M.E. DEGREE EXAMINATIONS: DECEMBER 2009

First Semester

STRUCTURAL ENGINEERING

SEE501: Theory of Elasticity and Plasticity

Time: Three Hours   **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. Why do we call stress as tensor quantity?

2. What is mean and deviatoric state of stress?

3. Differentiate stress and displacement formulation.

4. What are the two major classes of 2D problems?

5. What is axis symmetrical problem?

6. State the Kirch problem.

7. Explain St.Venants theory on torsion.

8. What is warping function?

9. Define plastic flow.

10. What is π -plane?

PART B (5 x 16 = 80 Marks)

11.(a)   The state of stress at a point with respect to X, Y, Z co-ordinate system is given below. Determine the stress tensor relative to the X', Y', Z' co- ordinate system obtained by a rotation of 30 degree about Z-axis.

$$\begin{bmatrix} 30 & 20 & -20 \\ 20 & 0 & -10 \\ -20 & -10 & 20 \end{bmatrix} \quad \text{MPa}$$

(OR)

(b)   Derive biharmonic equation in Cartesian co-ordinate system.

12.(a)   Assuming proper stress functions and derives expressions for stresses in a cantilever beam of narrow rectangular section with moment at the free end.

(OR)

(b)   Show that the following function is an stress function and investigate what problem it solves

$\phi = (3F/4d)[xy-(xy^3/3d^2)]$

13.(a) i) What is axis symmetric problem? Explain with the equation for axis symmetric problem. (6)

ii) Verify the following function $\Phi = r^4 \cos 2\theta$ (10)

(OR)

(b) Discuss the Kirsch effect of circular hole on stress distribution in a thin rectangular plate subjected to uni axial tension.

14.(a) Derive the expression for the angle of twist and shear stress at any point and hence maximum shear stress in a bar of elliptical cross section due to a torque T. Use St. Venant's warping function approach.

(OR)

(b) A two cell tube as shown in the fig. is subjected to a torque of 10kNm. Determine the shear stress in each part and angle of twist per meter length. Modulus of rigidity of the material as 83 kN/sq. mm.
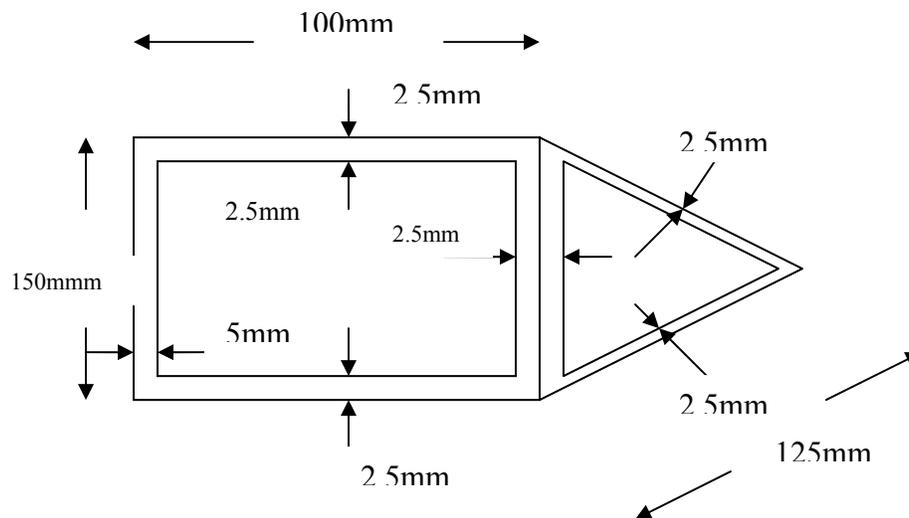
15.(a) Write short notes on
1. St.Venant's theory
2. Energy of distortion theory
3. Tresca's theory

(OR)

(b) A prismatic bar of length 'L' and rectangular cross section is subjected to two equal and opposite end moments. Give the three stages in the bar under bending. Obtain the expression for moment of resistance of beam under incipient yielding, elastoplastic yielding and fully plastic yielding.

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