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10CV661

Sixth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Theory of Elasticity

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain : i) Generalized Hooke's law ii) Saint Venant's principle. **(10 Marks)**

b. Explain plane stress and plane strain problems with examples. **(10 Marks)**

2 a. Derive Lame's constants with usual notations. **(10 Marks)**

b. Derive the compatibility equation for plane stress condition, in the presence of body forces. **(10 Marks)**

3 a. Derive differential equations of equilibrium for two dimensional body. **(10 Marks)**

b. Using stress – strain relationship and equations of equilibrium, show that the displacement in plane stress problem in the absence of body force must satisfy the equation :

$$\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\left(\frac{1+\mu}{1-\mu}\right)\frac{\partial}{\partial x}\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}\right)=0.$$ **(10 Marks)**

4 a. Explain strain gauge and strain rosette with figures. **(10 Marks)**

b. Investigate what problem does stress function :

$$\phi=\frac{3F}{4C}\left[xy-\frac{xy^3}{3C^2}\right]+\frac{P}{2}y^2$$

solves, when applied to the region $y = \pm c$; $x = 0$ and all positive. **(10 Marks)**

PART – B

5 a. Derive compatibility equation in polar co-ordinates. **(10 Marks)**

b. Show that $\phi = A\log r + Br^2\log r + Cr^2 + D$ is a stress function. Also find the stress components. **(10 Marks)**

6 a. Explain axi-symmetric problem with example. **(08 Marks)**

b. Derive the expression for radial and tangential stress of a thick cylinder subjected to internal pressure 'P_i' and external pressure 'P_0'. **(12 Marks)**

7 Discuss the effect of circular hole on stress distribution in plate subjected to uniform tensile stress 'P'. **(20 Marks)**

8 a. Derive the differential equation of torsion in the form $\nabla^2\phi = -2G\theta$. **(10 Marks)**

b. Prove that the angle of twist of an elliptical section with major axis '2a' and minor axis '2b' is given by $\theta=\frac{T(a^2+b^2)}{\pi a^3 b^3 G}$. **(10 Marks)**

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