Total No. of Questions : 8] | Total No. of Printed Pages : 3

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MVSE–102

M. E./M. Tech. (First Semester) EXAMINATION, March, 2010

(Structural Engg. Branch)

STRENGTH OF MATERIAL AND THEORY OF ELASTICITY

(MVSE–102)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks. Data missing and found necessary may be suitably assumed.

1. (a) Given state of stress at a point : 12

$$\sigma = \begin{pmatrix} xy^2 & xy(3+z) & yz^2 \\ xy(3+z) & y^2(3x-z^2) & x^2y^2z^2 \\ yz^2 & x^2y^2z^2 & 4z^3+y \end{pmatrix}$$

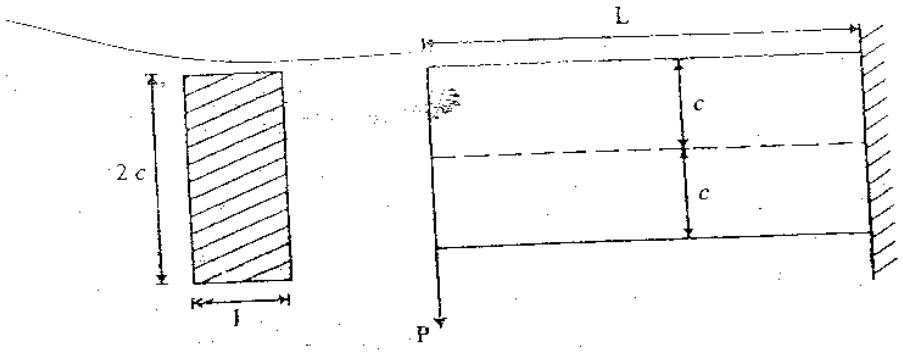
Obtain body force distribution at (1, 1, 1) so that the continuum is in equilibrium.

(b) Differentiate between plane stress and plane strain problems. 8

2. For a cantilever beam (fig. 1), subjected to a point load P at the free end, the stress solution is given as : 20

$$\sigma_x = -\frac{P_{xy}}{I};\ \sigma_y = 0;\ \tau_{xy} = -\frac{P}{2I}(c^2 - y^2)$$

P.T.O.



Obtain the expression for the maximum transverse deflection at the free end.

3. An infinitely large thin plate with a small circular hole is subjected to bi-axial state of equal tensile stress. Choose an appropriate stress function and prove that the stress distribution at the edge of the hole is uniform. 20

4. Find the principal stresses and principal planes for the state of stress at a point given by : 20

$$\sigma = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix} \text{ MPa}$$

5. Show by considering the equilibrium of the whole bar that when all stress components vanish except τ_{xz}, τ_{yz}, the loading must consist of torsional couples only. 20

6. The state of stress at a point is given as : 20

$$\sigma = \begin{pmatrix} 40 & 20 & 15 \\ 20 & -40 & 25 \\ 15 & 25 & 60 \end{pmatrix}$$

Obtain the resultant stress on an oblique plane equally inclined to the three axes. Also find the normal and the shear stress components.