B. Tech Degree IV Semester (Supplementary) Examination January 2011

ME 403 ADVANCED MECHANICS OF SOLIDS

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer ALL questions)

(8 x 5 =40)

I. (a) Explain generalized Hook's law.
(b) What is stress function? Explain.
(c) Show that the radial stress in hollow cylinder is always compressive in nature.
(d) Derive the expressions for radial and circumferential strains.
(e) What is stress ellipsoid? Explain the different conditions of stress ellipsoid.
(f) State and explain Maxwell's reciprocal theorem.
(g) Explain shear centre of flexure.
(h) Derive an expression for the rotation per unit length of a thin walled tube subjected to torsion.

PART B

(4 x 15 = 60)

II. (a) The stress state at a point is given by $T = \begin{bmatrix} 10 & 4 & 0 \\ 4 & 12 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

Determine the principal stresses. The stresses are in N/mm^2. (8)

(b) The stress state at a point is given by the three principal stresses 100, 120 and 200 N/mm^2 . Determine the shear and normal stresses on a plane which has normal with direction cosines as $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ and 0. (7)

OR

III. Derive equilibrium equations for plane stress state. (15)

IV. Derive the expressions for stress distributions for bending of curved bars. (15)

OR

V. A flat steel disk of 70cm outside diameter and 10cm inside diameter rotates at 2500 rpm. The disk and shrouding cause a tensile rim loading of 4.5 x 10^3 N/m^2. The maximum stress at this speed is to be 11.5 x 10^3 N/m^2 . Find the maximum shrinkage allowance on the diameter when the disk is rotating. (15)

VI. Explain Octahedral stresses. The state of stresses at a point is characterized by the components.

$\sigma x = 100 \times 10^6 N/m^2$, $\sigma y = -40 \times 10^6 N/m^2$,

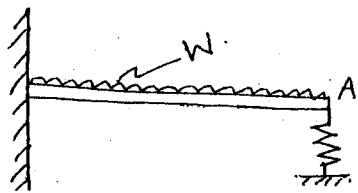
$\sigma z = 80 \times 10^6 N/m^2$

$\tau_{xy} = \tau_{yz} = \tau_{zx} = 0.$

Determine the extreme values of shear stresses, their associated normal stresses, the octahedral shear stress and its associated normal stress. (15)

OR

VII A cantilever is supported at the free end by an elastic spring of spring constant 'K'. Determine the reaction at the free end 'A'. The cantilever beam is uniformly loaded . The intensity of loading is 'W'. Calculate the reaction at free end if K=200 N/mm and W=2000 N.



(15)

VIII. Derive an expression for shear centre of a channel section. (15)

OR

IX. A shaft of elliptical section is subjected to torque of 2.5 KNm. If the maximum shear stress in the shaft is not to exceed 80MN/m^2, determine

(i) Major and minor axes, if major axis = 1.5 minor axis
(ii) Angular twist per meter length.

Take Modulus of rigidity = 80GN/m^2. (15)

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