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

II B.Tech I Semester Regular Examinations, November 2006
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

⋆ ⋆ ⋆ ⋆ ⋆

1. A bar of mild steel 20 mm diameter is subjected to an axial pull of 50 kN. The increase in length over a gauge length of 200 mm is measured to be 0.16 mm. The decrease in diameter was 0.0048 mm. From the above data determine the modulus of Elasticity and Poisson's ratio of mild steel. [16]

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]

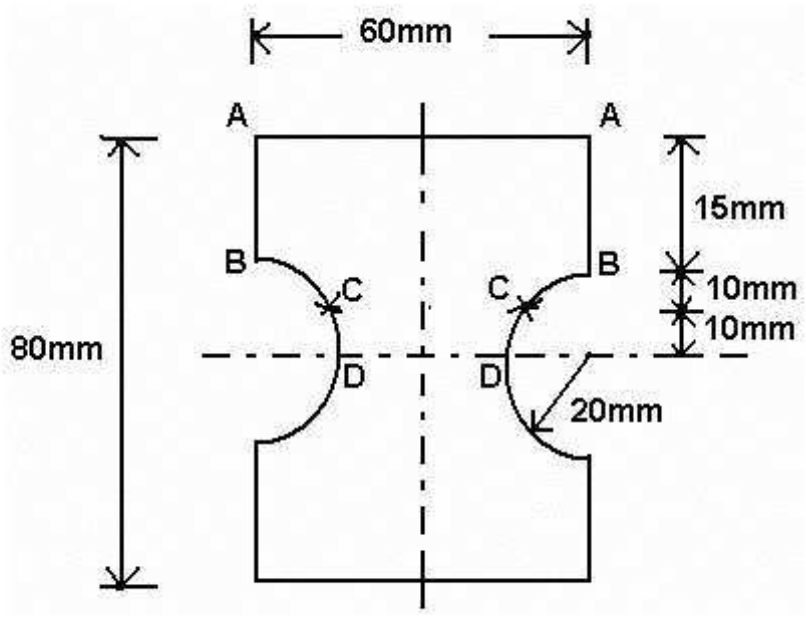

Figure 4

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

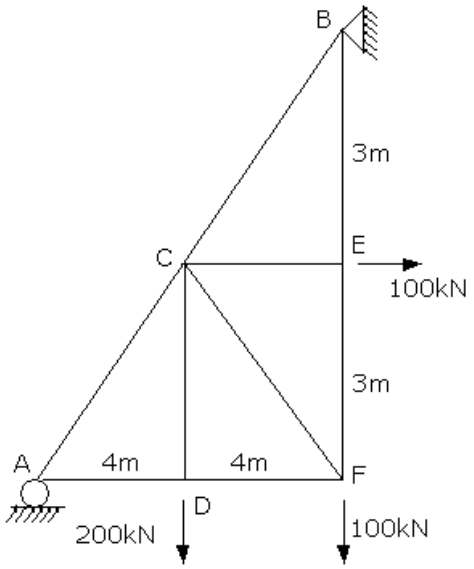

Figure 5

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

8. (a) Find the ratio of thickness to internal dia. Of a tube subjected to internal pressure when the pressure is 3/8 of the max permissible hoop stress.

   (b) Find the increase in internal dia of such a tube 100 mm in internal dia. Subjected to an internal pressure of $90N/mm^2$. Neglect longitudinal strain and take $E = 200GN/m^2$ and $\frac{1}{m} = 0.3$. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

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

II B.Tech I Semester Regular Examinations, November 2006
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

⋆ ⋆ ⋆ ⋆ ⋆

1. Prove that Poisson's ratio for the material of a body is 0.5, if its volume does not change when stressed. Prove also that Poisson's ratio is zero when there is no lateral deformation when a member is axially stressed. [16]

2. (a) Device the relations among loading, shear force and bending moment in a beam. [9]
   (b) A cantilever beam AB span 6m is subjected to a uniformly varying load of 8 kN/m intensity at the fixed end A and zero at the free end B. draw SFD and BMD. [7]

3. (a) Discuss the assumptions involved in the theory of simple bending. [6]
   (b) The cross section of a simply supported beam is as shown in Figure 3. Find its moment of resistance if permissible tensile stress is 160MPa. Compare it with equivalent section of same area but [10]
      i. Square section
      ii. Rectangular section with twice the width and
      iii. a circular section.

