Code No: A109210103 **R09** **Set No. 2**

II B.Tech I Semester Examinations,May 2011
STRENGTH OF MATERIALS-I
Civil Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. A compound cylinder is designed with an interfacial radial pressure of 8 MPa. Determine the diametral interference, and the final stresses under an internal pressure of 30 MPa. The diameters of the cylinder are 120 mm, 180 mm and 225 mm. Compute the maximum allowable internal pressure so that the maximum stress does not exceed 150 MPa. Assume E = 210 GPa. [15]

2. At a point in a beam section there is a longitudinal bending stress of 120N/mm^2 tensile and a transverse shear stress of 50 N/mm^2. Find the resultant stress on a plane inclined at 30^0 to the longitudinal axis. [15]

3. Find the elongation of a bar, length L and cross-sectional area A, under the action of its own weight. Assume the unit weight of the bar is w/unit length. [15]

4. A concrete pipe of radius 1.0 m and 100 mm wall thickness is pre-stressed by a wire 5 mm diameter to withstand a working pressure of 1.0 MPa. Determine the minimum initial stress required in the wire so that the pipe is not subjected to tensile stresses under the applied pressure. Assume E_c = 25 GPa, and E_s = 225 GPa. [15]

5. A simply supported box-beam with an overhang supports the loads shown in the figure 5. Determine the maximum value of load W at which the shearing stress and the flexural stress will not exceed their allowable values 2.5 N/mm^2 and 25 N/mm^2, respectively. [15]

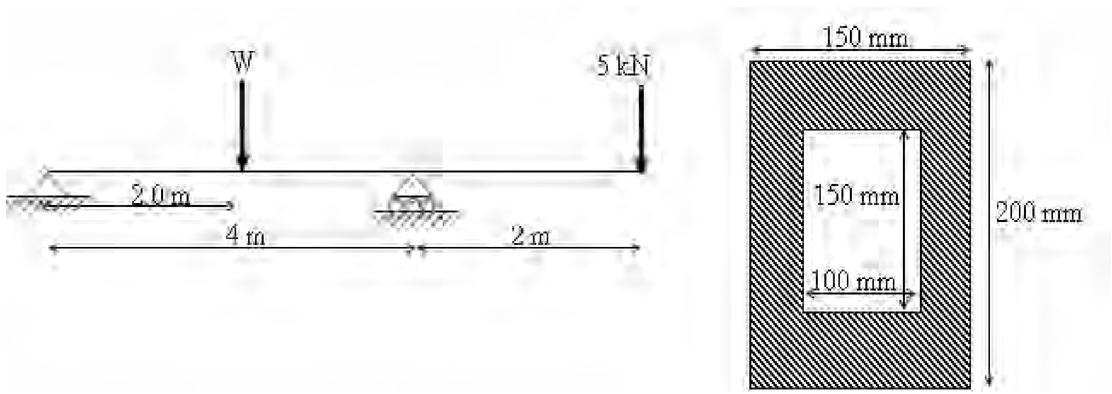

Figure 5:

6. A simply supported beam of T - section shown in figure 6. carries a uniformly distributed load of intensity 20 kN /m on its entire 5 m span. Determine the width

of the flange of the section so that the permissible stress 50 N/mm^2 in compression and 125 N/mm^2 in tension are reached simultaneously. [15]

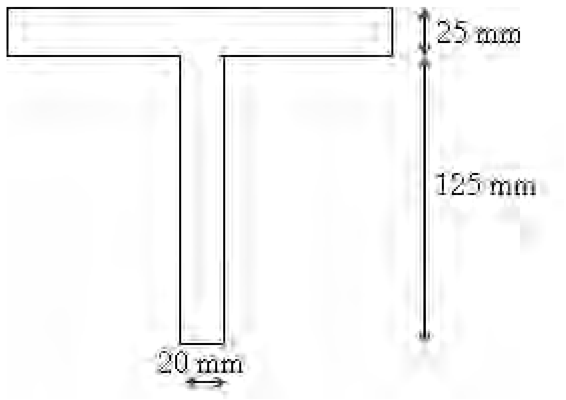

Figure 6:

