Code No: R059210303 **Set No. 1**

II B.Tech I Semester Supplementary Examinations, February 2007
MECHANICS OF SOLIDS
(Common to Mechanical Engineering, Mechatronics, Metallurgy & Material Technology, Production Engineering, Aeronautical Engineering and Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the terms:
   i. Normal stress
   ii. Tangential stress
   iii. Ductility
   iv. Brittleness. [6]
   (b) A flat steel plate is of trapezoidal form of uniform thickness 't'. Its width at one end is 'a' and at the other end is 'b'. If its length is 'L', determine its elongation under an axial pull. [10]
2. (a) Define statically determinate and statically indeterminate beams. Give examples. [6]
   (b) A cantilever beam of length 2m carries a uniformly distributed load of 2 kN/m over the whole length and a point load of 3 kN at the free end. Draw the SF and BM diagrams. [10]
3. (a) State the assumptions involved in the theory of simple bending. [6]
   (b) Derive the Bending equation from fist principle. [10]
4. For a section shown in figure4. determine the average shearing stresses at A,B, C and D for a shearing force of 23kN. Also sketch the shear stress distribution across the section. [16]

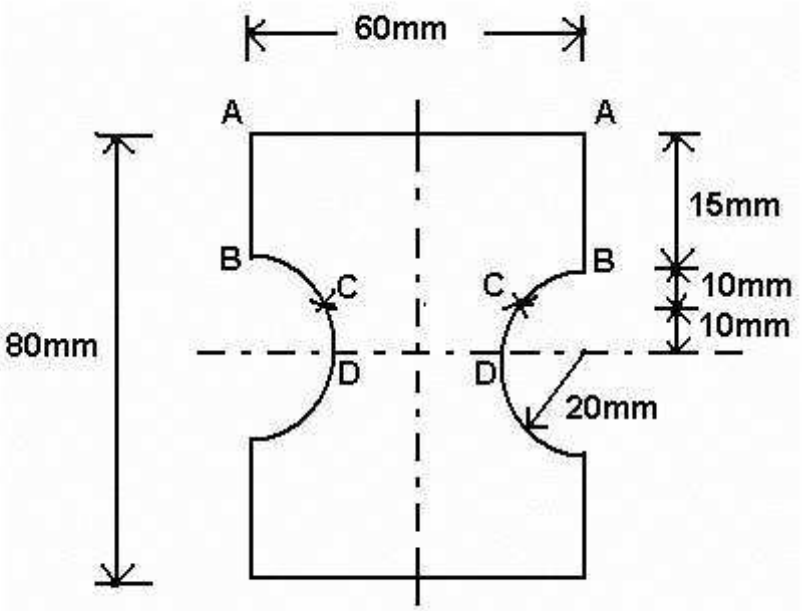

Figure 4

5. Find all the forces in the members of the truss as shown in the Figure 5 a below. [16]

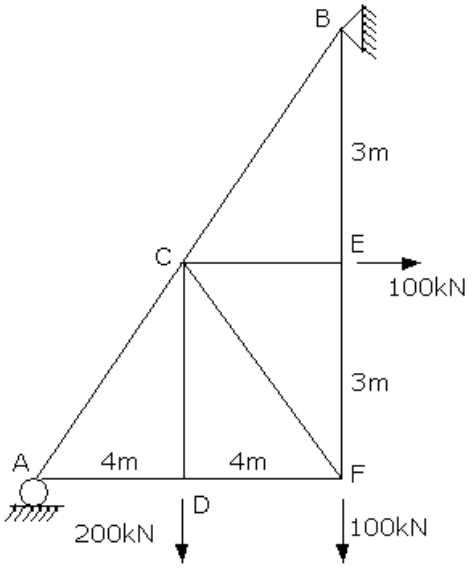

Figure 5

6. (a) What is moment area method? Explain the two Mohr's theorems, as applicable to the slope and deflection of a beam. [6]

   (b) A cantilever of uniform cross-section of length l carries two point loads, W at the free end and 2W at a distance a from the free end. Find the maximum deflection due to this loading. [10]

