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Roll No.

MVSE-102

M.E./M.Tech., I Semester

Examination, November 2018

Strength of Material and Elastic Theory

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Define stress invariants stress tensor and also derive the expression for three invariants of stress tensor.

   b) The components of stress at are given as $\sigma_x = 6N/mm^2$, $\sigma_y = 5N/mm^2$ and $\sigma_z = 4N/mm^2$ $\tau_{xy} = 3N/mm^2$ and $\tau_{yz} = 4N/mm^2$ determine the principal stresses and principal planes.

2. a) Derive the strain components in rectangular Cartesian coordinates.

   b) Derive the compatibility equation in Cartesian coordinates system in two dimensional (2-D) problems.

3. a) Derive the equations of equilibrium of stresses in polar co-ordinate system.

   b) Differentiate between plane stress and plane strain problems.

4. 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 stress distribution at the edge of hole is uniform.

5. a) Evaluate the principal stress values and the orientation of the major principal plane for the state of stress given below.

$$\sigma = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

   b) Differentiate between Orthotropic and isotropic elastic materials

6. a) Explain in brief pure bending of prismatic bars.

   b) Establish equilibrium in three dimensional (3-D) problems.

7. What is St. Venant's approach for the solution of torsional problems? Derive the expression for shear stress, angle of twist and twisting moment in case of thin rectangular section.

8. Write short note on following (any four):

   i) Theory of superposition

   ii) Stress function

   iii) Membrane analogy in torsional analysis

   iv) Two dimensional problem in Fourier series

   v) Boundary conditions

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