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M.TECH

Total Number of Pages : 1

M.TECH 1<sup>ST</sup> SEMESTER REGULAR EXAMINATIONS, DECEMBER 2018  
APPLIED ELASTICITY AND PLASTICITY

Branch: MD, Subject Code:MMDPC1010  
(Regulations 2018)

Time: 3 Hours

Max Marks : 70

Question Code: RD18002024

PART-A (10 X 2=20 Marks)

1. Answer the following questions.

- What is Stress invariants?
- What is deviatoric stress? Express it in tensor notation ?
- What is compatibility equation ? Express it 2-D without body force?
- What are stress tensors.
- Describe the equilibrium equations in polar coordinates.
- Express the stress components in terms of an Airy stress function.
- What do you mean by thin walled open and closed section, explain with an example.
- State St. Venants principle.
- Write all strain components( longitudinal and shear )in the form of displacements.
- Explain the boundary condition in the solution of a problem?

PART-B (5 X 10=50 Marks)

Answer any five questions from the following.

- 2 a) The following are the principal stress at a point in a stressed material. Taking  $E = 210\text{kN} / \text{mm}^2$  and  $\nu = 0.3$ , calculate the volumetric strain and the Lamé's constants. Take  $\sigma_x = 200\text{N} / \text{mm}^2$ ,  $\sigma_y = 150\text{N} / \text{mm}^2$ ,  $\sigma_z = 120\text{N} / \text{mm}^2$ . [6]
- b). Write the difference between Elstatic deformation and elasto plastic deformation. [4]
- 3.a) Derive the differential equation of equilibrium in 3D rectangular coordinates. [5]
- b)Describe  $\sigma_{oct}$  and  $\tau_{oct}$  in form of stress invariants ? [5]
- 4.a)Explain various elastic-plastic relationships with equivalent mechanical models and empirical relationships? [5]
- b)Describe Prandatl's approach to solve torsion problem [5]
5. A steel shaft is subjected to an end thrust producing a stress of 100 MPa and the minimum shearing stress on the surface arising from torsion is 80 MPa.The yield point of the material in simple tension was found to be 300 MPa .Calculate the factor of safety of the shaft according to: (i) Maximum shear stress theory [5+5]
- (ii)Maximum distortion energy theory
6. At a point P, The rectangular stress components are  $\sigma_x = 1, \sigma_y = -2, \sigma_z = 4, \tau_{xy} = 2, \tau_{yz} = -3$  and  $\tau_{xz} = 1$  all units of kPa. Find the principal stresses and check for invariance. [5+5]

7a.The stress tensor at a point is given as [6]

$$\begin{bmatrix} 200 & 160 & -120 \\ 160 & -240 & 100 \\ -120 & 100 & 160 \end{bmatrix} \text{ kN/m}^2$$

Determine the strain tensor at this point. Take  $E = 210 \times 10^2 \text{ kN/m}^2$  and  $\nu=0.3$ .

- Discussed briefly on Airy's strss function. [4]
8. Write short notes on
- Mindlin plate theory
  - Tresca's Theory [5]
- ==0== [5]