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

II B.Tech I Semester Regular Examinations, November 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. An unknown weight falls 4 cm on to a collar rigidly attached to the lower end of a vertical bar 4m long and 8 cm^2 in section. If the maximum instantaneous extension is found to be 0.42 cm, find the corresponding stress and the value of the unknown weight. E = 200 kN/mm^2. [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]

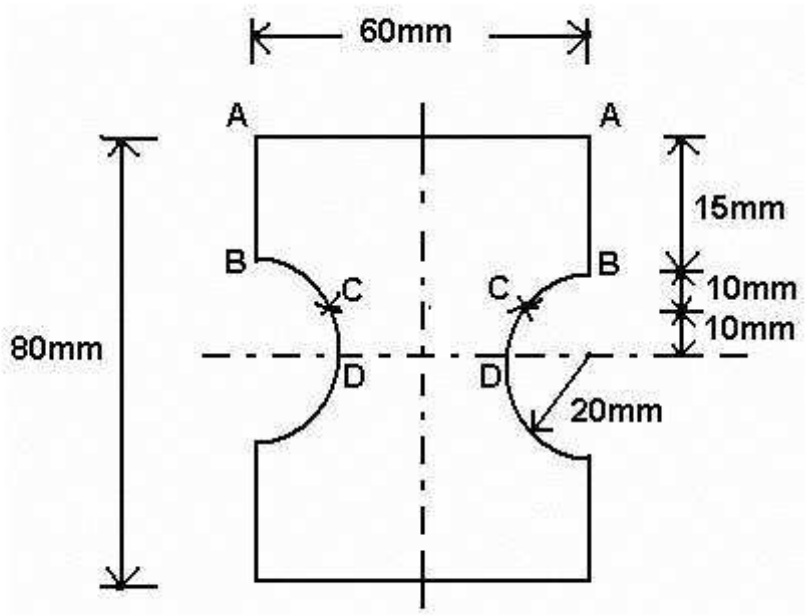

Figure 4

5. Calculate the forces induced in the members of the pin jointed truss shown in Figure 5 by method of section. [16]

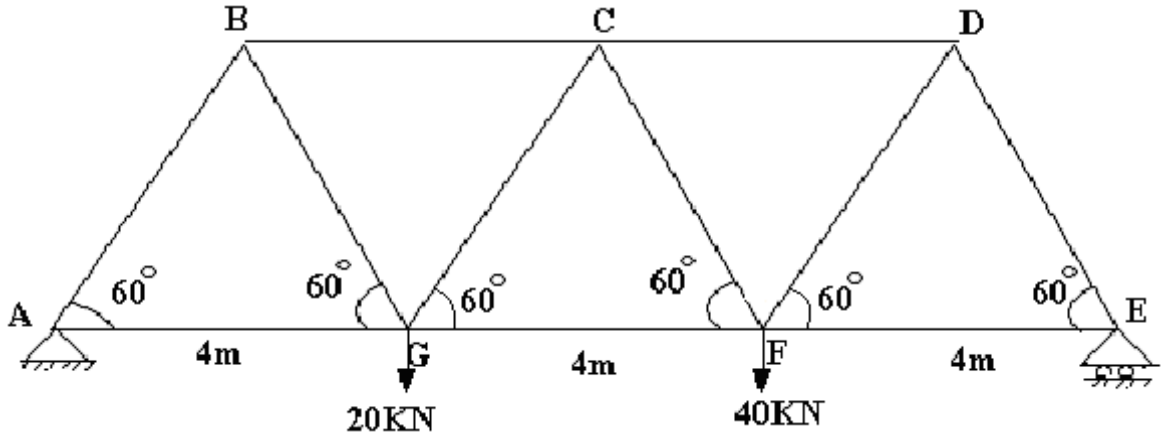

Figure 5

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. 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 tube whose external and internal diameters are 360 mm and 240 mm respectively has another tube 60 mm thick shrunk on to it. The bore of the outer tube is machined to 1 mm less than the external diameter of the tube on to which it is subsequently shrunk. If the tubes are made of steel for which the value of $E = 200KN/mm^2$, Determine expressions for the radial and hoop stresses developed in the inner tube. [16]

