

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

Paper ID : 100409

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. All parts carry equal marks. Write answer of each part in short.** (2×10 = 20)
- (a) Differentiate static and kinematic indeterminacy of structure.
 - (b) State degree of freedom.
 - (c) Define real work method.
 - (d) A cantilever beam of length L subjected to a concentrated load P at the free end. What is the deflection at the free end?
 - (e) Differentiate between determinate and indeterminate structures.
 - (f) State Muller-Breslau's principal for determinate structures.

- (g) Give the equation for a parabolic arch whose springing is at different levels?
- (h) State Eddy's theorem as applicable to arches.
- (i) Mention any three reasons due to which sway may occur in portal frames?
- (j) Define shear centre.

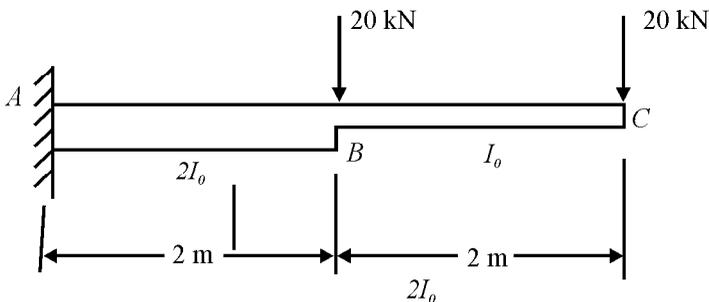
Section-B

2. Attempt any 5 questions from this section.

(10×5 = 50)

- (a) Explain in details about method of substitution and method of tension coefficient with examples.
- (b) Determine the deflection and rotation at the free end of the cantilever beam shown in figure.

Use unit load method. Given $E=2 \times 10^5 \text{ N/mm}^2$ and $I = 12 \times 10^6 \text{ mm}^4$.

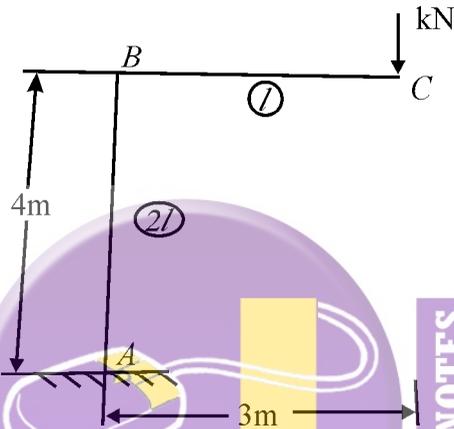


Figure

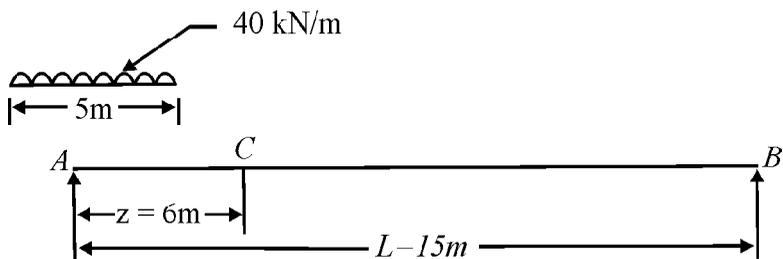
(2)

P.T.O.

- (c) State and prove the Maxwell's reciprocal theorem.
- (d) Determine the vertical deflection of point C in the frame shown in figure. Given $E=200\text{kN/mm}^2$ and $I=30\times 10^6 \text{ kgmm}^2$.



- (e) A simply supported beam has a span of 15m. UDL of 40kN/m and 5m long crosses the girder from left to right. Draw the influence line diagram for shear force and bending moment at a section 6m from left end. Use these diagrams to calculate the maximum shear force and bending moment at this



(3)

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- (f) a circular arch to span 25m with a central rise 5m is hinged at the crown and springing. It carries a point load of 100kN at 6m from the left support. Calculate
- (i) The reactions at the supports
 - (ii) The reactions at crown
- (g) Show that the parabolic shape is a funicular shape for a three-hinged arch subjected to a uniformly distributed load over to its entire span.
- (h) Uniformly distributed load of intensity 30kN/m crosses a simply supported beam of span 60m from left to right. The length of udl is 15m. find the value of maximum bending moment for a section 20m from left end. Find also the absolute value of maximum bending moment and shear force in the beam.