7. (a) Explain Macaulay's method of beam deflection analysis, and discuss its advantages the direct integration method.
   (b) Determine the mid-span displacements and slopes at the supports in the beams shown in figure 7 using the method of moment area. [15]

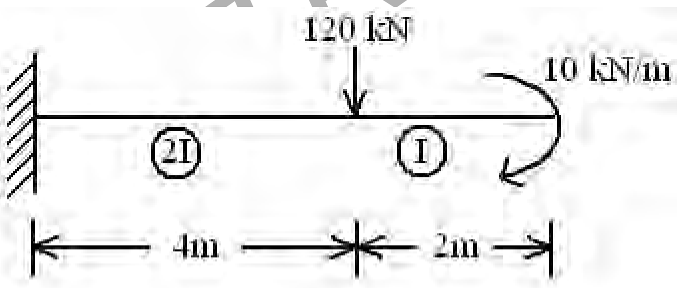

Figure 7:

8. Draw the shear force and bending moment diagrams for a simply supported beam of span 4.5 m subjected to loading as shown in figure 8. Locate the salient points. [15]

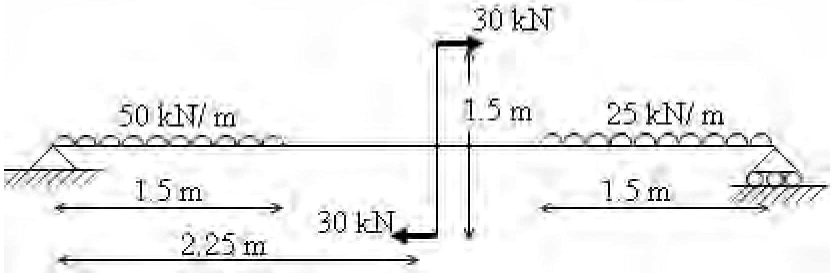

Figure 8:

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Code No: A109210103 **R09** **Set No. 4**

II B.Tech I Semester Examinations,May 2011
STRENGTH OF MATERIALS-I
Civil Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1. Determine the width of the inverted T-beam section shown in figure 1. So that the normal stresses at top and bottom of the beam will be in the ratio 3:1 respectively. [15]

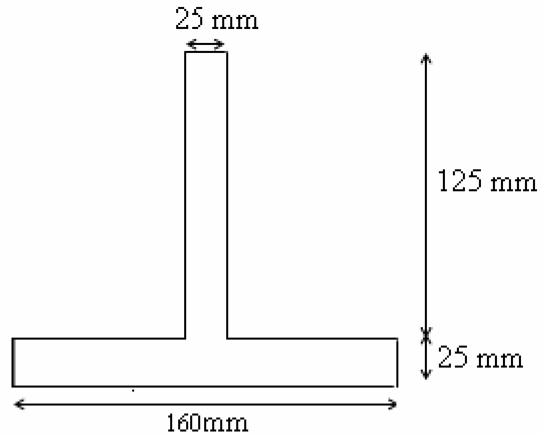

Figure 1:

2. A timber beam of 4.5 m span is subjected to the loading shown in figure 2. If the depth of the beam is twice the width, design the section of the beam for flexure and shear. The permissible stresses are 25 N/mm^2 in flexure and 3 N/mm^2 in shear. [15]

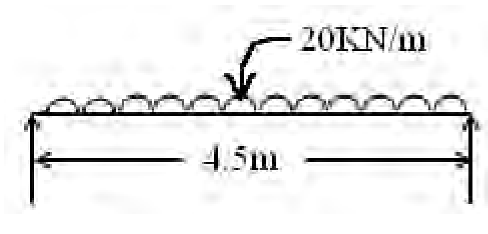

Figure 2:

3. (a) Explain elastic material and plastic material.
   (b) Derive the relation between the modulus of elasticity and modulus of rigidity from first principle. [15]

