Code No: A109210304 **R09** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
MECHANICS OF SOLIDS
Common to ME, MECT, MEP, AE, AME, MMT

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Determine the S.F. component sustained by the web of ISLB 450 ($b_f = 170.0$ mm, $t_f = 13.4$ mm, $t_w = 8.6$ mm).
   (b) Define M.I. and modulus of a section, and discuss their influence on the behaviour of beams. [8+7]
2. A cast iron pipe of 250.0 mm diameter and 6 mm thickness carrying water at a head of 36.0 m is supported at 6.3 m spacing. Determine the principal stresses and the maximum shear stress in the pipeline. [15]
3. (a) Discuss the concept of BM and SF along with suitable examples.
   (b) Develop the relation between BM and SF in a beam. [8+7]
4. Analyze the truss indicated in figure 4 by method of sections. [15]

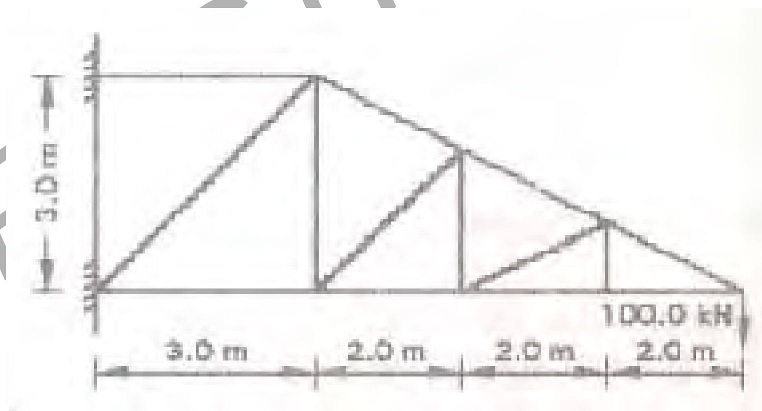

Figure 4

5. Develop the shear stress distribution diagrams for the sections shown for the following figures 5 when subjected to a transverse S.F. of 200.0 kN. What are the maximum shear stresses? [15]

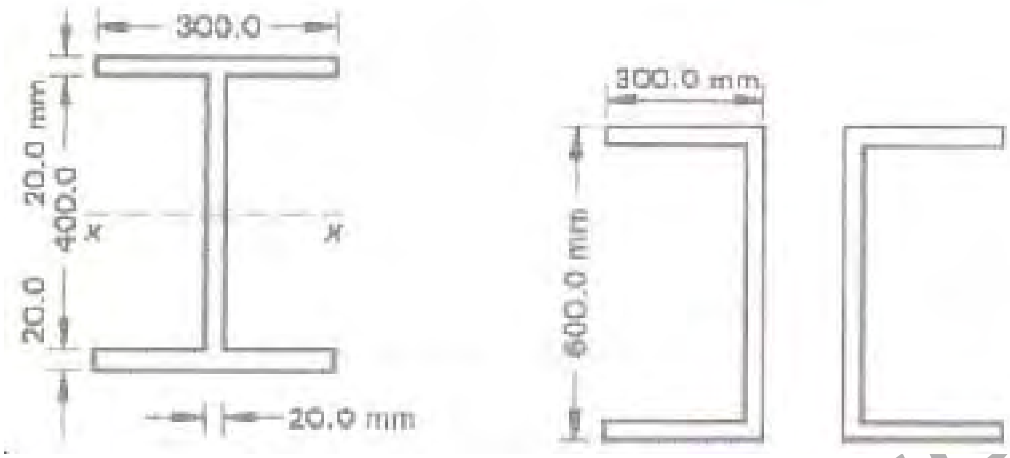

Figure 5

6. (a) Compare the behaviour of mild steel, high strength steel, copper, brass, aluminum, cast iron and concrete when subjected to load test till failure.
   (b) Compute the stresses and deformations in the steel rope of a pulley supporting a load of 126.0 kN. The rope is made of 12 wires of 2.5 mm diameter. The rope is 12.6 m on one side of the pulley and 8.1 m on the other side. Determine the elongation and the factor of safety of the system, if the yield stress for the wires is 1800.0 MPa and the Young's modulus for the rope is 150.0 GPa. [8+7]

7. (a) Determine the maximum deflection δ in a simply supported beam of length L carrying a concentrated load of P at 1/4 of the span from left hand side.
   (b) Determine the maximum deflection δ in a simply supported beam of length L carrying a uniformly distributed load from center of the beam to left hand support. [8+7]

8. The outer diameter of a cylinder is 1.2 times its inner diameter. Assuming $\upsilon = 0.15$, determine the ratio of external and internal pressures applied separately, so that in both the cases.
   (a) the largest stresses have the same numerical values and
   (b) the largest strains have the same numerical values. [15]

