**BBDNITM**

**MECHANICAL ENGG. DEPARTMENT**

**SESSION (2018-19)**

**Subject- Mechanics of Solids [RME303]**

**Assignment – 1**

1. Define the following terms:
   1. Resilience
   2. Proof resilience
   3. Modulus of resilience
   4. Principal planes and principal stresses
   5. Volumetric strain.
   6. Thermal stress.
   7. Bulk modulus
   8. Modulus of rigidity
   9. Relationship between young’s modulus and modulus of rigidity
2. A Mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. The ends of the rod and tube are brazed together, and the composite bar is subjected to an axial pull of 40 kN. If E for steel and copper is 200 GN/m2 and 100 GN/m2 respectively, find the stresses developed in the rod and the tube also find the extension of the rod.
3. A cast iron flat 300 mm long and 30 mm (thickness) × 60 mm (width) uniform cross section, is acted upon by the following forces : 30 kN tensile in the direction of the length 360 kN compression in the direction of the width 240 kN tensile in the direction of the thickness. Calculate the direct strain, net strain in each direction and change in volume of the flat. Assume the modulus of elasticity and Poisson’s ratio for cast iron as 140 kN/mm2 and 0.25 respectively.
4. A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. calculate the Poisson’s ratio and the values of the three moduli.
5. A steel rod of 20mm diameter passes centrally through a copper tube of 50mm external diameter and 40mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 50°C, calculate the stress developed in copper and steel. Take E for steel and copper as 200 GN/m2 and 100 GN/m2 and α for steel and copper as 12 x 10-6 per °C and 18 x 10-6 per °C.
6. Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 50cm apart. Diameters and lengths of each rod are 2cm and 4m respectively. A cross bar fixed to the rods at the lower ends carries a load of 5000 N such that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar. Take E for steel = 2 x 105 N/mm2 and E for copper = 105 N/mm2.
7. Find the young’s modulus of a rod of diameter 30mm and of length 300mm which is subjected to a tensile load of 60 KN and the extension of the rod is equal to 0.4 mm.
8. The ultimate stress for a hollow steel column which carries an axial load of 2MN is 500 N/mm2. If the external diameter of the column is 250mm, determine the internal diameter. Take the factor of safety as 4.0
9. A rectangular block of material is subjected to a tensile stress of 110N/mm2, one plate and a tensile stress of 47N/mm2 on another plate at right angle to each other and the above stress is accomplished by a shear stress of 63N/mm2. Determine the principle stress, principle plane and maximum shear stress.
10. Two planes AB,AC, which are right angles carries a shear stress of intensity 17.5N/mm2 while this plane also carrying a tensile stress of 70N/mm2 at a compressive stress of 35N/mm2respectively. Determine the normal tangential & resultant stress, principle planes and principle stress and also determine the maximum shear stress.