4. A cylindrical boiler of diameter 1.7 m, 4.5 m length and 10 mm thickness with flat ends is provided with six tie rods of 50 mm diameter. If the tie rods are stressed

initially to 100 MPa, determine the stresses in the tie rods and the cylinder under a pressure of 1.7 MPa. Assume the same material for the boiler and tie rods. [15]

5. Draw the shear force and bending moment diagrams for a beam supported and loaded as shown in figure 5. Locate the salient points. [15]

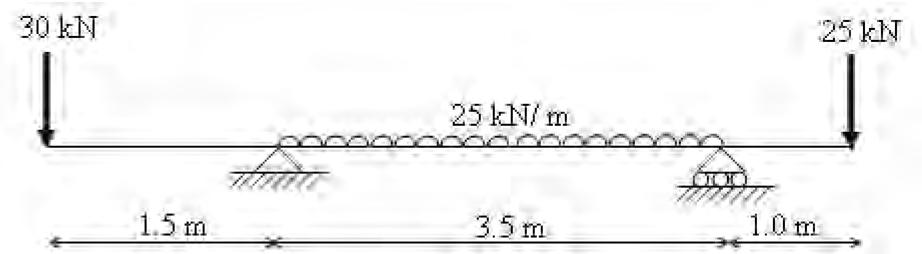

Figure 5:

6. At a point in an elastic material, a direct tensile stress of 60 N/mm^2 and a direct compressive stress of 40 N/mm^2 are applied on planes at right angles to each other. If the maximum principal stress is limited to 75 N/mm^2 (tensile), find the shear stress that may be allowed on the planes. Also determine the minimum principal stress and the maximum shear stress. [15]

7. Determine the maximum deflection δ and slope in a simply supported beam of length 16m carrying a concentrated load of P at 5m from right hand side and beam is also carrying a uniformly distributed load of 8 kN/m for the entire span. [15]

8. Design a spherical concrete dome over a circular opening of 7.2 m diameter to sustain a crown load of 500 kN. Allowable stresses are 5 MPa in compression and 0.5 MPa in tension. [15]

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Code No: A109210103 **R09** **Set No. 1**

II B.Tech I Semester Examinations,May 2011
STRENGTH OF MATERIALS-I
Civil Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Derive the formula for horizontal shearing stress from first principles.
   (b) Derive the relation between horizontal and vertical shearing stresses. [15]

2. (a) What are the advantages of compound cylinders? Explain analytically.
   (b) What are the advantages and disadvantages of shell structures? [15]

3. The maximum allowable stress in a cylinder of 700 mm inner diameter and 150 mm thickness is 6.3 MPa. Determine the maximum allowable internal and external pressures on the cylinder, when applied separately. [15]

4. At a point in strained material the principal stresses are 60 N/mm^2 and 40 N/mm^2. Find the position of plane across which the resultant stress is most inclined to the normal and determine the value of this stress. [15]

5. For a given permissible stress, compare the moments of resistance of a beam of square section placed
   (a) with two sides horizontal
   (b) with a diagonal horizontal. [15]

6. (a) The left half of a beam has flexural rigidity twice that of its right half. Determine the beam deflection profile when subjected to a u.d.l covering the left half of the span.
   (b) Determine the mid-span displacements and slopes at the supports in the beams shown in figure 6 using the method of integration. [15]

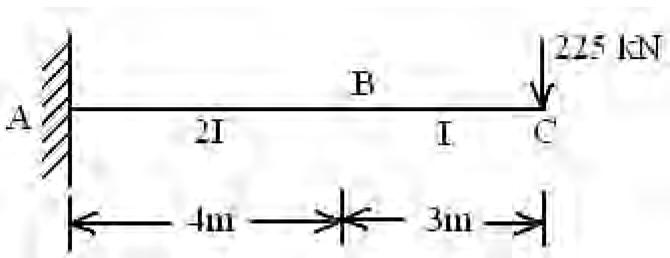

Figure 6:

7. A beam 6 m long carries a uniformly distributed load of 25 kN/m. The beam is simply supported at left-hand end and at a point distant x from the right-hand end. Determine the value of x if the mid-point of the beam is to be a point of contraflexure and for this position draw the shear force and bending moment diagrams. [15]