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Code No: A109210304 **R09** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
MECHANICS OF SOLIDS
Common to ME, MECT, MEP, AE, AME, MMT
Time: 3 hours **Max Marks: 75**
Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. The outer diameter of a cylinder is 1.8 times its inner diameter. Assuming υ=0.25, determine the ratio of external and internal pressures applied separately, so that in both the cases
   (a) the largest stresses have the same numerical values and
   (b) the largest strains have the same numerical values. [15]

2. Analyze the truss indicated in figure 2 by method of sections. [15]

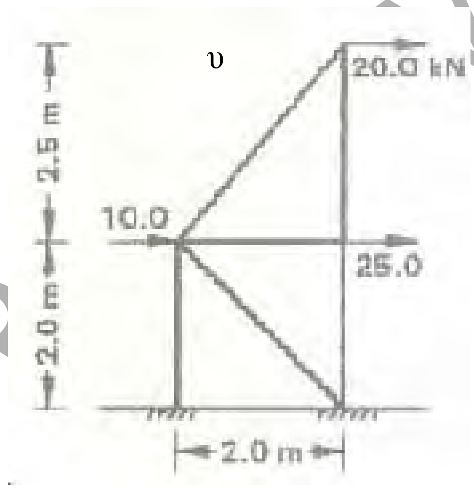

Figure 2

3. A water pipeline of 400.0 mm internal radius comprises segments simply supported over 6.0 m spans. Determine the minimum thickness of the pipe, if the allowable stresses in flexure and shear are 140.0 MPa and 100.0 MPa respectively. The effects of water pressure may be ignored. [15]

4. The maximum allowable stress in a cylinder of 700.0 mm inner diameter and 150.0 mm thickness is 6.3 MPa. Determine the maximum allowable internal and external pressures on the cylinder, when applied separately. [15]

5. A laminated beam is composed of three planks, each 150 mm by 60 mm, glued together to form a section 150 mm wide by 180 mm high. The allowable shear stress in the glue is 600 kPa, the allowable shear stress in the wood is 900 kPa, and the allowable flexure stress in the wood is 8 MPa. Determine the maximum uniformly distributed load which can be carried by the beam on a 2-m simple span. [15]

6. Compute the maximum deflections and support rotations in the beams of the following figure 6 using

   (a) The methods of integration and

   (b) The method of moment area. [15]

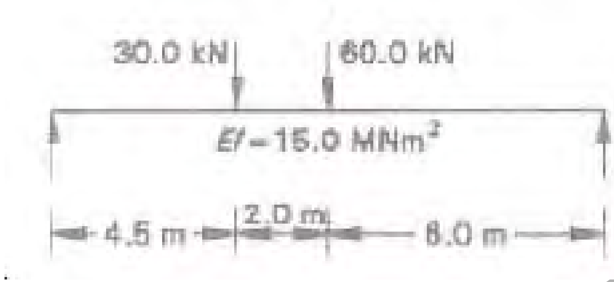

Figure 6

7. Develop Bending moment and Shear force for the figure 7 given below indicating the maximum and minimum values. [15]

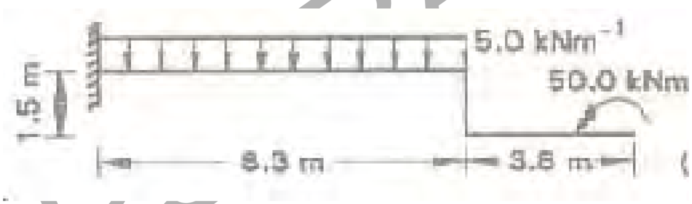

Figure 7

8. (a) During a stress-strain test, the unit deformation at a stress of 35 MN/m^2 was observed to be 167×10^{-6} m/m and at a stress of 140MN/m^2 it was 667×10^{-6} m/m. If the proportional limit was 200 MN/m^2, what is the modulus of elasticity? What is the strain corresponding to a stress of 80MN/m^2? Would these results be valid if the proportional limit were 150 MN/m^2, explain.

