

Code : 011511

B.Tech 5th Semester Exam., 2018

STRUCTURAL ANALYSIS—I

Time : 3 hours

Full Marks : 70

Instructions :

sik

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct answer of the following

(any seven) :

2×7=14

(a) In case of conjugate beam the internal hinged is converted into which support?

- (i) Fixed
- ✓(ii) Hinged
- (iii) Free
- (iv) Roller ✓

(b) The ordinates of influence line diagram for bending moment always have dimension of

- (i) force
- (ii) force × length ✓
- (iii) length →
- ✓(iv) None of the above

(c) A three-hinged parabolic arch of span 20 and rise 5 carries UDL of intensity 15 kN/m over whole span, the value of bending moment at a section 5 m from left end is

- (i) $\frac{wL^2}{8h}$
- (ii) $\frac{wL^2}{4}$
- (iii) $\frac{wL^2}{8}$

(iv) zero ✓

(d) Flexibility matrix method is based on the

- (i) static indeterminacy ✓
- (ii) kinematic indeterminacy
- ✓(iii) Both (i) and (ii)
- (iv) None of the above

(3)

(e) In a simply supported beam, a load 20 kN is placed at A which is at a distance of 6 m from the left caused the deflection at B of 10 mm. When the load is 10 kN at B which is same distance from the right end, then find the deflection at point A.

(i) 10 mm

(ii) 5 mm

(iii) 2.5 mm

(iv) 1 mm

(f) The Castigliano's theorem is applicable for the structures

(i) determinate

(ii) indeterminate

(iii) Both (i) and (ii)

(iv) None of the above

(g) The degree of kinematic indeterminacy of a pin-jointed space frame is given by

(i) $2j - r$

(ii) $3j - r$

(iii) $6j - r$

(iv) $j - 6r$

(4)

(h) The rate of change of bending moment in any structure is equal to the

(i) bending moment

(ii) stress

(iii) weight

(iv) shear force

(i) A cantilever beam of span L carries point load of intensity W kN at the free end and another beam which is simply supported at both ends of length L carries point load W kN at the center. What is the ratio of maximum deflection of cantilever beam to simply supported beam?

(i) 16

(ii) 8

(iii) 6

(iv) 24

(j) The strain energy stored in the member due to bending per unit volume is given by

(i) $\frac{f^2}{2E}$

(ii) $\frac{f^2}{4E}$

(iii) $\frac{f^2}{6E}$

(iv) $\frac{f^2}{3E}$

(Continued)

(5)

2. (a) Describe the differences between determinate and indeterminate structures. Also determine static and kinematic indeterminacy of structures shown in Fig. 1 :

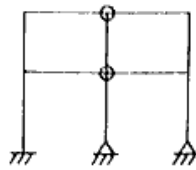


Fig. 1

- (b) A three-hinged parabolic arch ACB of span 30 m has its left support at depth 4 m and right support at depth 16 m below the crown hinge C . The arch carries a point load of 60 kN at a distance of 5 m from left side of C and point load of 120 kN at a distance of 10 m from right side of C . Find the reaction at the supports and the bending moment under the loads.
3. Three wheel loads 60 kN, 40 kN and 50 kN spaced at 2 m and 2 m, respectively roll on girder of span 20 m from left to right with the 60 kN load leading. Find maximum and absolute maximum bending moment that can occur at a section 6 m from the left support. Also determine maximum positive and negative shear force at that section.

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(6)

4. (a) Find out horizontal and vertical deflections of point A of circular structure shown in Fig. 2, EI is constant :

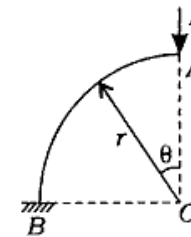


Fig. 2

- (b) Derive and describe the Maxwell law of reciprocal deflection theorem and also its generalized form.
5. A beam AB of length L simply supported at the ends carries a point load W at a distance from the left end and b distance from right end. Find the deflection under the load and the maximum deflection.
6. (a) A three-hinged parabolic arch ACB of span 30 m has its left support at depth 4 m and right support at depth 16 m below the crown hinge C . The arch carries a point load of 60 kN at a distance of 5 m from left side of C and point load of 120 kN at a distance of 10 m from right side of C . Find the reaction at the supports and the bending moment under the loads.

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(7)

- (b) Find the forces in each member by method of tension coefficient of the Fig. 3 :

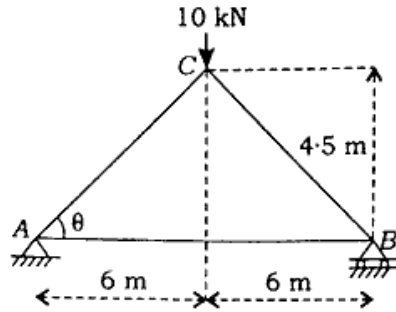


Fig. 3

7. (a) A cable is supported between two points 40 m horizontal apart. The left support is 5 m above the right support. The cable carries a load of 6 kN/m on the horizontal span. The lowest point of cable is 5 m below the left support. Find the maximum tension in the cable.

- (b) Draw the influence line diagram of the structure as shown in Fig. 4 for reaction at A, reaction at B, shear force and bending moment at section E :

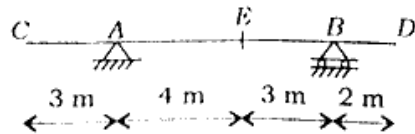


Fig. 4

Also find the ordinates of influence line diagrams.

(8)

8. Find vertical deflection, horizontal deflection and slope at end A of the frame member ABCD shown in Fig. 5 :

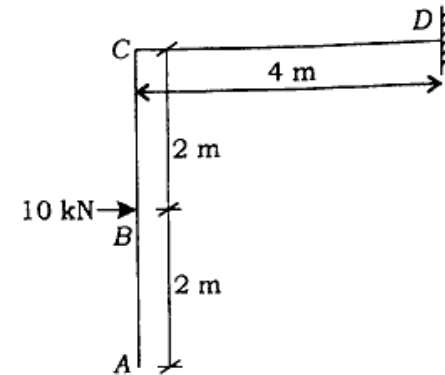


Fig. 5

Take $E = 210 \text{ kN/mm}^2$, $I_{AC} = 4 \times 10^7 \text{ mm}^4$ and $I_{CD} = 8 \times 10^7 \text{ mm}^4$.

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9. (a) What is the difference between flexibility matrix and stiffness matrix? Discuss in detail.
- (b) Determine the stiffness matrix of the structure shown in Fig. 6 :

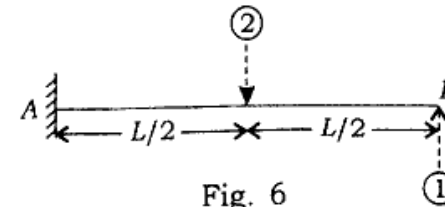


Fig. 6
