D 30987 (Pages : 2) Name..................................

Reg. No..................................

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION OCTOBER 2012

ME 09 502—ADVANCED MECHANICS OF SOLIDS

(2009 Scheme)

Time : Three Hours Maximum : 70 Mark.

Part A

Answer **all** *questions.*

I. (a) Define principal planes.

(b) Explain the significance of shearless plane.

(c) Define plane stress.

(d) Explain briefly unsymmetrical bending.

(e) What is meant by membrane analogy ? (5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

II. (a) Explain Saint Venant's princip...

(b) Write down compatibility equations in terms of Airy's stress function.

(c) What is meant by axisymmetric problems ? Give examples.

(d) Explain the effect of small central hole in a rotating disc.

(e) Explain minimum potential energy theorem.

(f) Explain warping of non circular shaft. (4 × 5 = 20 marks)

Part C

III. (a) State the condition under which the following is a possible system of strain :

$$\varepsilon_{xx} = a + b(x^2 + y^2) + x^4 + y^4, \; \gamma_{yz} = 0$$

$$\varepsilon_{yy} = \alpha + \beta(x^2 + y^2) + x^4 + y^4, \; \gamma_{2x} = 0$$

$$\gamma_{xy} = A + B\,xy(x^2 + y^2 - c^2), \quad \varepsilon_{zz} = 0.$$

Or

(b) If the displacement field given by $u_x = k\,xy, u_y = k\,xy, u_z = 2k\,(x+y)z$ where k is a constant.

(i) Write down the strain matrix.

(ii) What is the strain in the direction $n_x = n_y = n_z = \frac{1}{\sqrt{3}}$. (10 marks)

Turn over

IV. (a) Derive the equilibrium equations in polar coordinates.

Or

(b) Derive the expressions for the stresses in a rotating disc.

(10 marks)

V. (a) Derive an expression for the strain energy in a cantilever due to bending and shear under a concentrated edge load P.

Or

(b) Locate the shear center for a Channel Section.

(10 marks)

VI. (a) Show by membrane analogy that a multiply connected section under torsion is much stronger and stiffer compared to a singly connected section of same cross sectional area.

Or

(b) Derive the formula for the stresses and deformations in a thin hollow section under torsion using the principle of shear flow.

(10 marks)

[4 × 10 = 40 marks]