

Ref. No. : Ex/CE/PE/B/T/415B/2024

Name of the Examinations: B.E. CIVIL ENGINEERING FOURTH YEAR FIRST SEMESTER - 2024

Subject : ADVANCED SOLID MECHANICS

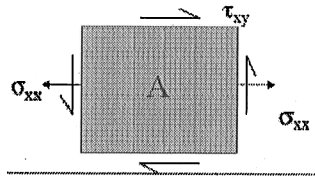
Time : 3 hours

Full Marks : 100

Part I

Instructions : Use Separate Answer scripts for each part

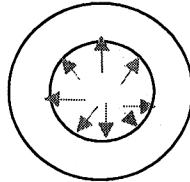
1. The stress pattern exhibited at a point in a continuum is shown as follows –



Obtain the Tresca and von Mises criteria for no yielding condition at the given point.(CO3) (10)

2. Plot the yield-safe zone defined by (i) Rankine (ii) Tresca (iii) St. Venant (iv) Haigh and (v) von Mises theories in 2D stress state. (CO3) (5)

3. An annular plate with inner radius R_1 and outer radius R_2 is subjected to a uniform pressure 'p' acting along the inner wall as shown in the figure below -



Obtain the expression for stresses developed anywhere in the plate applying the concept of Airy's stress function. (CO4) (15)

4. Obtain the orientation of maximum shear stress in a 3-D continuum. (CO1) (10)

5. Define Octahedral stress: Obtain the relationship between Octahedral shear stress and deviatoric stress and its relationship with the failure of a ductile material. (CO1 & CO3) (10)

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Part- II (Marks 50)

1. Starting from anisotropic material, show that the independent elastic constants for orthotropic material are only nine. 25
2. Starting from equilibrium equation, find the Bi-harmonic equation i.e. $\frac{\partial^4 \phi}{\partial x^4} + 2\frac{\partial^4 \phi}{\partial x^2 \partial y^2} + \frac{\partial^4 \phi}{\partial y^4} = 0$ for plane strain problem. Use this Bi-harmonic equation to obtain stress and displacement field for uniaxial tension problem. 25