QPC: RJ20MTECH019 AR 19 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (First Semester – Regular) Examinations, June – 2021

MPCSE1010 – THEORY OF ELASTICITY AND PLASTICITY

(STRUCTURAL ENGINEERING)

Time: 2 hrs Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A **(2 x 10 = 20 Marks)**

Q1. Answer **ALL** questions

a. State Generalized Hooke's law
b. State the uses of Mohr's circle
c. Write the strain displacement relationship
d. Differentiate plane stress and plane strain problems
e. Write the equilibrium equations in terms of 2D polar coordinates
f. Define boundary value problem
g. Define plasticity
h. Define strain hardening
i. What is flow rule?
j. Define velocity field

PART – B **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions **Marks**

2. The stress tensor at a point is given by **(6)**

$$[\sigma] = \begin{bmatrix} 200 & -80 & 60 \\ -80 & 120 & -60 \\ 60 & -60 & -180 \end{bmatrix} \text{ MPa}$$

i) Find stress invariants

ii) Also find principal stresses and its orientation

3. The state of the stress at a point in a body is given by **(6)**

σx = 150 MPa σy = -180 MPa σz = 120 MPa

τxy = 90 MPa τyz = 100 MPa τxz = -60 MPa

Determine the strain components at this point if E = 210 GPa and Poissons' ratio = 0.3. Also find Lame's constants

4. Show that $\varphi = \frac{q}{8c}\left[\frac{y^5}{5c^2} + \left(\frac{l^2}{c^2} - \frac{2}{5}\right)y^3 - \frac{x^2y^3}{c^2} + 3x^2y - 2cx^2\right]$ is a stress function and what problem it solves when applied to the region x = ± l and y = ± c. **(6)**

5. A long closed cylinder has an internal radius of 100mm and an external radius of 250mm. It is subjected to an internal pressure of 80 MPa. Determine the maximum radial, circumferential and axial stresses in the cylinder **(6)**

6. A steel bolt is subjected to a bending moment of 300 Nm and a torque of 150 Nm. If the yield stress in tension for the bolt material is 250 MPa, determine the diameter according to (i) Tresca criteria and (ii) Von mises criteria **(6)**

7. Explain the following **(6)**
   (i) Octahedral shearing stress theory
   (ii) Sand heap analogy
   (iii) Uniqueness theorem

8. Explain slip flow and Plastic flow **(6)**

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