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Code No: CE2901

GEC-R17

M. Tech I Semester Regular Examinations, February 2018

THEORY OF ELASTICITY

(Structural Engineering)

Time: 3 Hours

Max. Marks: 60

Note: Answer any **FIVE** questions. All Questions Carry Equal Marks.

5 × 12 = 60M

1. a) What is generalized Hooke's law? (3M)
b) Explain the compatibility conditions and their physical significance. Derive Beltrami – Mitchell compatibility equations in plane strain and derive the equations of Equilibrium in 2D case. (9M)
2. Determine principal stresses and principal strains for the state of stress at a point given below in kg/cm². (12M)

$$\begin{bmatrix} 200 & 30 & 40 \\ 30 & 100 & 20 \\ 40 & 20 & 50 \end{bmatrix}$$

3. Discuss various applications of polar coordinates and advantages of considering problem using polar coordinates. (12M)
4. Making use of equilibrium equations, stress-strain relation in three dimensions, show that the volume expansion 'e' satisfies the following differential equation. (12M)

$$\frac{\partial^2 e}{\partial x^2} + \frac{\partial^2 e}{\partial y^2} + \frac{\partial^2 e}{\partial z^2} = 0$$

5. Derive expression for Equations of equilibrium in three dimensions. (12M)
6. Obtain expression for torque and angle of twist of an elliptical shaft subjected to uniform torsion and draw contour lines for the wrapped cross section. (12M)
7. Explain with an example solution of torsional problems by energy method. (12M)
8. Derive the governing differential equation for a Plane stress problem in polar coordinates in terms of stress function. (12M)
