

**320411 (20)**

BE (4<sup>th</sup> Semester)

Examination, Nov-Dec 2021

Branch : Civil

**STRUCTURAL ANALYSIS - I**

*Time Allowed : Three Hours*

*Maximum Marks : 80*

*Minimum Pass Marks : 28*

**Note :** Marks are allotted as shown against each question. Solve questions for 16 marks from each unit.

**Unit-I**

**Q. 1.** (a) With an example define static indeterminacy. 2

**320411 (20)**

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(2)

(b) With examples explain different types of indeterminacies. 4

(c) Analyse the plane truss shown in Fig. 1, using the method of tension coefficients and find the forces in the members. 10

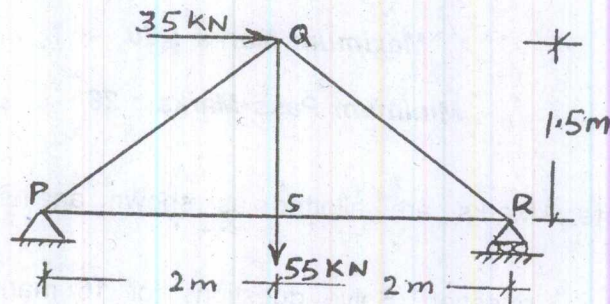


Fig. 1

### Unit-II

Q. 2. (a) State two conjugate beam theorem. 2

(b) A beam AB of 4 m span is simply supported as shown in Fig. 2. Determine : 14

20411 (20)



(3)

- (i) Deflection at C,
- (ii) Maximum deflection

Take  $E = 2 \times 10^8 \text{ kN/m}^2$ ,  $I = 2 \times 10^{-5} \text{ m}^4$

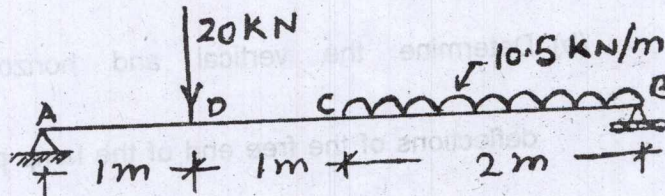


Fig. 2

OR

For the beam shown in Fig. 3, using the conjugate beam method, determine : 14

- (i) Slope at the ends
- (ii) Deflection at the centre

$E = 2 \times 10^8 \text{ kN/m}^2$ ,  $I = 2 \times 10^{-3} \text{ m}^4$

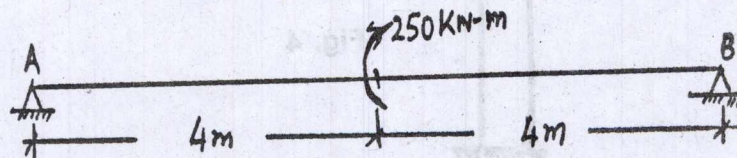


Fig. 3

320411 (20)

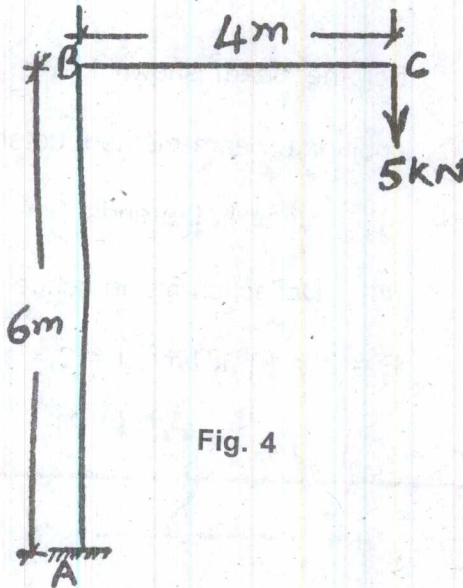
P.T.O.

