Roll No. ..... Total Pages : 3

BT-4/M-21 **44179**

MECHANICS OF SOLIDS-II

Paper–MEC-206A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions in all, selecting atleast *one* question from each unit. Assume any missing data suitably.

UNIT–I

1. A rod, 1.25 cm in diameter, stretched 0.32 cm under a steady load of 10 kN. What stress would be produced in the bar by a weight of 700 N which falls through 7.5 cm before commencing to stretch the rod, the rod being initially unstressed? The value of E may be taken as 21×10^6 N/cm^2. 15

2. (a) Explain the maximum principal stress theory of elastic failure. 7

(b) A solid circular shaft is subjected to a bending moment of 8 kNm and a torque of 12 kNm. In a uniaxial tensile test the shaft material gave the following results : Modulus of elasticity = 200 GN/m^2, Stress at yield point = 300 N/mm^2, Poisson's ratio = 0.3. Estimate the least diameter of the shaft using maximum principal stress theory. Take factor of safety as 3. 8

UNIT–II

3. A cylindrical vessel closed with plane ends is made of a 4 mm thick steel plate. Its diameter is 250 mm and length is 750 mm. It is subjected to an internal fluid pressure of 300 N/cm^2. Calculate the longitudinal and hoop stresses in the shell plate. Also, calculate changes in diameter, length and volume of the cylinder. Take E = 210 GN/m^2 and Poisson's ratio = 0.3. 15

4. A thick cylindrical shell with 300 mm outer diameter and 200 mm internal diameter is subjected to an internal pressure of 10 N/mm^2. Determine the minimum external pressure that can be applied so that tensile stress in the metal does not exceed 15 N/mm^2. 15

UNIT–III

5. A hollow steel disc of 400 mm outer diameter and 100 mm inside diameter is shrunk on a steel shaft. The pressure between the disc and the shaft is 60 MPa. Determine the speed of the disc at which it will loosen from the shaft neglecting the change in the dimensions of the shaft due to rotation, ρ = 7700 kg/m^3 and ν = 0.3. 15

6. Derive the expression for the stiffness of a close coiled helical spring under axial load. 15

UNIT–IV

7. The principal section of a crane hook is 100 mm deep trapezium, the width at intrados being 80 mm and at extrados 40 mm. The centre of curvature of the section is at a distance of 100 mm from the intrados and the load line is 80 mm from the same point. Compute the greatest load that the hook can carry if the maximum stress is not to exceed 150 MPa. 15

8. A 80 mm × 80 mm angle (Fig. 1) is used as a freely supported beam with one leg vertical. $Ixx = I_{yy} = 0.8736 \times 10^{-6}$ m^4. When a bending moment is applied in the principal plane Y-Y, the mid-section of the beam deflects in the direction AA at 30°15' to the vertical. Calculate the second moments of the section about its principal axes. Find also the bending stress at the corner β, if the bending moment is 2 kNm.

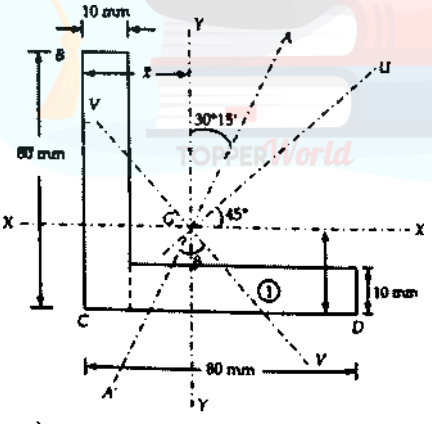

Fig. 1.