D17002013

**Registration No:** | | | | | | | | | | |

**Total Number of Pages : 02** **M.TECH**

**M.TECH 1ST SEMESTER REGULAR EXAMINATIONS, DECEMBER 2017**
**APPLIED ELASTICITY AND PLASTICITY**
**Branch: MD, Subject Code:MMDPC1010**
**Time: 3 Hours**
**Max Marks : 70**
**The figures in the right hand margin indicate marks.**

## PART-A (10 X 2=20 MARKS)

**1. Answer the following questions.**

a) What are compatibility equations?
b) Explain what plane stress and plane strain problem with example .
c) Express the stress compatibility equation for plane strain case.
d) Give the equations relating to bending of a beam by uniform load.
e) Give the relationship between Cartesian and polar co-ordinates.
f) Give the Prandtl equation
g) State Saint-Venant's theory.
h) Give the Von-Mises yield criteria.
i) Write the assumptions made in Kirchhoff's plate theory.
j) Give the assumptions in plastic analysis.

## PART-B (5 X 10=50 MARKS)

**Answer any five questions from the following.**

2. The state of strain at a point is given by $\varepsilon_x = 0.001$, $\varepsilon_y = -0.003$, $\varepsilon_z = \gamma_{xy} = 0$, $= -0.004$, $\gamma_{yz} = 0.001$.Determine:
   a. The stress tensor at this point.
   b. Also find Lame's constant.
   Take $E = 210 * 10^6 kN / m^2$ , Poisson's ratio = 0.28.

3. a. A homogeneous and isotropic elastic solid with Young's modulus 200 GPa and Poisson's ratio 0.3 is subjected to a displacement field given by

$$u = (x^3y^2z - 4xy^2z^2)10^{-4}$$
$$v = (x^2y^2z^3 + 3xyz^2)10^{-4}$$
$$w = (2x^4 - 3y^2z^2 + xyz^4)10^{-4}$$

   Evaluate the stress components at a point whose co-ordinates are (2.5, 4.0, -6.0).
   b. Express the above state of stress as the sum of its spherical and deviator components.

4. a. Express the stress components in terms of an Airy stress function. **(2)**
   b. Given the stress function $\varnothing = (H/\pi)z \tan^{-1}(x/z)$ . Determine whether stress function $\varnothing$ is admissible. If so determine the stresses. **(8)**

5. a. Write the assumptions made in Kirchhoff's plate theory. **(2)**

b. A steel tube, which has an outside diameter of 10cm and inside diameter of 5cm, is subjected to an internal pressure of 14 MPa and an external pressure of 5.5 MPa. Calculate the maximum hoop stress in the tube. **(8)**

6. a. Detail the experimental verification of st.Venant's Theory of plastic flow in detail.
   b. State and prove kirchoff's uniqueness theorem. **(6)**

7. a. The stress tensor at a point is given as

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

   Determine the strain tensor at this point. Take E = 210 X $10^2$ kN/$m^2$ and v=0.3. **(4)**
   b. Write the difference between Symmetric bending and un-symmetric bending.

8. Write short notes on:
   (a) Elstatic deformation and elasto plastic deformation
   (b) Isotropy and anisotropy.

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