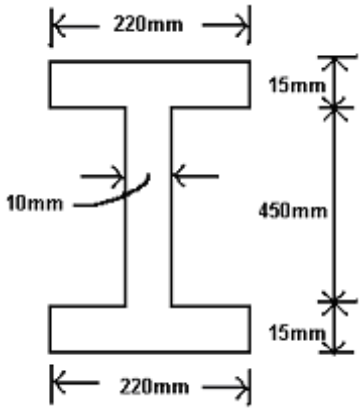

Figure 3

4. (a) From first principles show that the shear stress is not maximum at the neutral axis in case of an isosceles triangular section. [8]
   (b) A beam of T - section is having flange 120mm × 15mm and web 100mm × 15mm. It is subjected to a shear force of 24kN. Draw shear stress distribution across the depth marking values at salient points. [8]

5. Determine the forces in various members (figure5). [16]

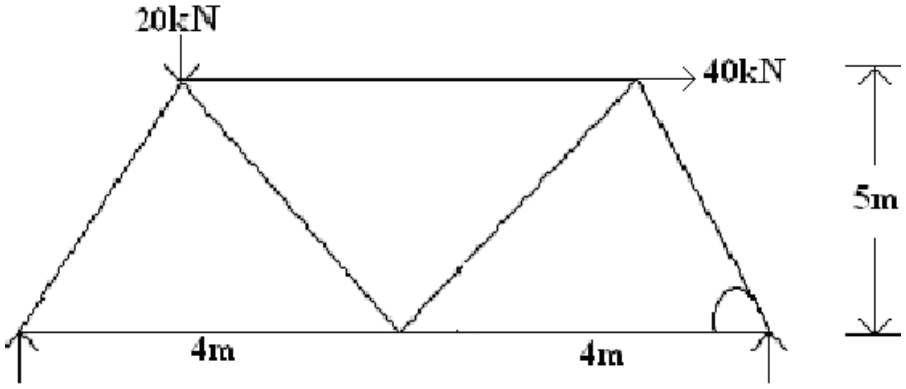

Figure 5

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. Calculate the increase in volume enclosed by a boiler shell 2.5 m long and 1 m in diameter, when it is subjected to an internal pressure of 1.5 N/mm^2. The wall thickness is such that the maximum tensile stress is 22 N/mm^2, under this pressure. Given E = 200 kN/mm^2 and Poisson's ratio = 0.25. [16]

8. A compound steel cylinder has a bore of 80 mm and an outside; diameter of 160 mm, the diameter at the common surface being 120 mm. Find the radial pressure at the common surface which must be provided by shrinkage if the resultant maximum hoop tension in the inner cylinder under a superimposed internal pressure of $60N/mm^2$ is to be half the value of the maximum hoop tension which would be produced in the inner cylinder if that cylinder alone were subjected to an internal pressure of $60N/mm^2$. Determine the final hoop tensions at the inner and outer surfaces of both cylinder under the internal pressure of $60N/mm^2$ and sketch a graph to show the hoop tension varies across the cylinder wall. [16]

⋆ ⋆ ⋆ ⋆ ⋆

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

II B.Tech I Semester Regular Examinations, November 2006
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

⋆ ⋆ ⋆ ⋆ ⋆

1. A round steel bar 25 mm diameter and 360 mm long is placed concentrically within a brass tube which has an outside diameter of 35 mm and an inside diameter of 27.5 mm. The length of the tube exceeds, that of the bar by 0.15 mm. Rigid plates are placed on the ends of the tube, through which an axial compressive force of 80 KN is applied on the compound bar. Determine the compressive stresses in the bar and tube. E for steel = $2.1\times10^5 N/mm^2$. E for brass = 10^5 N/mm^2. [16]

2. Draw the shearing force and bending moment diagrams for the beam loaded as shown in Figure2. [16]

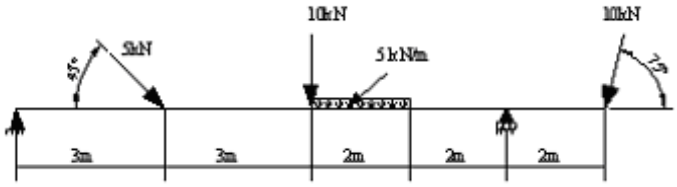

Figure 2

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

4. (a) From first principles prove that for a rectangular section the maximum shear stress is 1.5 times the average stress. Sketch the shear stress variation. [8]
   (b) A beam of I - section is having overall depth as 650mm and overall width as 220mm. The thickness of the flanges is 25mm where as the thickness of the web is 20mm. If the section carries a shear force of 61kN, calculate shear stress at salient points and sketch the shear stress distribution across the section.[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]

