Printed Pages : 2   **Roll No.** ☐☐☐☐☐☐☐☐☐☐   **MME-205**

M.TECH. (SEM–II)
CARRY OVER EXAMINATION 2016-17
ADVANCED MECHANICS OF SOLIDS

Time : 3 Hours   *Max. Marks : 100*

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

1.   **Attempt any Two parts of the following:**   **2 × 10 = 20**

   (a)   At a point p, the rectangular stress components are

   $\sigma_x = 1, \sigma_y = -2, \sigma_z = 4, \tau_{xy} = 2, \tau_{yz} = -3 \ and \ \tau_{xz} = 1$, all in units of kPa. Find the principal stresses and check for invariance.

   (b)   At a certain point in a drive shaft coupling, the stress components relative to axes (x, y, z) are σ_{xx} = 80 MPa, $_{yy}$ = 60MPa, $_{zz}$ = 20MPa, $_{xy}$20 MPa, $_{xz}$ = 40MPa, and $_{yz}$ = 10MPa

   (i)   Determine the stress vector on a plane normal to the vector R = i + 2j + k.

   (ii)   Determine the principal stresses $\sigma_1, \sigma_2 \ and \ \sigma_3$ and the maximum shear stress τ_{max} .

   (c)   Derive and explain the generalized Hook's law.

2.   **Attempt any Two parts of the following:**   **2 × 10 = 20**

   (a)   Explain in detail Tresca criterion of failure of ductile materials.

   (b)   Explain the analysis for torsion of elliptical cross section member.

   (c)   Apply Prandtl torsion theory to thin rectangular sections and derive the expressions for approximate formula for shear stress distribution?

3.   **Attempt any Two parts of the following:**   **2 × 10 = 20**

   (a)   Derive compatibility equation in terms of stress for the case of plane stress without body force?

   (b)   Explain in detail the methods of reducing harmful effects of stress concentrations.

   (c)   Write down the elements of reduced stiffness matrix of an unidirectional lamina stating the assumptions in evolving this matrix. Derive expression for the reduced stiffness coefficients in terms of elastic coeffic.

                                                                    P.T.O.

4. **Attempt any Two parts of the following:** **2 × 10 = 20**

    (a) Discuss in detail the following properties as applicable to composites:

        (i) Physical properties   **(ii)** Fatigue resistance properties

    (b) What are the failure criteria of composite materials? Explain any one of them in detail.

    (c) Two carbon steel balls, each 25 mm in diameter are pressed together by a force F=18 N. at the centre of the area of contact, determine the values of the principal stresses, and the octahedral shear stress. For carbon steel E= 207 GPa, and = 0.292

5. **Attempt any Two parts of the following:** **2 × 10 = 20**

    (a) Explain the following **(i)** Brittle fracture **(ii)** Stress intensity factor.

    (b) Define notch sensitivity? What do you understand by fracture toughness?

    (c) Write short notes on isotropy, anisotropy and orthotropy.