B. Tech Degree V Semester Examination, November 2009

ME 503 ADVANCED MECHANICS OF SOLIDS

(2002 Scheme)

Time : 3 Hours Maximum Marks : 100

I. a. Derive strain-displacement relations and compatibility equations for a two dimensional condition. (12)

b. Explain about plain stress and plain strain with the help of examples. (8)

OR

II. a. Derive differential equations of equilibrium for two dimensions. (8)

b. During the testing of an automobile using a 60^0 delta rosette, the following observations were made.

(i) $\epsilon_a = 280\times10^{-6}$, $\epsilon_b = 160\times10^{-6}$, $\epsilon_c = -80\times10^{-6}$

Find the principal strains and maximum shear strain> (12)

III. a. Derive an expression for strain components in polar co-ordinates. (8)

b. A thick cylinder of internal diameter 100mm and external diameter 200mm is subjected to an internal pressure of $10N/mm^2$. Find the variation of radial stress and circumferential stress across wall thickness. (12)

OR

IV. a. Derive an expression for radial and tangential stresses developed in a disk of uniform thickness with inner radius 'a' and outer radius 'b' rotating with an angular velocity w. (12)

b. A steel tube of 300mm outer diameter is to be shrunk on another steel tube of 90mm internal diameter. After shrinking the diameter of the junction is 180mm. Before shrinking the difference in the diameter of the junction is 0.12mm. Determine

(i) Shrinkage pressure at interface

(ii) Temperature difference to make the assembly.

Take E = 200 GPa, $\nu = .3$, $\alpha = 10\times10^{-6}$ per ^{0}C. (8)

V. a. Derive Cauchy's stress formulae and hence explain about stress ellipsoid. (8)

b. Derive the cubical equation for determining principal stresses in a three dimensional problem. (12)

OR

VI. The state of stress at a point is given as

$$\tau ij = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} KPa$$

Find the principal stresses and principal axes. (20)

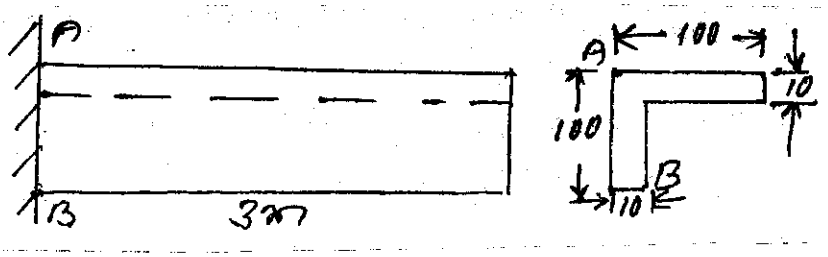
VII. a. Explain about the concept of shear centre. (8)

b. Explain about principle of virtual work and castigliano's theorems. (12)

OR

(Turn over)

VIII. A cantilever of equal angle section 100 x 100 x 10mm weighing 120N/m is 3m long and is fixed at one end. The principal moments of inertia are 2822 x 10^3 mm^4 and 718 x 10^3 mm^4. Calculate the bending stresses at points A and B due to self weight of beam (20)



IX. a. Explain about prandtt's membrane analogy. (12)

b. Explain about shear flow. (8)

OR

X. Derive an expression for stresses in a bar of elliptical cross section subjected to a torque T. (20)

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