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

II B.Tech I Semester Regular Examinations, November 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

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Define Factor of safety, Poisson's ratio and strain energy. [6]
   (b) Show that the volumetric strain of a body is the algebraic sum of the linear strains in three mutually perpendicular directions. [10]

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

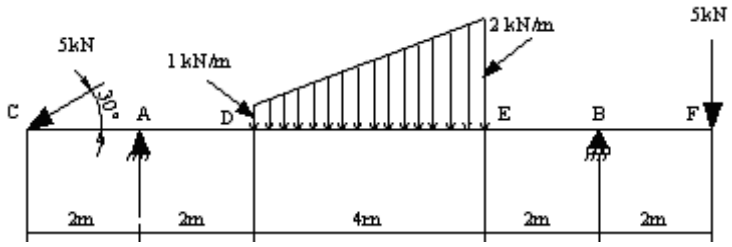

Figure 2

3. (a) What is elastic section modulus? [4]
   (b) A beam resting freely on supports 5.8m apart carries a u.d.l of 12 kN/m and also a point load of 15 kN at 2m from the left support. If the permissible stress in timber is 5 MPa, design a suitable section by making the depth equal to 1.8 times the width. [12]

4. (a) Prove 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 timber beam 120 mm wide and 185 mm deep supports a u.d.l. of intensity w kN/m length over a span of 2.7 m. If the safe stresses are 29 MPa is bending and 3 MPa in shear, Calculate the safe intensity of the load which can be supported by the beam. [8]

5. Explain the analysis of trusses by
   (a) Method of joints
   (b) Method of sections
   (c) Tension coefficient method. [16]

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. (a) Define pressure vessel and discuss the most important considerations while designing pressure vessel. [6]

   (b) A boiler shell is made of 15 mm thick plate having a limiting tensile stress of 125 N/mm^2. If the longitudinal and circumferential efficiencies are 70% and 60% respectively, determine the maximum diameter of the shell. The allowable maximum pressure is 2.2 N/mm^2. [10]

8. A tube whose external and internal diameters are 360 mm and 240 mm respectively has another tube 60 mm thick shrunk on to it. The bore of the outer tube is machined to 1 mm less than the external diameter of the tube on to which it is subsequently shrunk. If the tubes are made of steel for which the value of $E = 200KN/mm^2$, Determine expressions for the radial and hoop stresses developed in the inner tube. [16]

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

II B.Tech I Semester Regular Examinations, November 2007
MECHANICS OF SOLIDS
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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) Define the terms:
   i. Proportional limit
   ii. Poisson's ratio
   iii. Proof stress
   iv. Strain energy. [6]
   (b) A compound bar 1 metre long is 40 mm diameter for 300 mm length, 30 mm diameter for the next 350 mm length. Determine the diameter of the remaining length so that its elongation under an axial load of 100 kN does not exceed 1mm. Take E = $2\times10^5 N/mm^2$. [10]

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) 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 the shear stress is not maximum at the neutral axis in case of an isosceles triangular section. [8]
   (b) A beam of I- section has the following dimensions top and bottom flanges = 170mm × 20mm
   web = 25mm× 210mm
   The beam is subjected to a shear force of 19kN. Calculate shear stress at salient points. Sketch the shear stress variation. [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]

