PVP 12

Code: **MEMD1T2**

I M.Tech - I Semester - Regular Examinations – April, 2015

ADVANCED MECHANICS OF SOLIDS

(MACHINE DESIGN)

Duration: 3 hours Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. Locate the shear center of the section shown in Figure 1.

14 M

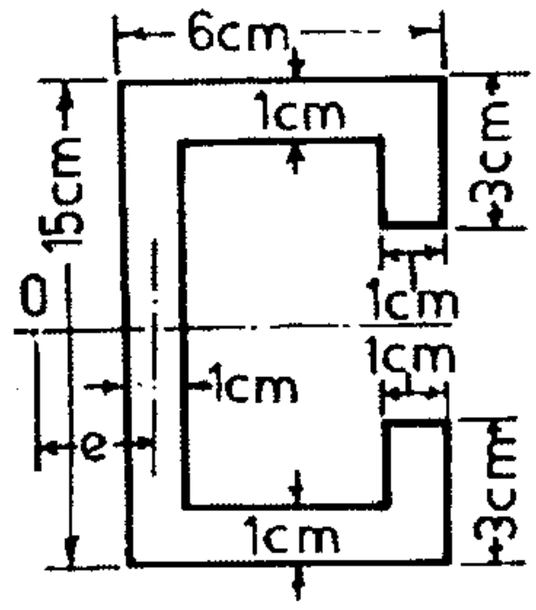

Figure 1

2. A circular cross section shaft is mounted in bearings that develop shear reactions only Figure 2. Determine the location and magnitude of the maximum flexural stress in the beam.

14 M

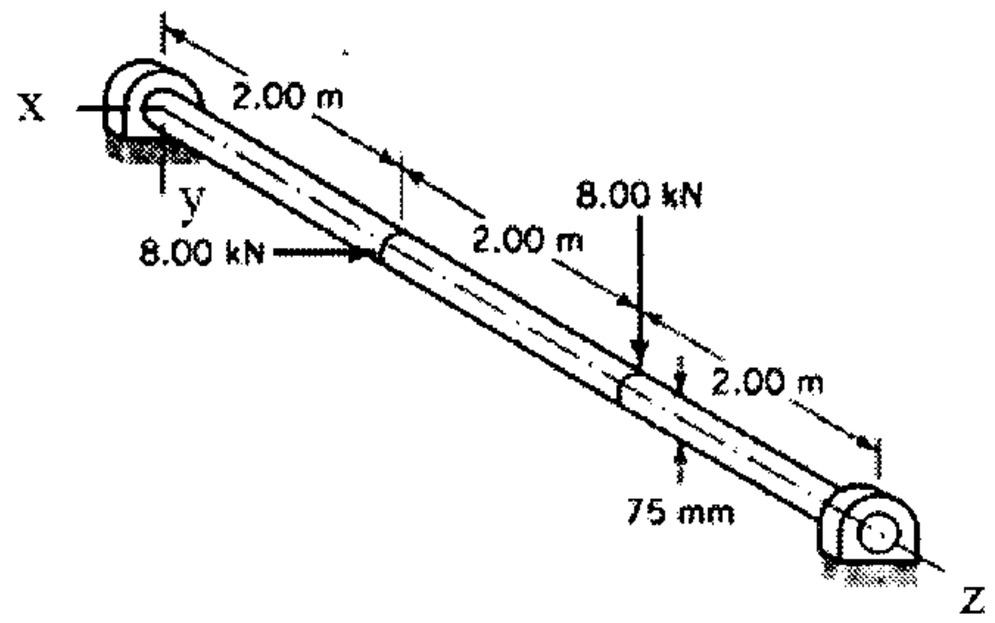

Figure 2

3. A load P=12.0 kN is applied to the clamp shown in Figure 3. Determine the circumferential stresses at points B and C, assuming that the curved beam formula is valid at that section. 14 M

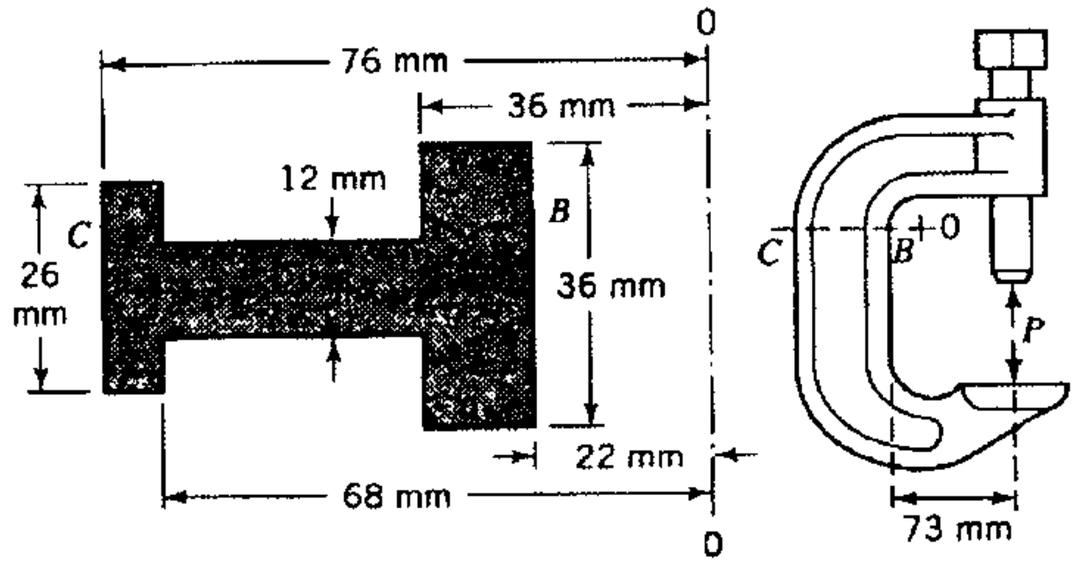

Figure 3

4. A 25 mm square shaft is made of steel having a yield stress of Y=380 MPa. It is used to transmit power from a tractor to farm implements. Determine the torque that can be applied to the shaft based on a factor of safety of SF=2 using the octahedral shear stress criterion of failure. 14 M

5. A solid disc of 25cm diameter is rotating at 1500rpm. Determine the maximum hoop stress induced in the cylinder. If its material density is 7800kg/m^3, poissons ratio is 0.28. Also draw the variation of radial and hoop stresses in the cylinder. 14 M

6. A rectangular steel plate (E=200GPa, υ=0.29, and Y=280MPa) has a length of 2m, width of 1m, and fixed edges. The plate is subjected to a uniform pressure p= 270kPa. Assume that the design pressure for the plate is limited by the maximum stress in the plate; this would be the case for fatigue loading, for instance. For a working stress limit σ_w=Y/2, determine the required plate thickness and maximum deflection. 14 M

7. A long wood beam (E=12.4GPa) of depth 200mm and width 60mm is supported by 100mm rubber cubes placed equidistant along the beam at l=600mm. The cube edges are parallel and perpendicular to the axis of the beam. The rubber has a spring constant of k_0=0.33N/mm^3. A load P is applied to the centre of the beam located over one of the rubber cubes. If the wood has a yield stress of Y=40MPa, determine the magnitude of P based on a factor of safety SF=2.5. What is the maximum pressure developed between the rubber and beam? 14 M

8. Explain the following.

i) 2D elasticity equations for plane stress and plain strain. 7 M

ii) Equilibrium and compatibility conditions for elastic solids. 7 M