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

II B.Tech I Semester Examinations,May/June 2012
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 steel bar 1.5 m long and 36 mm diameter is subjected to an axial energy of 10 Nm. Determine the tensile stress in the bar. If the same rod machined down to 20 mm diameter in the middle half of the bar, calculate the corresponding tensile stress in the bar. [15]

2. (a) State the assumptions made in the theory of pure bending.
   (b) Derive the flexure formula from first principle. [15]

3. (a) Determine the mid-span displacements and slopes at the supports in the beams shown in figure 1 using the method of integration.

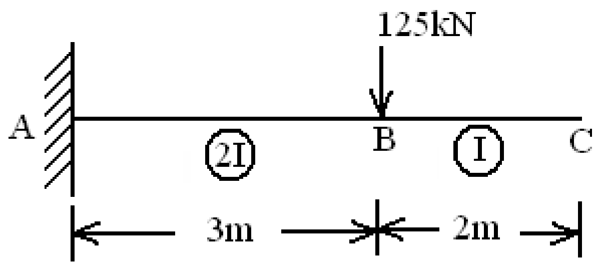

Figure 1:

   (b) Determine the mid-span displacements and slopes at the supports in the beams shown in figure 2 using the method of moment area. Assume constant flexural rigidity for the beams. [15]

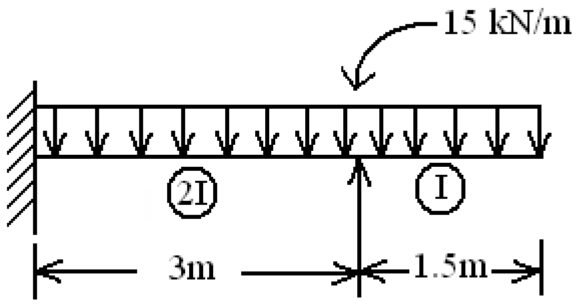

Figure 2:

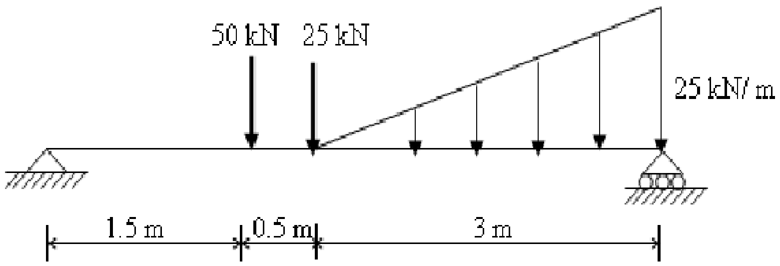

Figure 3:

4. Draw the shear force and bending moment diagrams for a simply supported beam loaded as shown in figure 3. Also find and show the magnitude of maximum bending moment. [15]

5. A beam of I-section 300 mm deep and 150 mm wide. The flanges are 10 mm thick and web thickness is 8 mm. At a section the beam is subjected to a shear force of 150 kN. Determine the proportions in which the flanges and the web resist the applied shear. [15]

6. 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]

7. (a) At a point the principal stresses are 150 N/mm^2 and 75 N/mm^2 both tensile. Find the normal and tangential stresses on a plane inclined at 60^0 to the axis of the major principal stress.
   (b) The principal stresses at a certain point in strained material are 160 N/mm^2 and 48 N/mm^2 both tensile. Find the normal and tangential stresses on a plane inclined at $20^0$with the major principal plane. [15]

8. (a) Derive the expressions for stresses in a thin spherical shell under radial pressure.
   (b) List the assumptions of thin cylinder theory, and explain the limitations of the theory. [15]

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

II B.Tech I Semester Examinations,May/June 2012
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 concrete pipe of radius 1 m and 100 mm wall thickness is pre-stressed by a wire 5 mm diameter to withstand a working pressure of 1 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 = 30 GPa, and E_s = 200 GPa [15]

2. A simply supported beam 6 m long is subjected to a clockwise moment of 25 kNm at 4.5 m from the left end, a concentrated load of 75 kN and an uniformly distributed load of 25 kN/m run over the left half of its span. Draw the shear force and bending moment diagrams. Mark the locations of points of inflection. [15]

3. (a) Explain working stress and factor of safety.
   (b) Derive the relation between various Elastic Constants from first principle. [15]

4. Compute the stresses in a ferro-cement spherical dome of radius 5.0 m, 30.0 mm thickness and 60^0 semi-central angle, when subjected to
   (a) self-weight
   (b) snow load of 2.5 kPa. [15]

