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Total No. of Questions : 09

B.Tech. (CE) (Sem.–4)

# STRUCTURAL ANALYSIS-I

Subject Code : CE-208

Paper ID : [A0609]

Time : 3 Hrs. Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

## SECTION-A

**I. Answer briefly :**

a. State the Muller Breslau's principle for plotting influence line diagrams.

b. Draw the conjugate beam for a beam fixed at one end and propped at the other end.

c. Is a two hinged arch statically indeterminate? Comment.

d. What do you mean by the term *'elastic curve of a beam'*?

e. Briefly explain the concept of geometric stability of a structural system.

f. State the *'Second moment area theorem'*.

g. What do you know by the term *'rolling loads'*?

h. What is the difference between *a two hinged arch* and *a three hinged arch?*

i. What do you understand by the term *'degree of kinematic indeterminacy'*?

j. Briefly explain the *"Maxwell's law of reciprocal deflections"* as applicable to beams.





## SECTION - B

2. Draw the influence line diagrams for reactions at supports A, B, C and for bending moment at support B for the beam as shown in Fig. 1. There is an internal hinge at D.

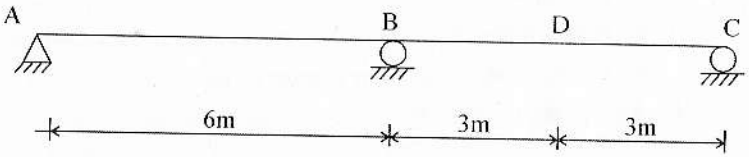


Fig. 1.

3. A thin cylinder *150mm* internal diameter, *2.5mm* thick, has its ends closed by rigid plates and is then filled with water. When an external axial pull of *37kN* is applied to the ends, the water pressure is observed to fall by $0.1N/mm^2$. Determine the value of Poisson's ratio. Take $E = 140,000N/mm^2$ and $K = 2200N/mm^2$.

4. A masonry retaining wall of trapezoidal section is *7.50 m* high, *1.75m* wide at the top and *4m* wide at the bottom. The earth face of the wall is vertical. The soil is level with the top of the wall. Find the maximum and minimum pressure intensities at the base of the wall. Soil weighs $16.5kN/m^3$ and masonry weighs $22.5kN/m^3$.

5. A three hinged parabolic arch *ACB* of span *50m* and rise *20m* carries a uniformly distributed load of *50kN/m* on *AC* and two concentrated loads of *100kN* each at distances *5m* and *10m* from *B*. Find the horizontal thrust, bending moment and radial shear at a section *15m* from A

6. The three hinged stiffening girder of a suspension bridge of span *180m* is subjected to two point loads of *250kN* and *360kN* at distances *30m* and *120m* from the left end. Find the shear force and bending moment for the girder at a distance of *45m* from the left end. The supporting cable has a central dip of *18m*.



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## SECTION-C

7. Three wheel loads *60kN*, *40kN* and *50kN* spaced *2m* and *2m* respectively roll on a simply supported girder of span *20m* from left to right with the *60kN* load leading, find the following:

   a) Maximum bending moment that can occur at a section *8m* from the left support.

   b) Maximum bending moment that can occur under the *40kN* load.

   c) Absolute maximum bending moment for the girder.

8. Analyze the truss as shown in *Fig. 2* using the method of joints. Also determine the vertical displacement of the point *A* using the unit load method. Assume the members to be pin connected at their ends. The cross-sectional area of each member of the truss is shown alongside in the figure and $E = 200GPa$ for each member.

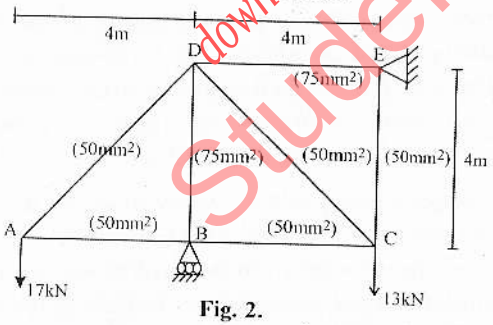


**Fig. 2.**

9. A cantilever *4m* long is supported at the free end by a prop, at the same level as the fixed end. A uniformly distributed load of *60kN/m* is carried along the middle half of the beam, as shown in *fig. 3*, together with a central concentrated load of *50kN*. Determine the load on the prop and the maximum bending moment in the beam. *EI* is constant throughout the length of the beam. Use Macaulay's method.

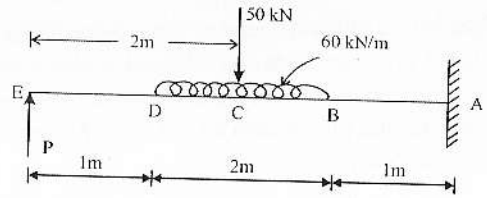


**Fig. 3**



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