

B. Tech Degree IV Semester Examination April 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) Define plane stress and plain strain. Give examples.
 (b) State and explain St. Venant's principle.
 (c) Represent all the nine stress components on a cubical element with positive directions.
 (d) Show the variation of σ_r and σ_θ for a cylinder subjected to (i) external pressure (ii) internal pressure.
 (e) State and explain the concept of virtual work.
 (f) State Castigliano's theorems.
 (g) Write short notes on (i) shear flow (ii) shear centre.
 (h) Explain membrane analogy.

PART B

- (4 x 15 = 60)
- II. (a) Explain the construction of a 2-D stress problem.
 (b) Write notes on strain measurement. *is Mohr circle is for strain measurement?*

OR

- III. (a) Explain compatibility conditions.
 (b) Explain stress function with examples.

- IV. (a) Obtain the general expression for σ_r and σ_θ for a rotating disk of uniform thickness.
 (b) Derive the general equilibrium equations in polar coordinates.

OR

- V. A flat steel disk of 75cm outside diameter with 15 cm diameter hole is shrunk around a solid steel shaft. The shrink fit allowance is 1 part in 1000 (ie, an allowance of 0.0075cm radius). $E = 214 \times 10^6$ kPa.
 (i) What are the stresses due to shrink fit?
 (ii) At what rpm will the shrink fit loosen up as a result of rotation?

- VI. Write notes on (i) Stress invariants, (ii) Reciprocal theorems in energy methods, (iii) Octahedral shear stress.

OR

- VII. Find the principal stresses and check for invariance for the following case.

$$\tau_{ij} = \begin{bmatrix} 1 & 2 & 1 \\ 2 & -2 & -3 \\ 1 & -3 & 4 \end{bmatrix} \quad (15)$$

- VIII. Derive an expression for stresses acting on a bar of elliptical cross section. Also find the maximum stress, angle of twist and torsional rigidity.

OR

- IX. Prove that $\theta = \frac{q}{2AG} \oint \frac{ds}{t}$ for thin walled tubes.