7. The cylindrical shell made of steel is having a diameter of 3 m and the shell is

subjected to an internal pressure of 1.5 N/mm^2. Longitudinal joint efficiency of the shell is 85%, ultimate tensile strength of the steel plate is 480 N/mm^2 and the factor of safety is 5. Determine the thickness of the shell plate. [16]

8. Compare the values of max. and minimum hoop stresses for a cast steel cylindrical shell of 600 mm external dia. And 400 mm internal dia. Subjected to a pressure of $30N/mm^2$ applied

   (a) Internally and

   (b) Externally. [8+8]

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Code No: R059210303 **Set No. 2**

II B.Tech I Semester Supplementary Examinations, February 2007
MECHANICS OF SOLIDS
(Common to Mechanical Engineering, Mechatronics, Metallurgy & Material Technology, Production Engineering, Aeronautical Engineering and Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A steel rod 28 mm diameter is fixed concentrically in a brass tube of 42 mm outer diameter and 30 mm inner diameter. Both the rod and tube are 450 mm long. The compound rod is held between two stops which are exactly 450 mm apart and the temperature of the bar is raised by 70^0C.
   (a) Find the stresses in the rod and tube if the distance between the stops is increased by 0.30 mm.
   (b) Find the increase in the distance between the stops if the force exerted between them is 90 kN

   Take $E_S = 200kN/mm^2$; $\alpha_S = 11.2 \times 10^{-6} per^0$C
   $E_b = 90kN/mm^2$; $\alpha_b = 2.1 \times 10^{-5} per^0$C [16]

2. A horizontal beam of 10m long is carrying a uniformly distributed load of 1 kN/m over the entire length. The beam is simply supported on two supports 6m apart. Find the position of the supports, so that the BM on the beam is as small as possible. Also draw the SF and BM diagrams. [16]

3. (a) State the assumptions involved in the theory of simple bending. [6]
   (b) Derive the Bending equation from fist principle. [10]

4. (a) What do you mean by shear stress in beams? [4]
   (b) From first principles derive the expression for shear stress at any point in any cross section of a beam which is subjected to a shear force F. [6]
   (c) A circular beam of 120mm diameter is subjected to a shear force of 7kN. Calculate:
      i. Average shear stress. [3]
      ii. Maximum shear stress. [3]

      Also sketch the variation of the shear stress along the depth of the beam.

5. Find all the forces in the members of the truss as shown in the Figure 5. [16]

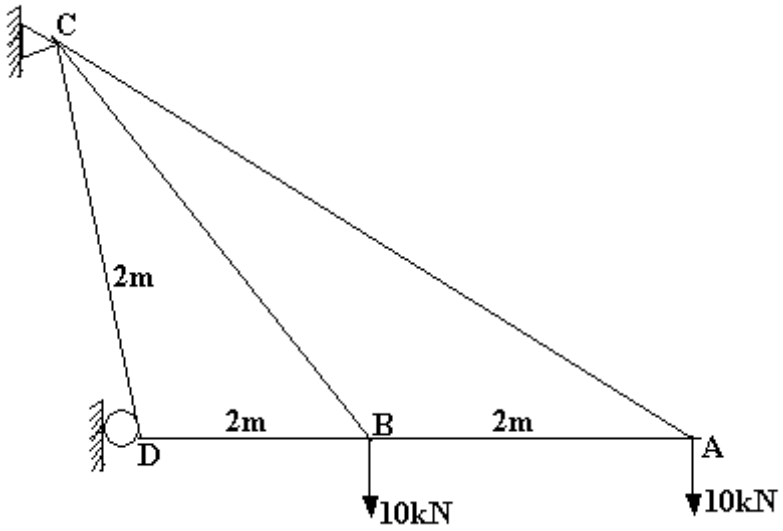

Figure 5

6. (a) A beam of length L is supported at each end with a couple applied at an intermediate point. Deduce an expression for the deflection and hence calculate the deflection at the point of application of the moment. [8]

   (b) A beam of length L carries a uniformly distributed load w/unit length and rests on three supports, two at the ends and one in the middle. Find how much the middle support be lower than the end ones in order that the pressures on the three supports shall be equal. [8]