(4)

Unit-III

Q. 3. (a) Explain Maxwell's law of reciprocal deflections. 2

(b) Determine the vertical and horizontal deflections of the free end of the lamp post shown in Fig. 4. Take  $EI = 16,000 \text{ kN-m}^2$ . 14



(5)

- (c) Each bar of the truss shown in Fig. 5 has a cross section of  $625 \text{ mm}^2$  and  $E = 200 \text{ kN/m}^2$ . Calculate the horizontal deflection of the joint C.

14

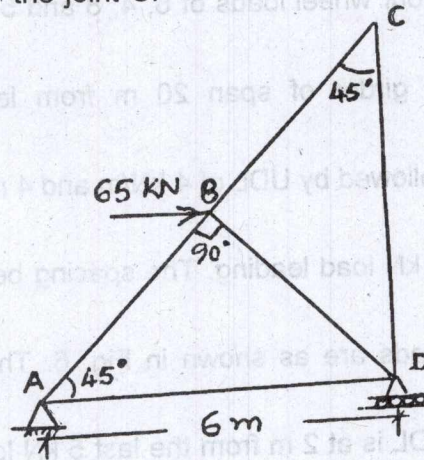


Fig. 5

Unit-IV

- Q. 4. (a) Write the propositions when a series of point load crosses a girder, the maximum bending moment will occur under :

6

320411 (20)

P.T.O.



**(6)**

- (i) given load
- (ii) under a given section (girder simply supported at ends)

(b) Four wheel loads of 6, 4, 8 and 5 kN carries a girder of span 20 m from left to right followed by UDL of 4 kN/m and 4 m long with 6 kN load leading. The spacing between the loads are as shown in Fig. 6. The head of UDL is at 2 m from the last 5 kN load. Using influence lines, calculate the shear force and bending moment at a section 8 m from left support when the 4 kN load is at the centre of the span.

10

**320411 (20)**

(7)

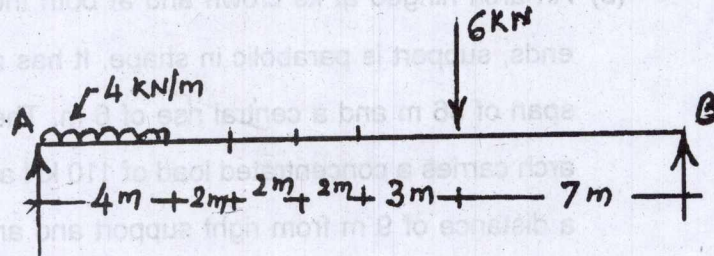


Fig. 6

OR

Draw the influence line diagrams for the forces in the members P, Q and R of the truss shown in Fig. 7. 10

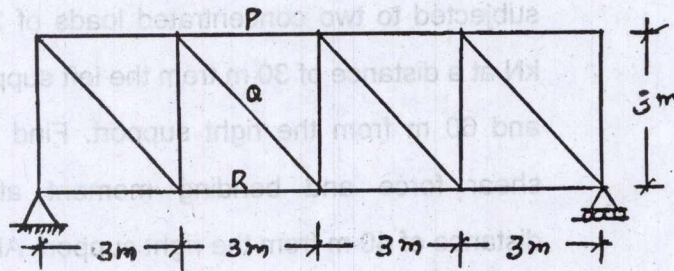


Fig. 7

Unit-V

Q. 5. (a) Explain briefly the advantages of suspension bridges. 2

**(8)**

- (b) An arch hinged at its crown and at both the ends, support is parabolic in shape. It has a span of 36 m and a central rise of 6 m. The arch carries a concentrated load of 110 kN at a distance of 9 m from right support and an UDL of 50 kN/m over the left half of the arch. Calculate the moment thrust and radial shear at a point 10 m from the right support. **14**

**OR**

A three hinged girder of a suspension bridge of 120 m span and central dip of 12 m is subjected to two concentrated loads of 250 kN at a distance of 30 m from the left support and 60 m from the right support. Find the shear force and bending moment at a distance of 40 m from the right support. Also, calculate the maximum tension and its slope in the cable. **14**