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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 Lamé'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 :

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.