   (b) A uniform bar of length L, cross-sectional area A, and unit mass ρ is suspended vertically from one end. Show that its total elongation is $\delta = \frac{\rho g L^2}{2AE}$. If the total mass of the bar is M, show that $\delta = \frac{MgL^2}{2AE}$. [8+7]

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Code No: A109210304 **R09** **Set No. 1**

II B.Tech I Semester Examinations,November 2010
MECHANICS OF SOLIDS
Common to ME, MECT, MEP, AE, AME, MMT

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

Answer any FIVE Questions
All Questions carry equal marks

⋆⋆⋆⋆⋆

1. A uniform slender rod of length L and cross-sectional area A is rotating in a horizontal plane about a vertical axis through one end. If the unit mass of the rod is ρ and it is rotating at a constant angular velocity ϖ rad/sec. Show that the total elongation of the rod is $\frac{\rho\varpi^2L^3}{3E}$. [15]

2. A mild steel pipeline of 550.0 mm diameter and 5 mm thickness is subjected to an internal water pressure of 1.1MPa. The pipeline is subjected to a torque of 70.0 kNm as well. Determine the design stresses in the pipeline. [15]

3. Show that the shearing stress developed at the neutral axis of a beam with circular cross section is $\tau = \frac{4}{3}\left(\frac{V}{\pi r^2}\right)$. Assume that the shearing stress is uniformly distributed across the neutral axis. [15]

4. (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 4 using the method of moment area. Assume constant flexural rigidity for the beams. [15]

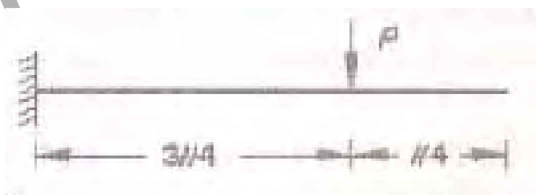

Figure 4

5. Plot a curve showing the percentage increase in maximum σ_t over average σ_t for ratios of thickness to inside radius of thick-walled cylinders varying from 0 to 3. [15]

6. A wooden beam 150 mm wide by 300 mm deep is loaded as shown in figure 6. If the maximum flexural stress is 8 MN/m^2, find the maximum values of w and P that can be applied simultaneously. [15]

7. Develop Bending moment and Shear force for the figure 7 given below indicating the maximum and minimum values. [15]

8. Analyze the truss indicated in the figure 8 by method of joints. [15]

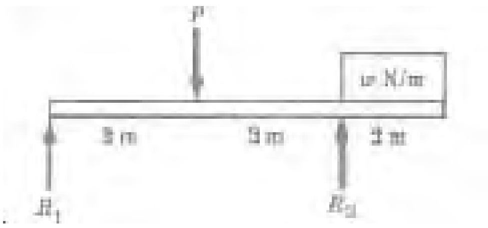

Figure 6

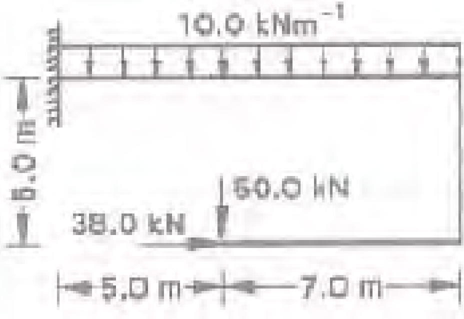

Figure 7

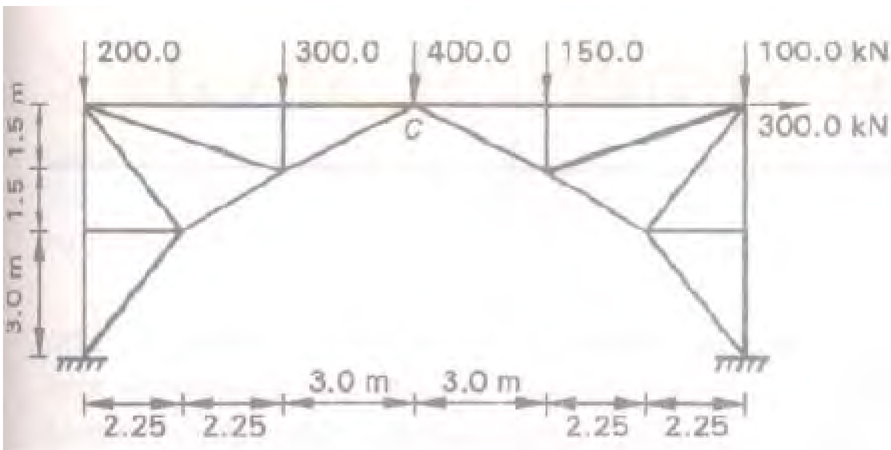

Figure 8

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Code No: A109210304 **R09** **Set No. 3**

II B.Tech I Semester Examinations,November 2010
MECHANICS OF SOLIDS
Common to ME, MECT, MEP, AE, AME, MMT
Time: 3 hours **Max Marks: 75**
Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) State and prove the moment area theorems. What are the limitations of the moment area method?
   (b) Determine the mid-span displacements and slopes at the supports in the beams shown in figure 1 using the method of integration. Assume constant flexural rigidity for the beams. [15]

