C 1257

(Pages : 3)

Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) [14 SCHEME] DEGREE EXAMINATION, APRIL 2016

ME 14 404—ADVANCED MECHANICS OF SOLIDS

Time : Three Hours

Maximum : 100 Marks

Part A

Answer any **eight** *questions.*

1. Explain the Cauchy's equation.
2. Show that in the case of a two dimensional stress system, the magnitudes of the two principal stresses are given by $(\sigma - \sigma_x) \times (\sigma - \sigma_y) = \tau^2_{xy}$.
3. The state of stress at a point is given by ; σ_x = 60 MPa ; σ_y = – 40 MPa ; σ_z = 20 MPa. Determine the normal and shearing stress on a plane inclined at 30° with the x-axis.
4. Plot the variations of circumferential stress developed in a steel disc of uniform thickness and of diameter 600 mm ; when rotating at a speed of 2400 r.p.m.
5. Derive the expression for stress in hollow disc rotating with the uniform angular velocity.
6. Determine the intensities of principal stresses for a flat steel disc of uniform thickness and 2 m. in diameter, rotating with the uniform angular velocity of 4400 r.p.m. Take density of material 78 kN/m^3 and Poisson's Ratio = 0.3.
7. Explain the Castigliano's first theorem.
8. Find the product of inertia about XX and YY axes for an area bounded by parabola $Y^2 = 4ax$ and line $x = h$ and the X-axis.
9. Derive the equation of strain energy stored in a circular shaft due to torsion.
10. In order to reduce the stress and the angle of twist, 0.5 cm. thick flat plates are welded to on the sides of the section, as shown by dotted lines in Figure 1. Determine the maximum shear stress.

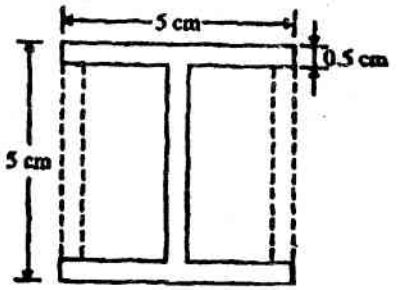

Figure 1

(8 × 5 = 40 marks)

Turn over

Part B

Answer any **one** *question from a module.*

11. (a) The normal stress in two mutually perpendicular directions are 600 N/mm^2 and 300 N/mm^2 both tensile. The complimentary shear stresses in these directions are of intensity 450 N/mm^2. Find the normal and tangential stresses on the two planes which are equally inclined to the planes carrying the normal stresses mentioned above.

Or

(b) Explain the Saint Venant's Principle and also briefly discuss about the limitation.

12. (a) A disc of uniform thickness having inner and outer diameters 120 mm. and 600 mm. respectively is rotating at 3600 r.p.m. about its axis. Determine the stress variations along the radius of the disc. Also determine the minimum allowable speed if the ultimate tensile strength of material is 400 N/mm^2.

Or

(b) A long cylinder of 300 mm. radius is rotating 4500 r.p.m. The density of mass is 7800 kg/m^3 and Poisson's ration 0.3. (i) Calculate the maximum stress in the cylinder ; and (ii) Draw the variations of radial and circumferential stress along the radius.

13. (a) Find slope and deflection at point C for the beam shown in Figure 2 using Castigliano's beam method. Take EI = 20000 kN-m^2.

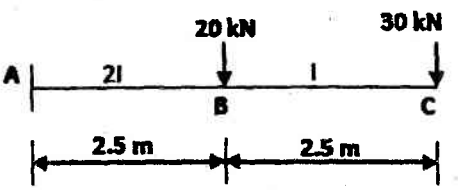

Figure 2

Or

(b) A steel bar 1.5 m. long and 12 cm. in diameter is subjected to an axial load of 1200 N. Find the maximum induced stress if .

1 The load is applied gradually.

2 The load is applied suddenly.

3 The load is applied after falling through a height of 8 cm. What are the strain energies in each of the above cases ? Take E = 200 GN/m^2.

14. (a) A hollow thin-wall torsion member has two compartments with cross-sectional dimensions as indicated in Figure 3. The material is an aluminum alloy for which G = 26.0 GPa. Determine the torque and unit angle of twist if the maximum shear stress, at locations away from stress concentrations, is 40.0 MPa.

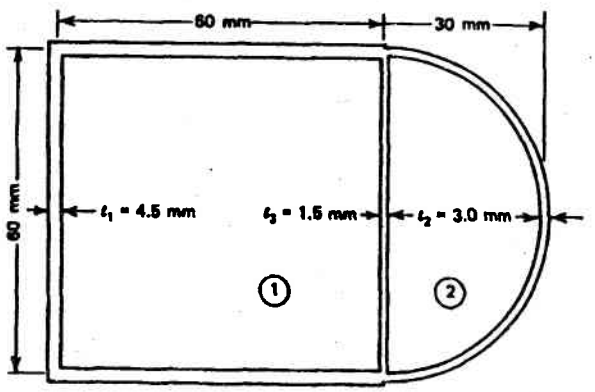

Figure. 3

Or

(b) A two cell tubular section shown in Figure 4 is subjected to an external torque of 25 kNm. in clockwise direction. Determine the internal shear flow distribution.

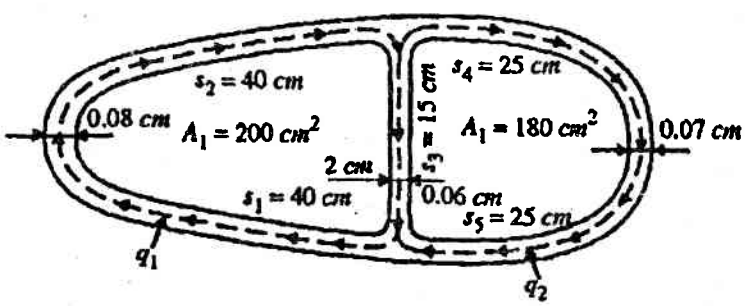

Figure 4

(4 × 15 = 60 marks)