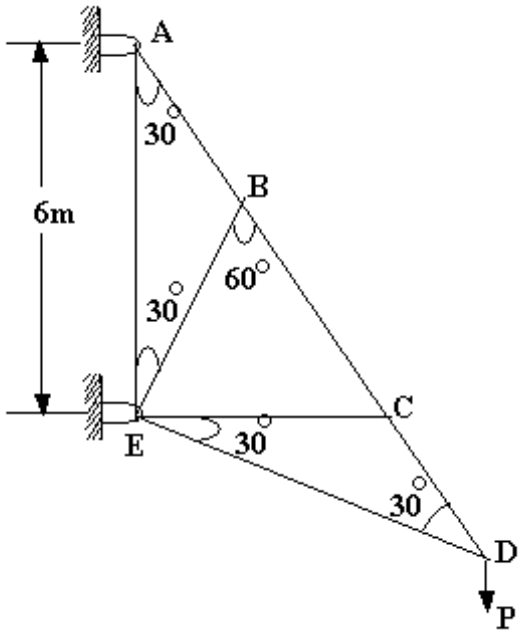

Figure 5

6. (a) Derive an expression for slope and deflection at the free end of a Cantilever beam AB of span l and stiffness EI when it is subjected to a triangular Load zero at the free end to w per unit length at the fixed end. [8]

   (b) A uniform section beam of length L is simply supported at its ends and carries a single concentrated load W at a distance of L/3 from one end. Working from fundamental beam theory, derive formula for the deflection [8]

   i. under the load

   ii. at the centre

   iii. at the point of maximum deflection.

7. A cylindrical shell 3 m long has 1 m internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm^2. Take E = 200 kN/mm^2 and Poisson's ratio = 0.3. [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]

⋆ ⋆ ⋆ ⋆ ⋆

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

II B.Tech I Semester Regular Examinations, November 2006
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

⋆ ⋆ ⋆ ⋆ ⋆

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 carries a load that varies from zero at the left support to 4 kN/m run at midspan and decreases to 1 kN/m run at the right support. Draw the shear force end bending moment 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. 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]

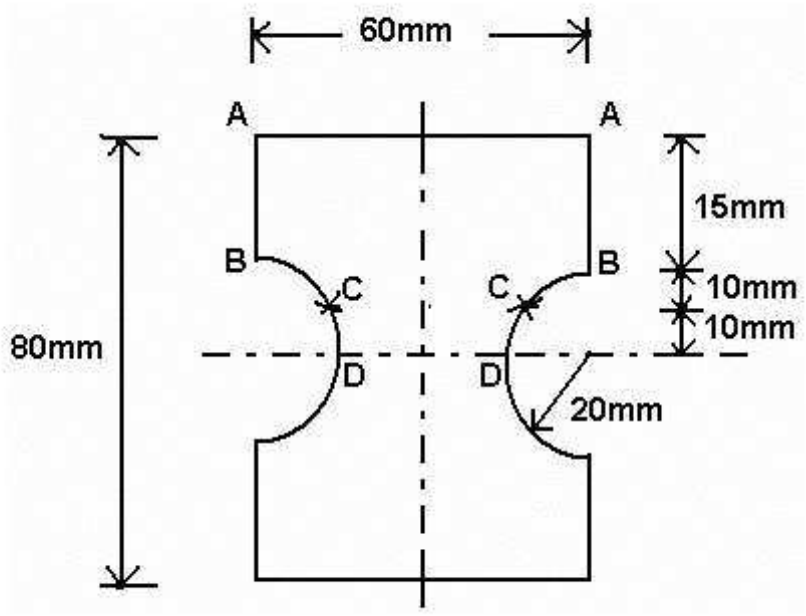

Figure 4

5. Explain the analysis of trusses by

(a) Method of joints

(b) Method of sections

(c) Tension coefficient method. [16]

6. A beam A B of span 6 meters and of flexural rigidity EI = 8 $\times 10^4 kN - m^2$ is subjected to a clockwise couple of 60 kN-m at a distance of 4 m from the left end.

   Find the deflection at the point of application of the couple and the maximum deflection and slope. [16]

7. (a) Derive the expression for the change of diameter and length of a thin cylindrical shell subjected to an internal pressure. [8]

   (b) A cylindrical shell 2.4 m long 0.6 m in diameter is made up of 12 mm thick plate. Find the changes in the length and diameter, when the shell is subjected to an internal pressure of 2 N/mm^2. [8]

8. A compound cylinder is formed by shrinking one tube on to another, the final dimensions being, internal diameter 120 mm, external diameter 240 mm, diameter at junction 180 mm. if after shrinking on, the radial pressure at the common surface is $8N/mm^2$, calculate the initial hoop stresses across the sections of the inner and outer tubes. If a fluid under a pressure of $60N/mm^2$, is admitted inside the compound cylinder, calculate the final stresses set up in the sections of the pipes. [16]

⋆ ⋆ ⋆ ⋆ ⋆