5. The shear force acting at a section of a beam is 75 kN. The section of the beam is of T-shape of dimensions 100 mm × 150 mm × 12 mm. Determine the shear stress at the neutral axis and also draw the shear stress distribution across the section. [15]

6. A beam of unsymmetrical I-section shown in figure 6 is simply supported over a span of 4.5 m Determine the uniformly distributed load that the beam can carry if the permissible stress is 162.5 N/mm^2. [15]

7. (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]

8. (a) Determine the maximum deflection δ in a simply supported beam of length 12 m carrying a concentrated load of 250 kN at 3 m from right hand side and also carrying a uniformly distributed load of 6 kNfor the entire span. Use Macaulay's method.

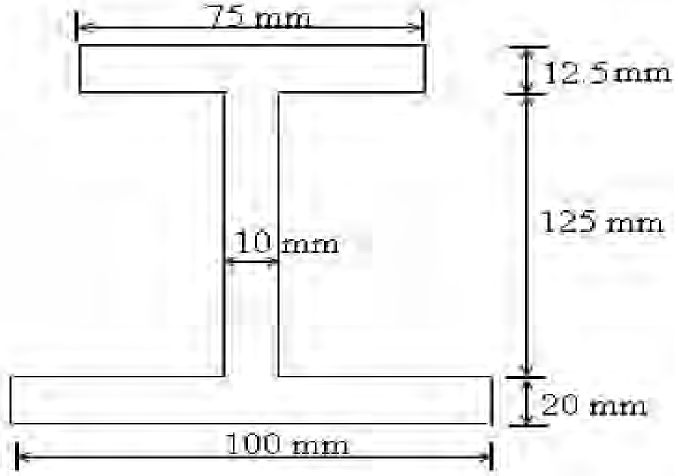

Figure 6:

(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 right hand support. Use moment area method. [15]

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

II B.Tech I Semester Examinations,May/June 2012
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 elongation of a conical bar, length L and diameter at base D, under the action of its own weight, assume the density of the material is ρ. [15]

2. A simply supported steel beam of span 6 m has I-section 350 mm deep and 165 mm wide has flanges 9.8 mm thick and web 7.0 mm thick. If the maximum permissible stress is 165 N/mm^2, find the safe uniformly distributed load that the section can carry. [15]

3. At a certain point in a piece of elastic material there are normal stresses of 48 N/mm^2 tensile and 32 N/mm^2 compressive on two planes at right angles to one another, together with shearing stresses of 24 N/mm^2 on the same planes. If the loading on the material is increased so that the stresses reach K times those given. Find the maximum value of K if the maximum direct stress in the material is not to exceed 128 N/mm^2 and the maximum shearing stress is not to exceed 80 N/mm^2. [15]

4. A cylindrical boiler of 2 m diameter, 7.2 m length and 16 mm thickness with flat ends is provided with six tie rods of 50 mm diameter. If the tie rods are stressed initially to 200 MPa, determine the stresses in the tie rods and the cylinder under a pressure of 3.6 MPa. Assume the same material for the boiler and tie rods. [15]

5. Determine the length of overhang of the beam a as shown in figure 5, such that deflection at the free ends of the beam is zero. [15]

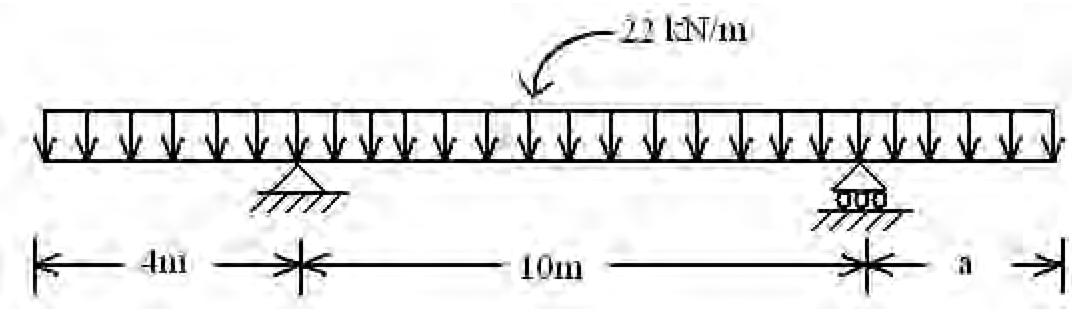

Figure 5:

6. Draw the shear force and bending moment diagrams for a simply supported beam loaded as shown in figure 6. Also find and show value of maximum bending moment. [15]

