis
 - Deflection at the centre.
- (h) State and prove the Betti's and Maxwell's law of reciprocal theorem.

Section-C

Attempt any two questions :

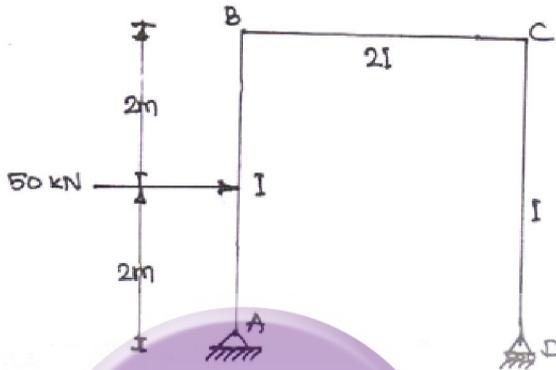
15×2=30

3. Determine the vertical and horizontal displacement of the joint B in a pin jointed frame shown in fig.

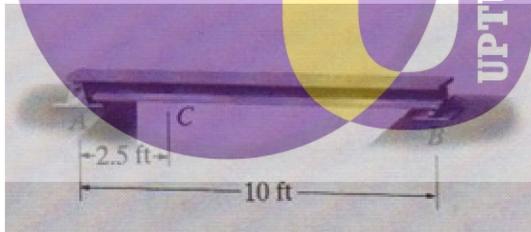


- (a) Determine the vertical displacement of joint C if a 4 kN force is applied to the truss at C?
- (b) If no loads act on the truss, what would be the vertical displacement of joint C if member AB were 5 mm too short?
- (c) If 4 kN force and fabrication error are both accounted, what would be the vertical displacement of joint C?
4. (a) Determine the horizontal displacement of support D of the frame shown in fig. The values of I are indicated

along the members. Take $E=200 \times 10^6 \text{ kN/m}^2$ and $I=300 \times 10^{-6} \text{ m}^4$ 8



- (b) Construct the influence line for the shear at point C of the beam in fig. (7)

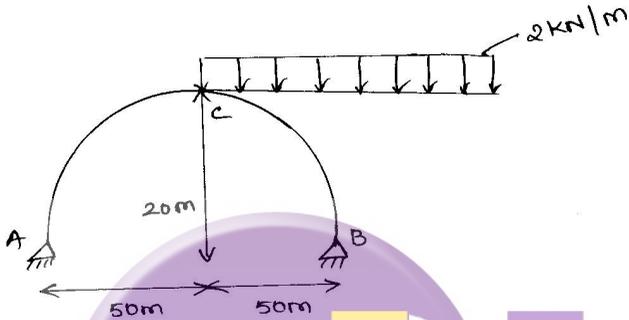


5. (a) Explain briefly :
- (i) Three hinged arch
 - (ii) spandrel braced arch. (7)

(6)

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- (b) A three hinged parabolic arch of span 100 m and rise 20 m carries a uniformly distributed load of 2 kN/m length on the right half as shown in the figure. Determine the maximum bending moment in the arch. (8)



UPTU NOTES