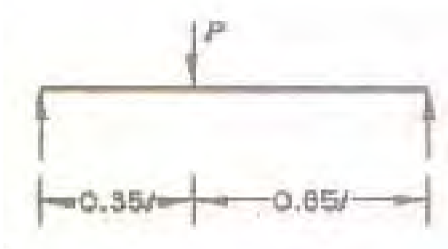

Figure 1

2. The outer diameter of a cylinder is 1.4 times its inner diameter. Assuming $\nu = 0.30$, determine the ratio of external and internal pressures applied separately, so that in both the cases
   (a) the largest stresses have the same numerical values and
   (b) the largest strains have the same numerical values. [15]
3. (a) Discuss the method of joints, and its limitations.
   (b) Explain the method of sections, and its limitations.
   (c) Explain the method of tension coefficients, and its limitations. [15]
4. (a) Define M.I. (Moment of Inertia) and modulus of a section, and discuss their influence on the behaviour of beams.
   (b) Compute the distance between the channel sections of 6.5 mm uniform thickness shown in figure 4b so that the principal M.1.of the combined section are equal. [8+7]
5. (a) How is the yield stress of a material without a well defined yield point determined?
   (b) Define proof stress of a material and explain its significance.

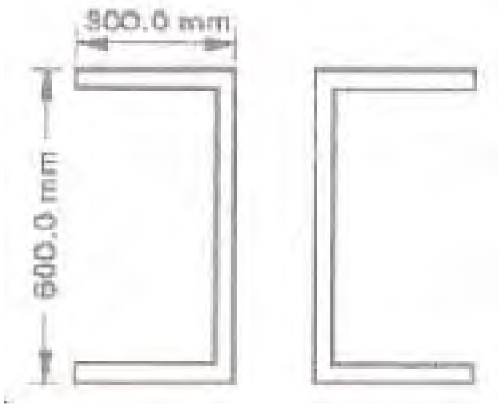

Figure 4b

(c) Determine the maximum load that can be supported by a 10.0 m long steel rope comprising 12 wires of 2.0 mm diameter, if the working stress is 230.0 MPa and Young's modulus is 180.0 GPa. The rope should not elongate more than 10.0 mm under the load. [4+4+7]

6. The volume of a hollow cylinder of 800.0 mm diameter, 1.4 m length and 10.0 mm thickness increases by 1245.0 ml when subjected to an internal pressure of 4.5 MPa. Determine the Poissons ratio of the material, if E = 190.0 GPa. [15]

7. (a) Develop Bending moment and Shear force diagrams for the figure 7a given below indicating the maximum and minimum values.

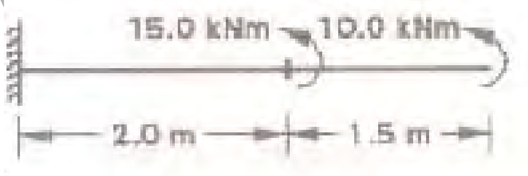

Figure 7a

(b) Develop Bending moment and Shear force diagrams for the figure 7b given below indicating the maximum and minimum values. [8+7]

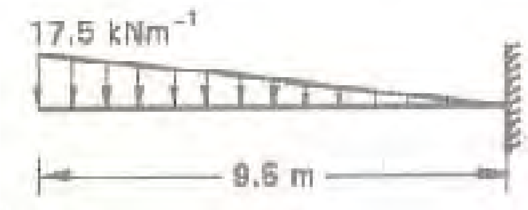

Figure 7b

8. Develop the shear stress distribution diagrams for the sections shown for the following figures 8 when subjected to a transverse S.F. of 200.0 kN. What are the maximum shear stresses? [15]

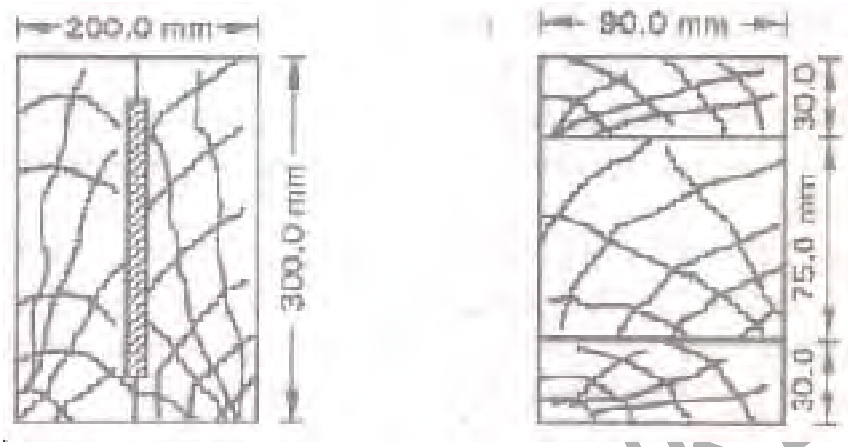

Figure 8

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