7. (a) Enumerate the differences between longitudinal stress and circumferential stress in a cylindrical shell subjected to an internal pressure. [6]

   (b) A thin cylindrical pressure vessel of inside diameter 350 mm is subjected to an internal pressure of 500 kPa. Determine the thickness of the cylindrical wall assuming joint factor to be 0.85 and corrosion allowance 1 mm. The allowable stress for the cylindrical material is 160 N/mm^2. [10]

8. Compare the values of max. and minimum hoop stresses for a cast steel cylindrical shell of 600 mm external dia. And 400 mm internal dia. Subjected to a pressure of $30N/mm^2$ applied

   (a) Internally and

   (b) Externally. [8+8]

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Code No: R059210303 **Set No. 3**

II B.Tech I Semester Supplementary Examinations, February 2007
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A steel bar of 4 m long is 32 mm in diameter for 1m of its length, 28 mm in diameter for 2 m, and 25 mm in diameter for the remaining length. The bar is kept in tension, with stress in the smallest section being 110 N/mm2. If E = $2.127\times10^5 N/mm^2$, calculate the total elongation of the bar and the energy stored in it. [16]

2. Draw the SFD and BMD for the beam loaded as shown in the Figure2. [16]

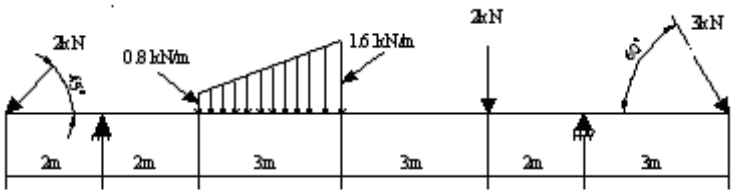

Figure 2

3. (a) State the assumptions involved in the theory of simple bending. [6]
   (b) Derive the Bending equation from fist principle. [10]

4. (a) Obtain an expression for the shear stress at any point in a circular section of a beam subjected to shear force F. Draw the variation of shear stress. [8]
   (b) A rolled steel joist of I section has top flange 150mm × 20mm bottom flange 180mm × 25mm and web of size 300mm ×15mm. It is used as a simply supported beam over a span of 6m to carry an u.d.l. of 76kN/m over its entire span. Draw shearing stresses across a section at $^1/_4$ span. [8]

5. Figure 5 shows a cantilever truss ABCDE, subjected to a vertical load P = 100 KN at joint D. Determine the forces in the members and reactions at the supports. [16]

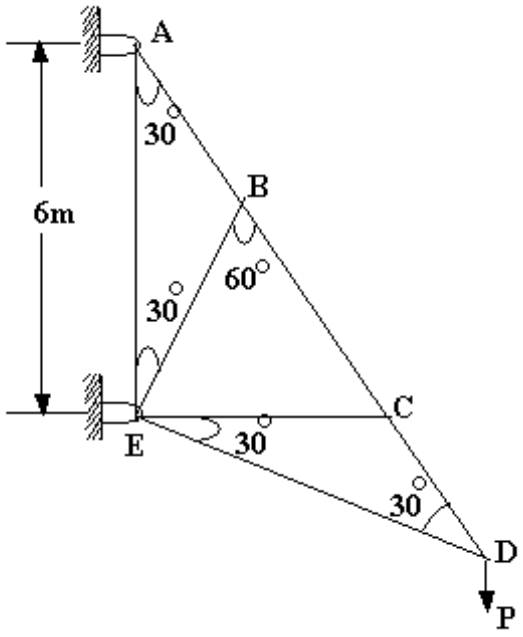

Figure 5

6. A beam of uniform section, 10 meters long, is simply supported at the ends. It carries point loads of 110 kN and 60 kN at distances of 2m and 5m respectively from the left end. Calculate: The deflection under each load and maximum deflection Given : E = 200 $\times 10^6 N/m^2$ and I = 118 $\times 10^{-4} m^4$. [16]

