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320451 (20)

BE (4^{th} Semester)

Examination, Nov.-Dec., 2021

Branch : Civil

STRUCTURAL ANALYSIS - I (NEW)

Time Allowed : Three Hours

Maximum Marks : 80

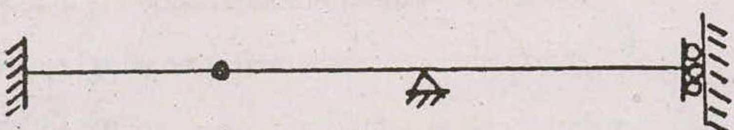
Minimum Pass Marks : 28

Note : Part (a) of each question is compulsory. Attempt questions worth 16 marks from each unit.

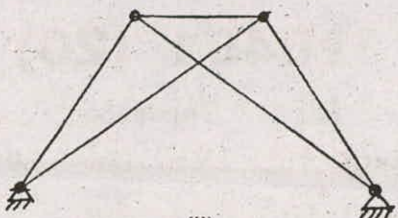
Unit-I

Q. 1. (a) Explain the term "Indeterminate structures". **2**

(b) Find out static (external and internal) and kinematic indeterminacies of the structures shown in fig. 1. Also mention the type of structure. **7**



(i)



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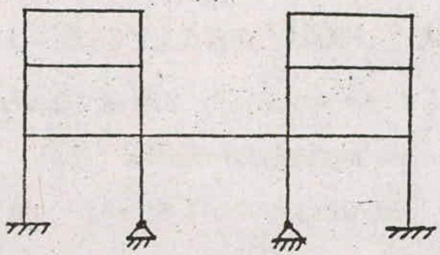

(iii)

Fig. (1)

(c) Fig. 2 shows the plan of a tripod, the feet A, B and C being in the same horizontal plane and the Apex D being 3.75 m above the plane. Horizontal loads of 200 kN and 300 kN are applied at D in the direction shown. Find the forces in the members assuming that all joints are pin-joints and frame is space frame. Use method of tension coefficient. 7

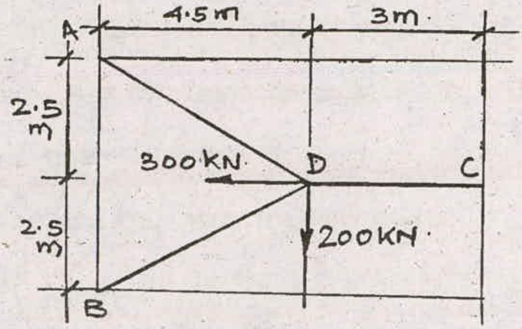

Fig. (2)

(d) Using the method of tension coefficient determine the forces in the members of the plane frame shown in fig. 3. 7

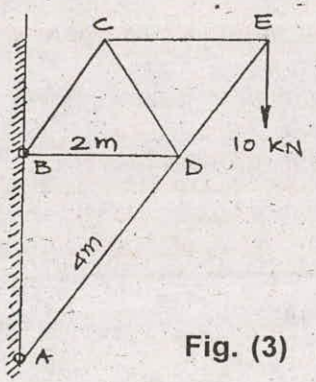

Fig. (3)

Unit-II

Q. 2. (a) Differentiate pin jointed plane frames and rigid jointed plane frames. 2

(b) An overhanging beam ABC, supported at A and B is loaded as shown in fig. 4. Determine :

(i) deflection at the free end C and

(ii) maximum deflection between A & B.

Take $E = 2 \times 10^5$ N/mm^2 and $I = 450$ cm^4. **7**

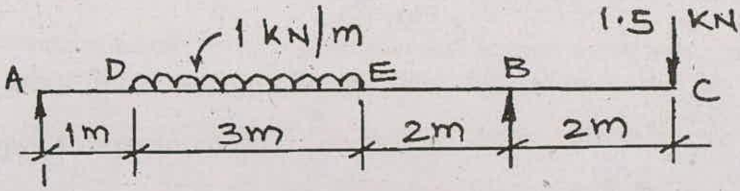

Fig. (4)

(c) Determine the deflection at points B and C of the cantilever beam shown in Fig. 5, use moment area method. **7**

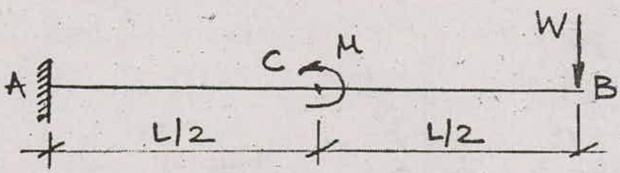

Fig. (5)

(d) Using conjugate beam method, find slopes at the ends and central deflection for a simply supported beam shown in fig 6. **7**

