Code : 011511

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 statically 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

(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

(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

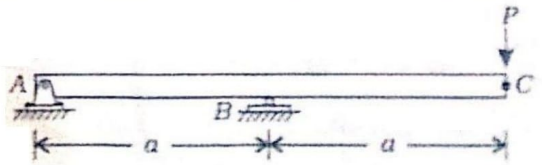

Fig. 1

(b) In Fig. 2, determine the value of a so that the slope at A is equal to zero. EI is constant : 7

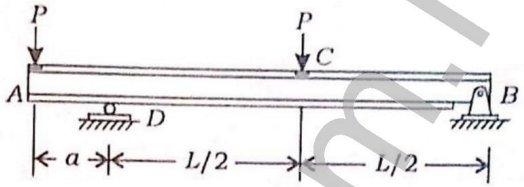

Fig. 2

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

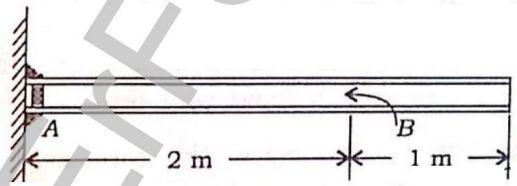

Fig. 3

4. Generate stiffness matrix for beam with respect to coordinates shown in Fig. 4 : 14

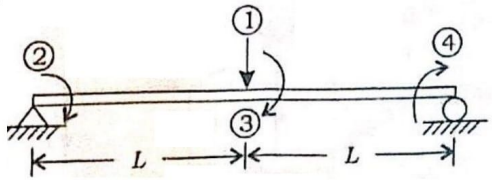

Fig. 4

(Turn Over)

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

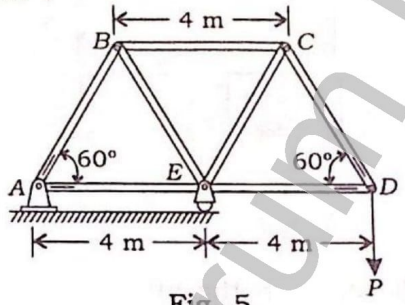

Fig. 5

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

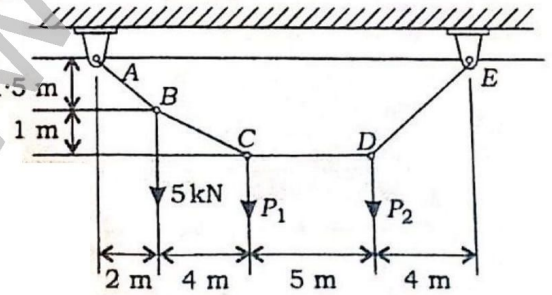

Fig. 6

(Continued)

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

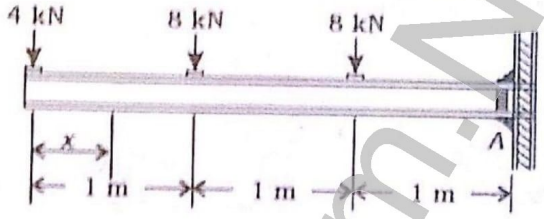

Fig. 7

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, $E = 200$ GPa. Use the method of virtual work : 14

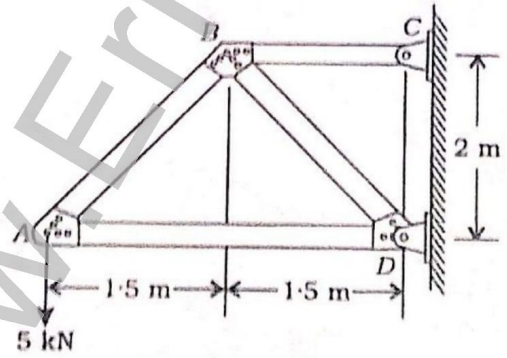

Fig. 8

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