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10CV661

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Theory of Elasticity

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Obtain strain displacement relationship in Cartesian form. **(06 Marks)**

b. Calculate the principal stresses and their directions for the displacement fields in a plane stress idealization shown below. Given E = 200GPa and Poisson's ration = 0.25 at point (2,4).

$u = (4x^4 + 2x^2y^2 + x + 3) \times 10^{-3}$

$v = (y^4 + 3x^2y + 1) \times 10^{-3}$ **(14 Marks)**

2 a. Derive the compatibility equation in terms of stress components for plane strain problems. **(10 Marks)**

b. Check whether $\phi = -\frac{F}{d^3} xy^2 (3d - 2y)$ represents a stress function or not. Find the stress components. **(10 Marks)**

3 a. What is meant by strain rosette and how it is used to determine the principal strain at a point? **(05 Marks)**

b. The strain measured from a rectangular strain rosette are $\epsilon_0 = 2 \times 10^{-3}$; $\epsilon_{45} = 5 \times 10^{-3}$ and $\epsilon_{90} = 1.0 \times 10^{-3}$. Determine : (i) Principal strains and their direction (ii) Principal stresses (iii) Maximum shear stress. Take E = 200GPa and $\mu = 0.25$. **(15 Marks)**

4 a. Explain St. Venant's principal. **(03 Marks)**

b. Investigate what problem to solved by the following stress function applied to the region included in x = 0 and x = ℓ and y = ± C. $\phi = \frac{3F}{4C}\left\{xy - \frac{xy^3}{3c^2}\right\} + \frac{py^2}{2}$ **(17 Marks)**

PART – B

5 a. Derive the differential equations of equilibrium in polar co-ordinate system. **(10 Marks)**

b. Determine σ_r, σ_θ and $\tau_{r\theta}$ for the stress function $\phi = -\frac{p}{\pi} r\theta \operatorname{Sin} \theta$. Find their values at P = 10Mpa ; r = 2 and $\theta = 45$ for axisymmetric case. **(10 Marks)**

6 a. Derive the expression for stress function in case of axi symmetric stress distribution. Hence obtain the expressions for stress components. **(08 Marks)**

b. Obtain the expressions for stress components in a thin solid circular rotating disc and show the variation of same across diametric section. **(12 Marks)**

7 Obtain the stress concentration factor for a plate containing a small circular hole under the action of uniform tensile stress along its longitudinal axis. **(20 Marks)**

8 a. For torsional problems show that the stresses function must satisfy $\nabla^2\phi = -2G\theta$ with usual notations. **(08 Marks)**

b. Obtain the expression for maximum shear stress in a shaft of elliptical cross section having major and minor axis 2a and 2b respectively. **(12 Marks)**

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