7. A spherical shell of 90 mm internal dia. has to withstand an internal pressure of $35 N/mm^2$. Find the thickness of shell required, the max. permissible tensile stress is $80 N/mm^2$. [16]

8. Compare the values of max. and minimum hoop stresses for a cast steel cylindrical shell of 600 mm external dia. And 400 mm internal dia. Subjected to a pressure of $30 N/mm^2$ applied

   (a) Internally and

   (b) Externally. [8+8]

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Code No: R059210303 **Set No. 4**

II B.Tech I Semester Supplementary Examinations, February 2007
MECHANICS OF SOLIDS
(Common to Mechanical Engineering, Mechatronics, Metallurgy & Material Technology, Production Engineering, Aeronautical Engineering and Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive relation between three elastic moduli [8]
   (b) Draw stress - strain diagram for mild steel. Indicate salient points and define them. [8]

2. A simply supported beam of length 8m rests on supports 5m apart, the right hand end is overhanging by 2m and the left hand end is overhanging by 1m. The beam carries a uniformly distributed load of 5 kN/m over the entire length. It also carries two point loads of 4 kN and 6 kN at each end of the beam. The load of 4 kN is at the extreme left of the beam, whereas the load of 6 kN is at the extreme right of the beam. Draw the SF and BM diagrams for the beam and find the points of contra flexure. [16]

3. (a) A cantilever of length 2.8 m fails when a load of 4.7 kN is applied at the free end. If the section of the beam is 65 mm × 105 mm find the stress at failure. [8]
   (b) A T-beam having flange 210 mm × 20 mm is simply supported over a span of 5 m. It carries a u.d.l of 8.8 kN/m over its entire span. Calculate the maximum compressive and tensile stress occurring in the section. What is the magnitude of flexural stress at the junction of flange and web? Draw the variation of stress across the section. [8]

4. (a) From first principles show that for a rectangular section the maximum shear stress is 1.5 times the average stress. Sketch the variation of shear stress. [8]
   (b) A rolled steel joist of I section has top flanges 90mm × 20mm bottom flange 170mm × 20mm and web of size 220mm × 20mm. It is used as a simply supported beam over a span of 5m to carry an u.d.l. of 65kN/m over its entire span. Obtain the shear stress values at salient points and sketch the variation of shear stress. [8]

5. Find the forces in all the members of the warrentype Cantilever truss shown in Figure 5 by the method of sections. Tabulate the values. [16]

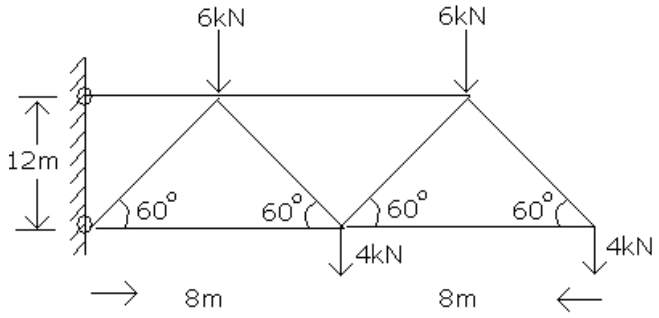

Figure 5

6. (a) Derive the relation ship between slope, deflection and radius of Curvature of a simply supported beam. [6]

   (b) A 300 mm long cantilever of rectangular section 48 mm wide and 36 mm deep carries a uniformly distributed load. Calculate the value of load w if the maximum deflection in the cantilever is not to exceed 1.5 mm. Take E = $70\times10^9 GN/m^2$. [10]

7. Derive the formula for the thickness of the thin cylindrical shell and solve the following problem. A thin cylindrical shell of 1 m diameter is subjected to an internal pressure of 1 N/mm^2. Calculate the suitable thickness of the shell, if the tensile strength of the plate is 400 N/mm^2 and factor of safety is 4. [16]

8. Compare the values of max. and minimum hoop stresses for a cast steel cylindrical shell of 600 mm external dia. And 400 mm internal dia. Subjected to a pressure of $30N/mm^2$ applied

   (a) Internally and

   (b) Externally. [8+8]

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