

B.Tech 5th Semester Exam., 2017

STRUCTURAL ANALYSIS—I

Time : 3 hours

Full Marks : 70

Instructions :

- (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 any seven of the following : 2×7=14

(a) It is generally assumed that the cable is

- (i) perfectly flexible
- (ii) perfectly inflexible
- (iii) inextensible

(iv) perfectly flexible and extensible

(b) If in planar system, X parts/members are there with Y no. of forces, then the condition for statical determinacy is

- (i) $Y < 3X$
- (ii) $Y > 3X$
- (iii) $Y = 3X$
- (iv) None of the above

(c) Generally in a truss system compressive parts are thicker than tensile parts.

- (i) True
- (ii) False
- (iii) Cannot say
- (iv) Depends upon situation

(d) If a member of a truss is in compression, then what will be the direction of force that it will apply to the joints?

- (i) Outward
- (ii) Inward
- (iii) Depends on case
- (iv) No force will be there

(e) In conjugate beam, free end is replaced by

- (i) roller
- (ii) pin
- (iii) fixed support
- (iv) link

(3)

- (f) The Castigliano's second theorem can be used to compute deflections
- (i) in statically determinate structures only
 - (ii) for any type of structure
 - (iii) at the point under the load only
 - (iv) for beams and frames only
- (g) The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in
- (i) vertical direction
 - (ii) horizontal direction
 - (iii) inclined direction
 - (iv) the direction in which the deflection is required
- (h) Shape of a three-hinged arch is always
- (i) hyperbolic
 - (ii) circular
 - (iii) parabolic
 - (iv) can be any arbitrary curve

(4)

- (i) In influence line diagrams (ILD)
- (i) points remain fixed, position of load changes
 - (ii) points change, position of loads remain fixed
 - (iii) Both of them changes
 - (iv) Neither of them changes
- (j) The double integration method to calculate slope of deflected beam is applicable only when
- (i) slope is very large
 - (ii) slope is very small
 - (iii) slope is -ve
 - (iv) slope is +ve

2. (a) In Fig. 1, determine the displacement and slope at point C. EI is constant : 7

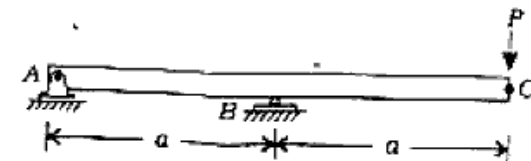


Fig. 1

- (b) In Fig. 2, determine the value of a so that the slope at A is equal to zero. EI is constant :

7

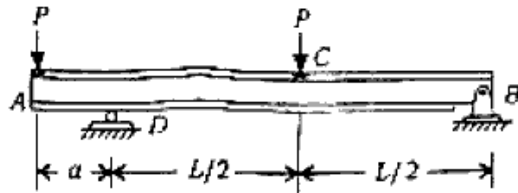


Fig. 2

3. In Fig. 3, draw the influence line for (a) the vertical reaction at A , (b) the shear at B and (c) the moment at B . Assume A is fixed :

14

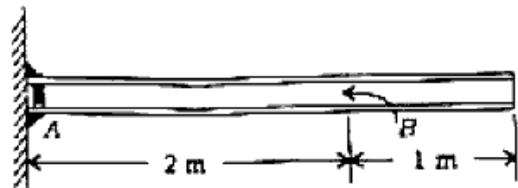


Fig. 3

4. Generate stiffness matrix for beam with respect to coordinates shown in Fig. 4 :

14

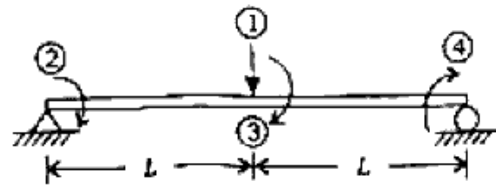


Fig. 4

5. In Fig. 5, determine the force in each member of the truss. State whether the members are in tension or compression. Set $P = 8$ kN :

14

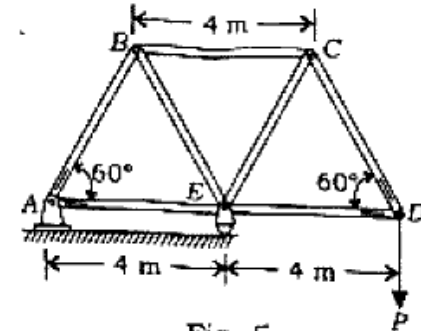


Fig. 5

6. (a) Discuss different types of structural stabilities. 7
 (b) Derive the critical load of column if its one end is fixed and one end is free. 7
7. In Fig. 6, determine the forces P_1 and P_2 needed to hold the cable in the position shown, i.e., so segment CD remains horizontal. Also find the maximum loading in the cable :

14

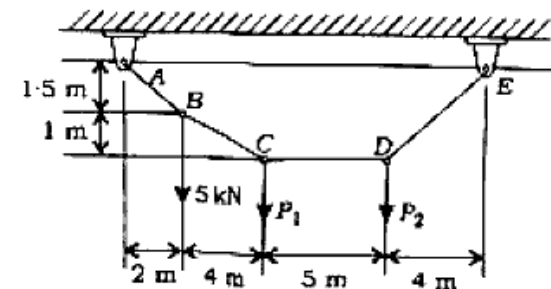


Fig. 6

(7)

8. For Fig. 7, determine the shear and moment throughout the beam as a function of x : 14

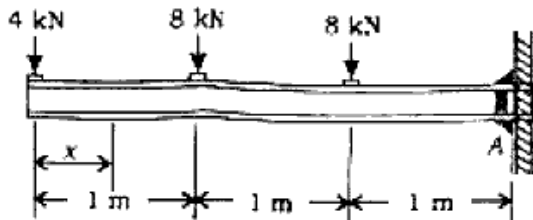


Fig. 7

9. For Fig. 8, determine the vertical displacement of joint A. Each bar is made of steel and has a cross-sectional area of 600 mm^2 . Take, $E = 200 \text{ GPa}$. Use the method of virtual work : 14

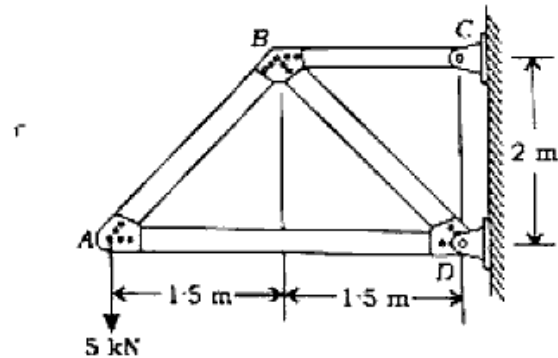


Fig. 8
