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10CV661

Sixth Semester B.E. Degree Examination, June/July 2019
Theory of Elasticity

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain : i) Stress at a point
ii) Generalised Hooke's law. **(10 Marks)**

b. The state of stress at a point is given as
$\sigma_x = 200MPa$, $\sigma_y = -100MPa$, $\sigma_z = -100MPa$,
$\tau_{xy} = \tau_{yz} = \tau_{xz} = 200MPa$, determine the normal stress, shearing stresses on the octahedural plane. **(10 Marks)**

2 a. Derive the differential equation of equilibrium in two dimensional Cartesian coordinate system. **(10 Marks)**

b. Derive the biharmonic equation in polar co-ordinate system. **(10 Marks)**

3 a. The state of stress at a point is given by the following matrix. Determine the principal stresses and their principal directions on any one of plane.

$$\begin{bmatrix} 9 & 6 & 3 \\ 6 & 5 & 2 \\ 3 & 2 & 4 \end{bmatrix} MPa .$$ **(10 Marks)**

b. Derive the compatibility equation for plane stress problem in Cartesian co-ordinates when body forces are absent. **(10 Marks)**

4 Determine the stress components and sketch their variations in a region included in y = 0, y = h, x = 0 on the side x positive for the given stress function.

$$\phi = -\left(\frac{F}{h^3}\right) xy^2(3h - 2y).$$ **(20 Marks)**

PART – B

5 a. Derive the equations of equilibrium for two dimensional problems in polar co-ordinates. **(10 Marks)**

b. Show that $\phi = -\frac{Pr^2}{2\pi}\left(\theta - \frac{\sin 2\theta}{2}\right)$ represents a stress function. **(10 Marks)**

6 a. Show that $\phi = A \log r + Br^2 \log r + Cr^2 + D$ is a valid stress function for two dimensional problems in polar co-ordinates with axisymmetric stress distribution. **(10 Marks)**

b. Derive the expressions for stresses in axi-symmetri case of a hollow cylinder subject to uniform pressure on inner and outer surfaces. **(10 Marks)**

7 Discuss the effect of circular hole on the stress distribution in an rectangular plate subjected to tensile stress in x-direction only and hence evaluate the stress concentration factor. **(20 Marks)**

8 Derive the expression for stress components at any point of a shaft of elliptical cross section having major and axis and minor axis 2a and 2b respectively. Also obtain the angle of twist of above section with major and minor axis. **(20 Marks)**

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