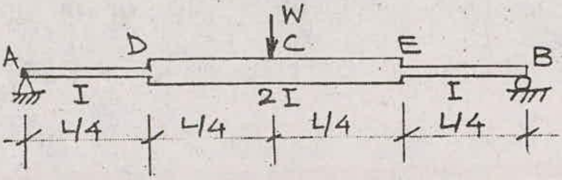

Fig. (6)

Unit-III

Q. 3. (a) What is strain energy ? 2

(b) Using Castigliano's first theorem, determine the deflection and rotation of the overhanging end A of the beam loaded as shown in fig. 7. 14

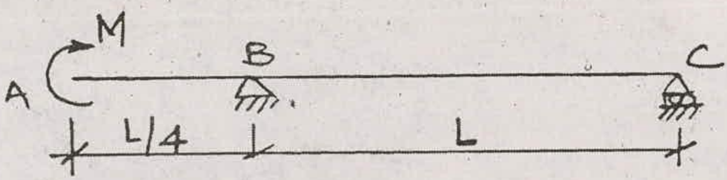

Fig. (7)

(c) The frame shown in fig. 8 consists of four panels each 2.5 m wide and cross-sectional areas of the members are such that when the frame carries equal loads at the panel points of the lower chord the stress in all tension members is 100 N/mm^2 and the stress in all compression members is 80 N/mm^2. Determine the relative movement between the joints C and K in the direction CK. Take E = 2 × 10^5 N/mm^2. Use strain energy/unit load method. **14**

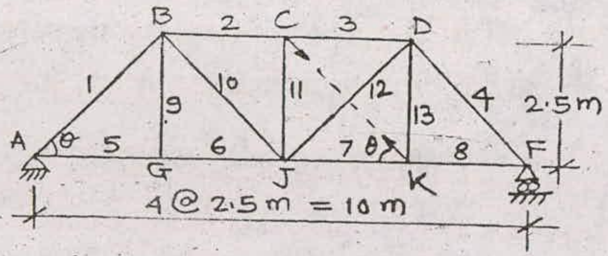

Fig. (8)

Unit-IV

Q. 4. (a) Define influence line diagram and mention its uses. **2**

(b) Find the absolute maximum bending moment due to the moving load system shown in fig. 9 moving over a simply supported beam of 40 m span. **14**

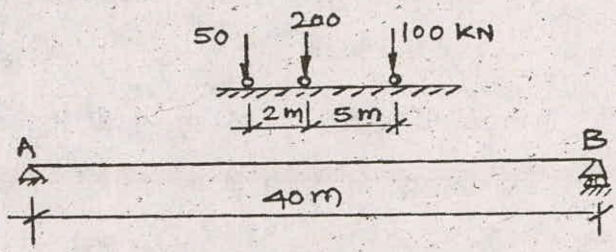

Fig. (9)

(c) Fig. 10 shows the deck type N-truss. Draw the influence line diagram for the members U_0L_1, U_1U_2, U_1L_1, L_1L_2, U_1L_2, U_2L_2, U_3L_3. **14**

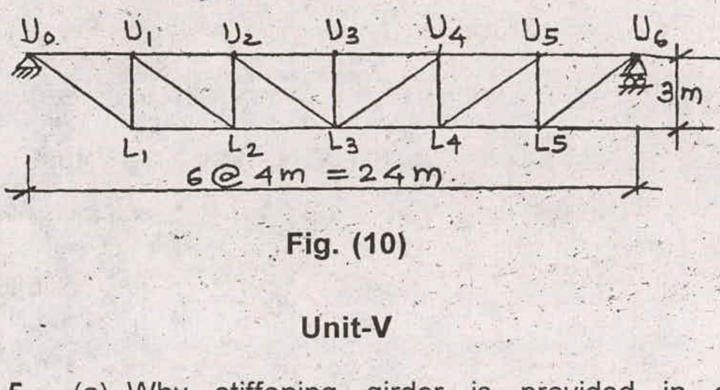

Fig. (10)

Unit-V

Q. 5. (a) Why stiffening girder is provided in a suspension bridge ? **2**

(b) A three hinged parabolic arch of 30 m span and 6 m central rise, hinged at the crown and at the ends, carries a point load of 6 kN at 8 m horizontally from left end hinge. Calculate normal thrust, radial shear at the section under the load, reactions at the hinges left and right. Also calculate the maximum positive and negative bending moment. **14**

(c) A two hinged parabolic arch hinged at the ends has a span of 60 m and a rise of 12 m. A concentrated load of 8 kN acts at 15 m from the left hinge. The second moment of area varies as the secant of the slope of the rib axis. Calculate the horizontal thrust and reactions at the hinges. Also calculate the maximum positive and negative bending moment. **14**