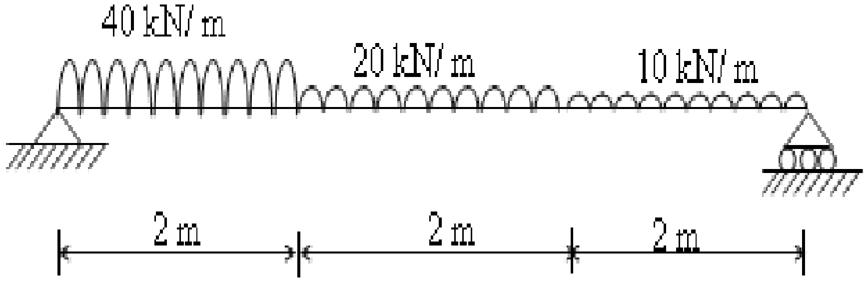

Figure 6:

7. Compute the stresses in a ferro-cement spherical dome of radius 5 m, 30 mm thickness and 60^0 semi-central angle, when subjected to

   (a) crown load of 180 kN

   (b) snow load of 2.5 kPa. [15]

8. A beam of triangular section base b and height h is subjected to a shear force F. Find the ratio of maximum shear stress to the shear stress at neutral axis. Also determine the ratio of maximum shear stress to the mean shear stress. [15]

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Code No: A109210103 **R09** **Set No. 3**

II B.Tech I Semester Examinations,May/June 2012
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 circular beam of 150 mm diameter is subjected to a shear force of 25 kN. Determine the maximum shear stress, average shear stress and the shear stress at a distance of 25 mm from neutral axis. [15]

2. (a) Determine the maximum values of slope and deflection in a cantilever of span 3.8 m, if it carries a load of 20.0 kN at the free end and 50.0 kN at 1.0 m from the free end. Assume EI = 120.0 MNm^2.
   (b) Determine the mid-span displacements and slopes at the supports in the beams shown in figure 2 using the method of moment area. Assume constant flexural rigidity for the beams. [15]

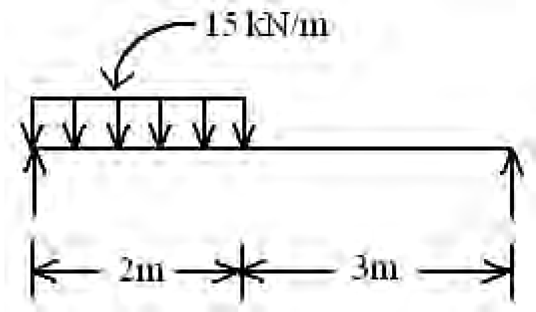

Figure 2:

3. Find the moment of resistance of a square beam cross-section if one of its diagonal is placed vertical. Assume the cross-sectional area is 2500 mm^2 and the permissible bending stress is 40 N /mm^2. [15]

4. A compound cylinder comprises an inner tube of diameters 350 mm and 450 mm, and an outer tube of diameters 400 mm and 500 mm. determine the diametral interference required so that the final maximum stress in the tube does not exceed 180 MPa under an internal pressure of 55 MPa. Neglect the effects of longitudinal stresses. Assume E = 250 GPa. [15]

5. Direct stresses of 100 N/m^2 (tensile) and 90 N/mm^2 (compressive) exist on two perpendicular planes at a certain point in a body. They are also accompanied by shear stresses on the planes. The greater principal stress at the point due to these is 150 N/mm^2,
   (a) Find the shear stresses on these planes.

(b) Find also the maximum shear stress at the point. [15]

6. A composite bar consists of a steel rod 3 m long and 25 mm diameter encased in a copper tube 25 mm internal diameter and 32 mm external diameter. A weight of 10 kN is dropped from a height of 20 mm on to a collar fixed at the bottom end of the composite bar. Calculate the maximum instantaneous stresses induced in the two components. Assume E = 200 GN/m^2 for steel and 100 GN/m^2 for copper. [15]

7. A pressurised cylinder of 450 mm internal diameter and 6 mm wall thickness registered a pressure fall of 0.21 MPa when subjected to an axial tension of 470.0 kN. Determine the poisons ratio of the material. Assume E = 210 GPa for the cylinder and K = 2.9 GPa for the fluid. [15]

8. A prismatic beam of weight W, length L rests on two simple supports A and B, A being at one end. Find the position of B which gives the least value of the maximum bending moment. For this position find the reactions, the maximum bending moment and the point of contra flexure. [15]

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