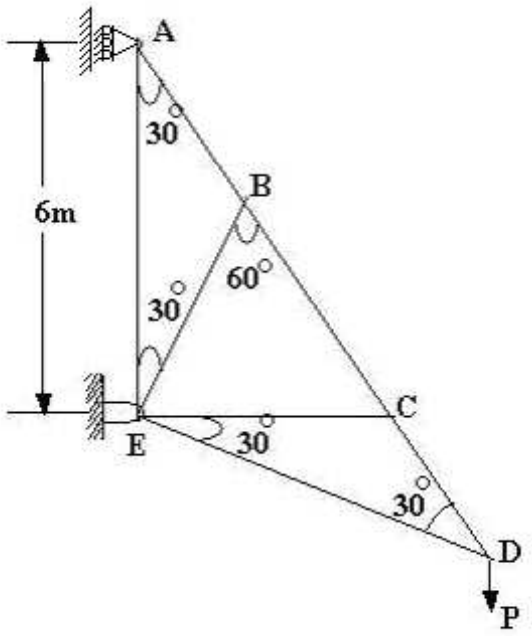

Figure 5

6. (a) 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. An air vessel of a torpedo is 500 mm diameter, and 10 mm thick, the length being 2 m. From fundamentals, find the change in diameter and length, when charged to 10 N/mm^2 internal pressure. Take E = 200 kN/mm^2 and Poisson's ratio = 0.3.[16]

8. A tube whose external and internal diameters are 360 mm and 240 mm respectively has another tube 60 mm thick shrunk on to it. The bore of the outer tube is machined to 1 mm less than the external diameter of the tube on to which it is subsequently shrunk. If the tubes are made of steel for which the value of $E = 200KN/mm^2$, Determine expressions for the radial and hoop stresses developed in the inner tube. [16]

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

II B.Tech I Semester Regular Examinations, November 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) Derive relation between three elastic moduli [8]
   (b) Draw stress - strain diagram for mild steel. Indicate salient points and define them. [8]
2. (a) How do you classify loads? Give examples. [4]
   (b) A simply supported beam of length 5m carries a uniformly increasing load of 800 N/m run at one end to 1600 N/m run at the other end. Draw the S.F. and B.M. diagrams for the beam. [12]
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. 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]

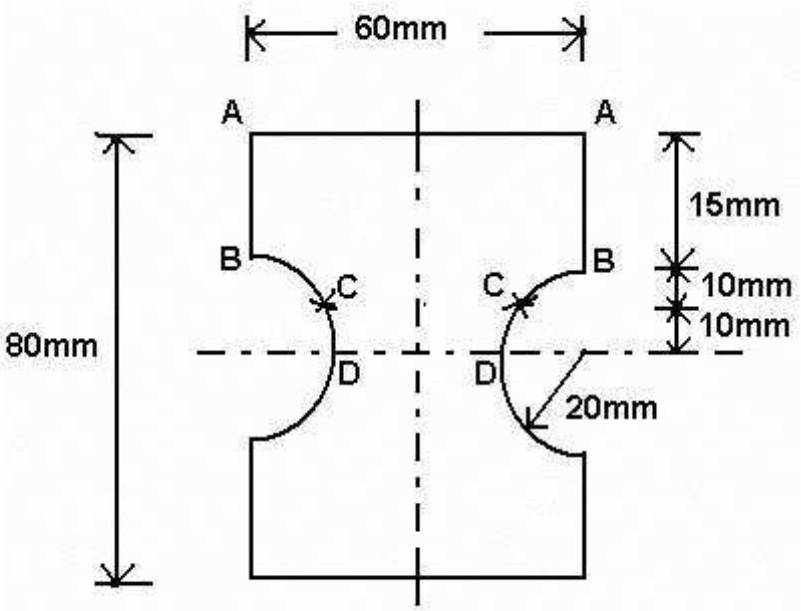

Figure 4

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

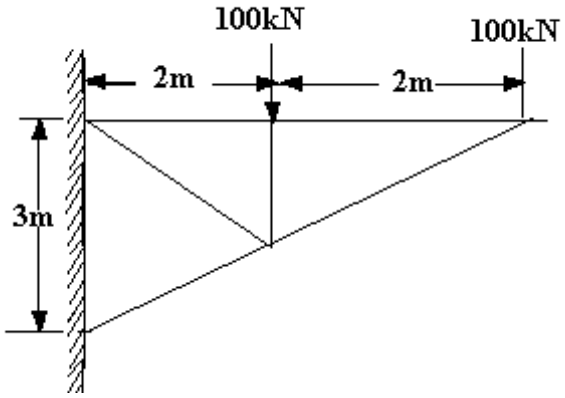

Figure 5

6. A simply supported 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. 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. 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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