8. A steel tube 32 mm external diameter and 20 mm internal diameter encloses a copper rod 16 mm diameter to which it is rigidly joined at each end. If, at a temperature of 300 C there is no longitudinal stresses. Calculate the stresses in the rod and the tube when the temperature is raised to 160^0 C. The coefficient of expansion for steel and copper are 11×10^{-6} and 18×10^{-6} per degree centigrade respectively. $E = 2.1 \times 10^5$ N/mm^2 for steel and 1.0×10^5 N/mm^2 for copper. [15]

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Code No: A109210103 | R09 | Set No. 3

II B.Tech I Semester Examinations,May 2011
STRENGTH OF MATERIALS-I
Civil Engineering

Time: 3 hours | Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks
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1. The volume of a hollow cylinder of 800 mm diameter, 1.4 m length and 10 mm thickness increases by 1245 ml when subjected to an internal pressure of 4.5 MPa. Determine the Poissons ratio of the material, if E = 190.0 GPa. [15]

2. (a) The plate of a boiler is subjected to principal stresses of 120 N/mm^2 and 60 N/mm^2 both tensile. Find the intensity of stress which acting alone will produce the same maximum strain. Take Poisson's ratio = 0.3.
   (b) A rectangular steel bar is subjected to a tensile stress of 80 N/mm^2 as well as a shear stress of 30 N/mm^2. Determine the principal stresses and the principal planes. Find also what stress acting alone can produce the same maximum strain. Take $\frac{1}{m} = 0.31$. [15]

3. (a) Determine the maximum deflection δ in a simply supported beam of length L carrying a concentrated load of P at mid span. Use moment area method.
   (b) Determine the maximum deflection δ in a simply supported beam of length L carrying a uniformly distributed load through out the length. Use double integration method. [15]

4. Draw the shear force and bending moment diagrams for a beam supported and loaded as shown in figure 4. Also find maximum bending moment. [15]

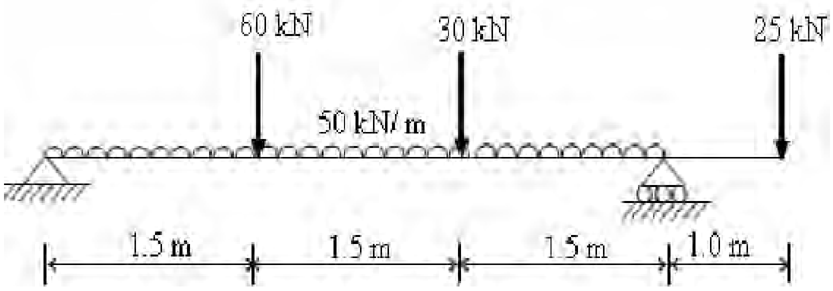

Figure 4:

5. Design a cylinder of 1.8 m diameter to sustain an internal pressure of 35 MPa assuming a permissible stress of 230 MPa and Poisson's ratio of 0.25. Apply thick cylinder theory. [15]

6. A simply supported beam 125 mm wide and 200 mm deep and 6 m long carries a uniformly distributed load of 5 kN/m. Determine the shear stress developed at

horizontal layers 60 mm apart from top to bottom for a section 1.5 m from the right support. Also determine the maximum shearing stress developed in the beam. [15]

7. Three rods, each initially of 20 mm in diameter and 2.0 m long, support a load of 100 kN. The center rod is made of steel and the outer ones of copper. If the temperature of the rods is increased by 1000 C and the rods are so adjusted that they are extended by equal amounts, determine the load carried by each rod. The coefficient of expansion for steel and copper are 12×10^{-6} and 18×10^{-6} per degree centigrade respectively. E = 210 GN/m^2 for steel and 85 GN/m^2 for copper. [15]

8. A vertical mast of 12 m high tapers linearly from 250 mm diameter at base to 100 mm at the top. At what point will the mast break under a horizontal load at the top? If the ultimate strength of the material of the mast is 40 N /mm^2, calculate the magnitude of the failure load. [15]

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