BTS (C) – V – 06 – 029 (H)

B. Tech Degree V Semester (Supplementary) Examination May 2006

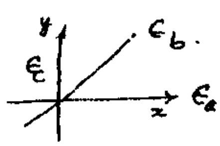
ME 503 ADVANCED MECHANICS OF SOLIDS

(2002 Admissions onwards)

Time : 3 Hours | Maximum Marks : 100

I. (a) In a flat plate a state of plane strain exists. If $\sigma_x = 14\,MPa$, $\tau_{xy} = 4\,MPa$ and $\in_z = -3.6\times10^{-4}$ find the value of σ_y and the principal stresses. (10)

(b) The strains measured by a 3 – element rectangular rosette are given below. Find the principal strains. (Figure)
$\in_a = 700\times10^{-6}$, $\in_b = 300\times10^{-6}$, $\in_c = 300\times10^{-6}$. (10)



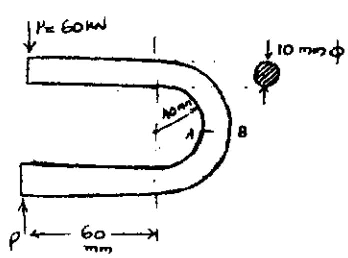
OR

II. (a) Determine whether the following $\phi = \frac{3F}{4h}\left(xy - \frac{xy^3}{3h^2}\right) + \frac{p}{2}y^2$ can be used as a stress function. If so, determine the components of stresses represented by it. (10)

(b) Obtain the expressions for σ_x & σ_y in terms of Lame's constants, strain components and dilatation. (10)

III. (a) Derive the expressions for strain components in polar co-ordinates. (8)

(b) Calculate the stresses at points A & B of the U – frame shown. (12)



OR

IV. (a) Derive the expressions for radial and tangential stresses in a thick cylinder of inner radius 'a' and outer radius 'b' and subjected to an internal pressure of P_i. (10)

(b) A thick cylinder of internal radius 50 mm and external radius 125 mm is subjected to an internal pressure of 10 N/mm^2. Determine the variation of radial and tangential stresses across the wall thickness. (10)

(Turn Over)

V. (a) Derive the differential equations of equilibrium in 3 – Dimensional Cartesian co-ordinates. (10)

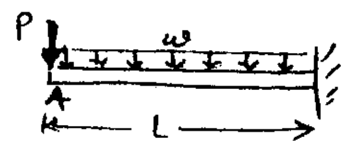
(b) Derive the equations of equilibrium in terms of displacements. (10)

OR

VI. The stress components at a point are given by $\begin{bmatrix} 10 & 5 & 6 \\ 5 & 8 & 10 \\ 6 & 10 & 6 \end{bmatrix} MPa.$ Calculate the principal stresses and the orientation of principal planes. (20)

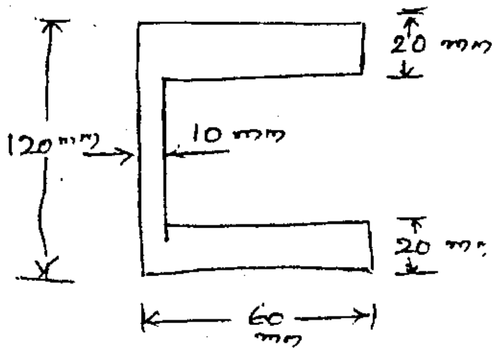
VII. (a) State and explain the Castigliano's theorems. (8)

(b) A cantilever beam AB supports a uniformly distributed load w and a concentrated load P as shown. If L = 2 m, w = 4 kN/m, P = 6 KN and EI = 5 MN m^2 determine the deflection at A. (12)



OR

VIII. A channel section shown is subjected to a transverse shear force. Determine the location of the shear center. (20)



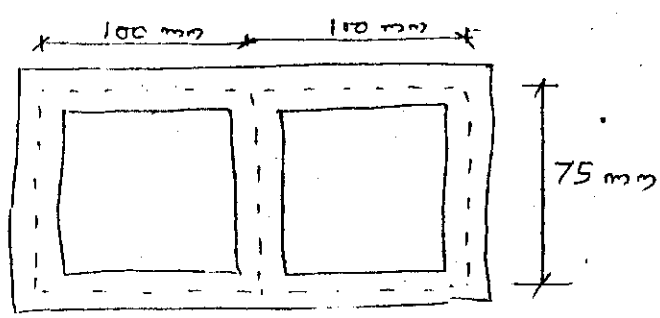
IX. Derive the expressions for stresses in a bar of elliptical cross section subjected to a torque T. Also determine the torsional rigidity. (20)

OR

X. A steel box girder has the cross section shown. The wall thickness is 10 mm. If the shear stress due to torque is limited to 100 Pa; determine –

(i) the maximum permissible torque

(ii) the twist per unit length. (20)



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