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Paper Code : CE(ES)402   Introduction to Solid Mechanics

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :   [1 x 10 = 10]

    (I)   A frame which is composed of members just sufficient to keep it in equilibrium, such frame is _____

    (II)   The maximum _____ stresses occur at top most fibre of a simply supported beam.

    (III) What do you mean by lateral strain?

    (IV) Shear stress on principal plane is _____

    (V)   How the elastic constants E and K are related?

    (VI) What is the bending moment at end supports of a simply supported beam?

    (VII) Which of the following is correct boundary condition for a beam supported by pin at both ends?
    a) Displacement at both ends is non-zero
    b) Displacement at one of the end is non-zero
    c) Displacement at both ends is zero
    d) Can't say

    (VIII) Define: Poisson's ratio

    (IX) Shear stress at top most fibre of rectangular section is _____

    (X)   What is modulus of rigidity?

    (XI) What is the product of force and radius?

    (XII) What is the relation between angular deflections between two legs connected by a fixed-connected joint?
    a) They are unequal
    b) They are equal
    c) Can't say
    d) They don't show angular deflection

Group-B (Short Answer Type Question)
Answer any three of the following   [5 x 3 = 15]

2. A simply supported beam AB of span 4 m span is subjected to a clockwise moment of 20 Kn-m at its centre. Draw SF and BM diagrams.   [5]

3. A simply supported beam is subjected to a combination of loads as shown in figure. Sketch the shear force and bending moment diagrams and find the position and magnitude of maximum bending moment.   [5]
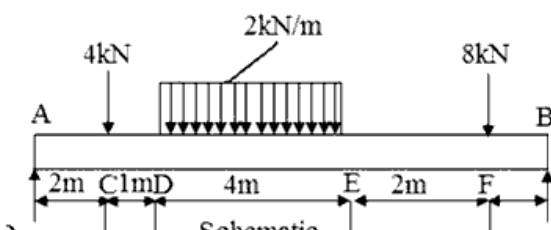
4. A cantilever beam of length 2 m fails when a load of 2 KN is applied at the free end. If the section is 40 mm x 60 mm, find the stress at the failure.   [5]

5. Derive the stress equation for Mohr's Circle.   [5]
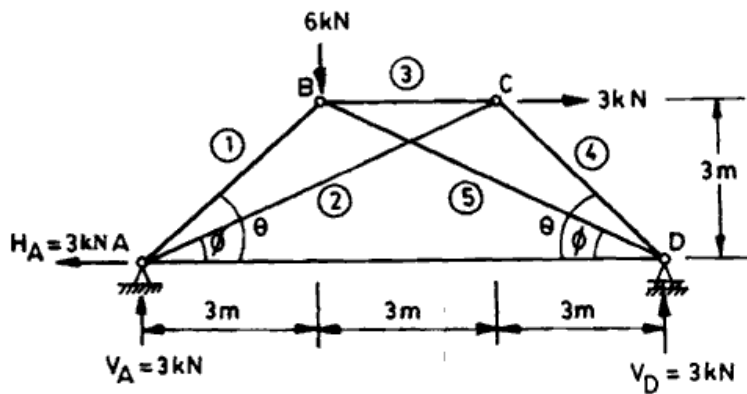
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6. Calculate the maximum stress induced in a cast iron pipe of external diameter 40 mm, internal diameter 20 mm and length 4 m when the pipe is supported at its ends and carries a point load of 80 N at its center. [5]

Group-C (Long Answer Type Question)
Answer any three of the following [15 x 3 = 45]

7. (a) What are the assumptions made in the theory of pure bending? [6]

   (b) The cross section of a joist in a T section 120 mm x 200 mm x 12 mm, with 120 mm side horizontal. Sketch shear stress distribution and hence find the maximum shear stress, if it has to resist a shear force of 2000 kN. [9]

8. (a) State the assumptions while deriving the general formula for shear stresses. [5]

   (b) Define: Shear stress distribution [5]

   (c) What do you understand by the term point of contraflexure? [5]

9. (a) Derive the relationship between shear force, bending moment and deflection. [8]

   (b) A cantilever beam of span L, flexural rigidity EI is subjected to a hogging bending moment M at the free end. Calculate the maximum deflection by direct integration method. [7]

10. (a) What is torsion in strength of material? [5]

   (b) Where is the maximum shear stress in a circular shaft due to torsion? [5]

   (c) What is difference between torque and torsion? [5]

11. For the simply supported truss shown in figure given below, find the nature and magnitude of forces in all the members. [15]

*** END OF PAPER ***