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Total Number of Pages: 02

M.TECH
MDPC102

1st Sem M.Tech Regular/ Back Examination – 2015-16
Subject Name: APPLIED ELASTICITY AND PLASTICITY
BRANCH(S):MECHANICAL SYSTEM DESIGN

Time: 3 Hours

Max marks: 70

Q.CODE:T966

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1. Answer the following question.

(2x10)

- What do you mean by stress at a point?
- Explain what plane stress and plane strain problem with example are.
- What do you mean by state of pure shear?
- State the significance of yield criteria and name any two.
- What do you mean by π -plane?
- Write the assumptions made in Kirchhoff's plate theory.
- What do you mean by thin walled open and closed section, explain with an example.
- State St. Venants principle.
- What is the importance of boundary condition in the solution of a problem?
- Differentiate between elastic and plastic deformation.

Q2.(a) Prove that principal planes corresponding to a given state of stress at a point are Mutually orthogonal. (5)

(b) Write down the plastic stress-strain relationship with diagram. (5)

3. Derive the differential equation of equilibrium in 3D rectangular coordinates. (10)

Q4.(a) The state of stress at a point is characterized by the components

$$\sigma_x=12.31, \sigma_y=8.96, \sigma_z=4.34, \sigma_{xy}=4.20, \sigma_{yz}=5.27, \sigma_{zx}=0.84.$$

Decompose the given state of stress into hydrostatic state and pure shear state.

(b) Determine the shearing stress and normal stress in an octahedral plane if the

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Q5.The displacement field for a body is given by (10)

$$U = [(x^2 + y^2 + 2)i + (3x + 4y^2)j + (2x^3 + 4z)k].$$

Determine the magnitude of principal strain and volumetric strain.

Q6.Consider the following case of plane stress, $\sigma_x = 2/3(10^3)\text{kg/cm}^2$, $\sigma_y = 4/3(10^3)\text{kg/cm}^2$, $\sigma_{xy} = 1/3(10^3)\text{kg/cm}^2$. If the yield stress is $4/3(10^3)\text{kg/cm}^2$ in an uniaxial tensile test, determine whether there is yielding according to Tresca and Vonmises condition or not. (10)

7.What do you mean by compatibility condition. Derive the First group and Second group compatibility condition. (10)

8.Write short notes on any two (5x2)

(a) Mindlin plate theory

(b) Prandtl's approach to solve torsion problem

(c) Airy's stress function.

(d) Stress invariants.