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Roll No. .....

MVSE–102

M. E. (First Semester) EXAMINATION, Dec., 2010

STRENGTH OF MATERIAL AND THEORY OF ELASTICITY

(MVSE–102)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions.

1. (a) State the assumptions made in the theory of elasticity. 6

   (b) Derive the following equations : 14

$$\sigma_x = \lambda_e + 2G \in x$$

$$\sigma_y = \lambda_e + 2G \in_y$$

$$\sigma_z = \lambda_e + 2G \in_z$$

where, $\lambda = \dfrac{\mu \in}{(1+\mu)(1-2\mu)}$.

2. In a 2-D problem, derive the following equations : 20

   (i) Compatibility equations

   (ii) Differential equations

   Using the above explain how a problem in elasticity can be solved.

3. (a) Derive the equations of equilibrium in polar co-ordinates. 8

   (b) For the case of axially symmetric stress distrib... taking the general solution of the compat... equation in the form :

$$Q = A \log r + B r^2 \log r + C r^2 + D$$

   calculate the maximum circumferential stress ... cylinder of internal radius r_i and external radius ... subjected to uniform pressure p_i and p_e at the ... and outer surface.

4. Find out the expression for vertical and horizontal deformations of a circular ring of radius R, subjected ... dimetrical opposite loads P-P, using energy method. 20

5. Why do we use polar co-ordintate systems ? Derive equations of equilibrium and compatibility in polar co-ordinates. 20

6. (a) What do you understand by membrane analogy ? How is it useful in torsional analysis ? 10

   (b) Derive the expressions for shear stress, angle of twist and twisting moments in case of a thin rectangular section. 10

7. (a) What are the rectangular components of stress in three dimensions ? 10

   (b) Establish equation of equilibrium in three dimension. 10

8. Write short notes on any *four* of the following : 5 each

   (i) Boundary conditions

   (ii) Strain energy in torsion

   (iii) Torsional analysis of rolled sections

   (iv) Saint-Venant's principle

   (v) Pure bending of prismatic bars