**Exam.Code:0940**
**Sub. Code: 6712**

**2053**
**B.E. (Mechanical Engineering)**
**Fourth Semester**
**MEC-402: Mechanics of Solids**

**Time allowed: 3 Hours** **Max. Marks: 50**

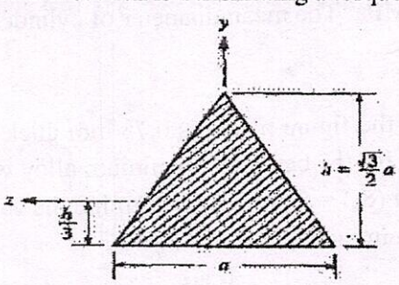
***NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part.***

*x-x-x*

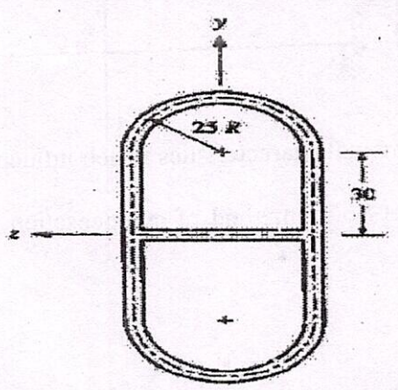
Q1. (a) Define the term shape factor in bending. Write its significance.
(b) State and prove Castigliano first theorem.
(c) Define Prandtl's stress function in torsion.
(d) What do you mean by strain rosette. Draw sketch of rectangular rosette.
(e) Define fracture toughness. Write the relation to determine effective fracture toughness.
(2×5=10 Marks)

**Part A**

Q2. (a) Define Airy stress function. Write its formula for plane stress problem. (2 Marks)
(b) Consider the equilateral cross section with sides of length 'a' as shown in the figure below. Determine the shear stress distribution if section is transmitting a torque T. (8 Marks)



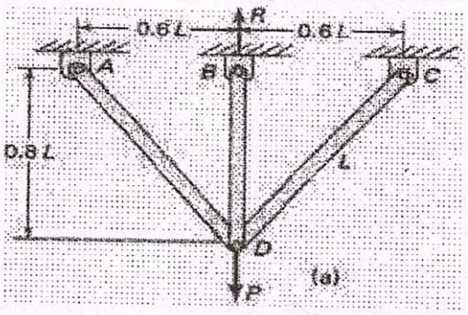

Q3. A thin walled, two cell aluminium tube as shown in the figure below, symmetric with the y and z axis is transmitting a torsional moment of 2.5 KN-m. The thickness of each wall is 5 mm. For aluminium modulus of elasticity (E) = 70 GPa and Poisson's ratio (ν) = 0.33. Determine the average shear stress in each wall and the angle of twist per unit length. All dimensions in given figure are in mm. (10 Marks)




Q4 (a) A simply supported beam carries a load P at a distance c away from its left end. Using Rayleigh method, determine the beam deflection at the point where P is applied. Assume a deflection curve of the form v = ax (L – x), where a is to be determined. (5 Marks)

*P.T.O.*

(b) A symmetric plane structure constructed of three bars of equal axial rigidity AE is subjected to a load P at joint D, as shown in Figure below. Using Castigliano's theorem, find the force in each bar. (5 Marks)

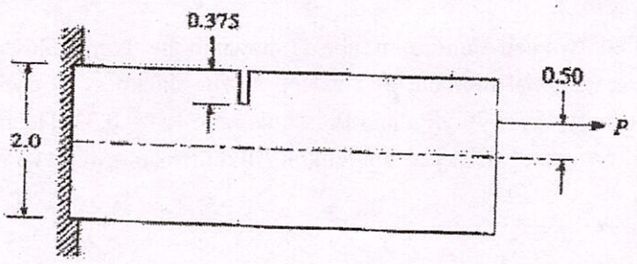



## Part B

Q5. (a) Compare Tresca and von mises yield theories with the help of neat sketch. (5 Marks)

(b) Determine the maximum shear stress on the outer surface of a closed thin-walled circular cylinder internally pressurized at 7 MPa. The mean diameter of cylinder is 500 mm and wall thickness is 12 mm. (5 Marks)

Q6. The long bar shown in the figure below is 0.75 mm thick and is loaded by force P offset from centre 0.5 inch. The material used for the bar is an aluminium alloy with critical stress intensity factor ($K_{Ic}$) = 30 MPa $\sqrt{m}$ and Yield Strength ($S_y$) = 500 MPa. Determine the value of P for which crack will propagate. All dimensions in the figure are in inches. (10 Marks)




Q7. (a) Write various fundamental characteristics which influence the output of a strain gage. (5 Marks)

(b) Describe the Babinet-Soliel method of compensation used for determining the fractional fringe order at a point in the model. (5 Marks)

*x-x-x*