Section-C

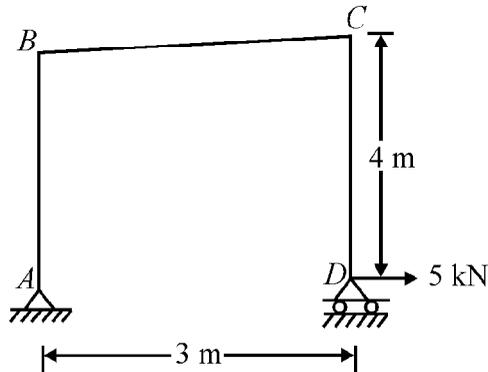
Note : Attempt any 2 questions from this section.

(15×2 = 30)

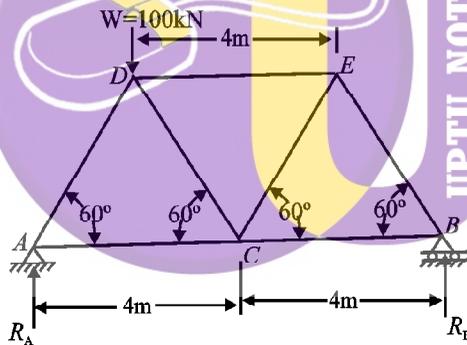
3. (a) Determine the horizontal displacement of the roller end D of the portal frame shown in figure. EI is 8000 kNm² throughout.

(4)

P.T.O.



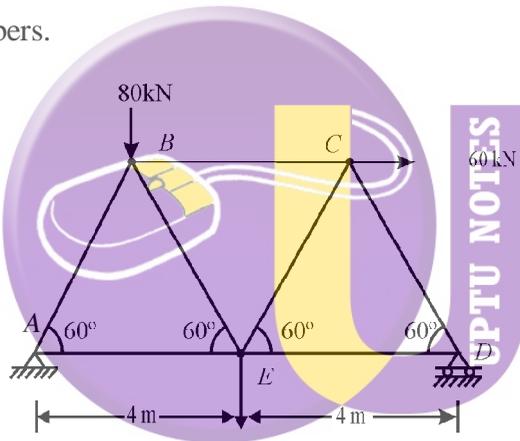
- (b) Figure shows a pin-jointed truss loaded with a single load W is 100kN. If the area of cross-section of all members shown in figure is 1000mm^2 , what is the vertical deflection of point C ? Take $E=200\text{kN/mm}^2$ for all members.



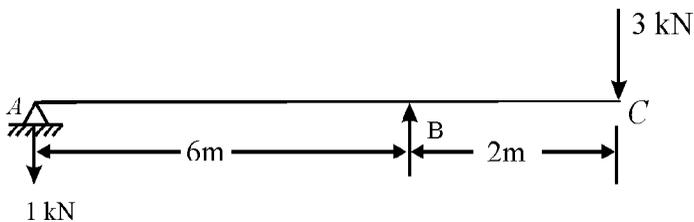
4. (a) Four point loads 8, 15, 15 and 10kN have centre to centre spacing of 2m between consecutive loads and they traverse a girder of 30m span from left to right with 10kN load leading. Calculate the maximum bending moment and shear force at 8m from the left support.

- (b) A three-hinged circular arch hinged at the springing and crown points has a span of 40m and a central rise of 8m. it carries a uniformly distributed load 20kN/m over the left-half of the span together with a concentrated load of 100kN at the right quarter span point. Find the reactions at the supports, normal thrust and shear at a section 10m from left support.

5. a) Analyse the truss shown in figure by the method of tension coefficient and determine the forces in all the members.



- (b) Determine the vertical deflection at the free end and rotation at A in the overhanging beam shown in figure. Assume constant EI. Use castigliano's method.



(6)

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