Roll No. ..... **Total Pages : 05**

34025

BT-4/M-20

STRENGTH OF MATERIAL-I

ME-206E

Time : Three Hours] [Maximum Marks : 100

Note: Attempt *Five* questions in all, selecting at least one question from each Unit. Assume any missing data.

Unit I

1. (a) A rod 12.5 mm in diameter is stretched 3.2 mm under a steady load of 10 kN. What stress would be produced in the bar by a weight of 700 N, falling through 75 mm before commencing to stretch, the rod being initially unstressed ? The value of E may be taken as 2.1×10^5 N/mm^2. **10**

(b) An unknown weight falls through a height of 20 mm on a collar rigidity attached to the lower end of the vertical bar 5 m long and 800 mm^2 cross-section. If the maximum extension of the rod is to be 2.5 mm, what is the corresponding stress and magnitude of the unknown weight ? Take E = 2.0×10^6 kg/cm^2. **10**

2. (a) Discuss any *two* theories of failure with their limitations and applications. **8**

(b) A cylindrical shell made of mild steel plate and 1.2 m in diameter is to be subjected to an internal pressure of 1.5 MN/m^2. If the material yields at 200 MN/m^2, calculate the thickness of the plate on the basis of the following three theories, assuming a factor of safety of 3 in each case :

(i) Maximum principal stress theory

(ii) Maximum shear stress theory

(iii) Maximum shear strain energy theory. **12**

Unit II

3. Define hoop and circumferential stress.

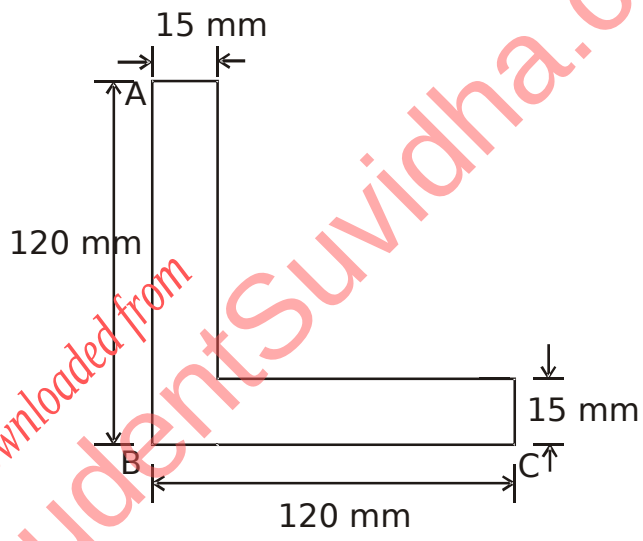
A copper tube of 50 mm internal diameter, 1.2 m long and 1.25 mm thick, has closed ends and is filled with water under pressure when a distortion of the end plates, determine the alteration of pressure when an additional volume of $3 \times 10^{-6} m^3$ of water is pumped into the tube. Modulus of elasticity for copper = 100 GN/m^2, Poisson's ratio 0.3. Bulk modulus for water = 2 GN/m^2. **20**

4. A simply supported beam of span 3.6 m carries a load of 600 N at its centre. The section of the beam is an equal angle of size 120 mm × 120 mm × 15 mm as shown in figure. The vertical load line passes through the centroid of the section. Determine : **20**

(a) Stress at point A, B and C of the mid section of the beam.

(b) Deflection of beam at mid-section and

(c) Position of neutral axis. Take E = 2×10^5 N/mm^2.



Unit III

5. A steel tube of 200 mm external diameter is to be shrunk onto another steel tube of 60 mm internal diameter. The

diameter at the junction after shrinking is 120 mm. Before shrinking on, the difference of diameters at the junction is 0.08 mm. Calculate the radial pressure at the junction and the hoop stress developed in the two tubes after shrinking on. Take E as 2×10^5 N/mm^2 **20**

6. What do you mean by uniform strength of a disk ? Discuss the concept by taking suitable examples.
A steam turbine motor is running at 4800 r.p.m. It is to be designed for uniform strength for a stress of 90 MN/m^2. If the thickness of the rotor at the centre is 30 mm and density of its material is 8000 kg/m^3, find the thickness of the rotor at a radius of 400 mm. **20**

Unit IV

7. A central horizontal section of a hook is a trapezium with inner width 80 mm, outer width 50 mm and depth 150 mm. The centre of the curvature of the section is at a distance of 120 mm from the inner fibre and the load line is 100 mm from the inner fibre. What maximum load, the hook will carry if maximum stress is not to exceed 120 MN/m^2 **20**

8. (a) Differentiate open and closed spring along with their applications. **8**

(b) An open coiled helical spring has 20 coils of wire of diameter 10 mm at a pitch of 80 mm, the coils having a mean radius of 120 mm. If the spring is subjected to an axial twist of 5 Nm, find the maximum normal and shear stress in the section of the wire. If E = 200 GPa and G = 80 GPa, determine the axial extension of the spring and the relative rotation between the ends. Find the strain energy stored in the spring. **12**