CBCS Scheme

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16MDE252

Second Semester M.Tech. Degree Examination, Dec.2017/Jan.2018
Theory of Plasticity

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer any FIVE full questions, choosing one full question from each module.*
2. *Missing data, if any, may be suitably assumed.*

Module-1

1 a. The stress Tensor at a point is given by

$$\tau_{ij} = \begin{bmatrix} 50 & 50 & 150 \\ 50 & 100 & 100 \\ 150 & 100 & 150 \end{bmatrix} \text{MPa}$$

Calculate for the plane having direction consin, $l = \frac{1}{\sqrt{6}}$, $m = \frac{1}{\sqrt{3}}$, and $n = \frac{1}{\sqrt{2}}$

i) Total stresses ii) Normal stress and shear stress. **(08 Marks)**

b. The state of stress at a point is given by the following stress tensor.

$$\tau_{ij} = \begin{bmatrix} 50 & 50 & -40 \\ 50 & -30 & 30 \\ -40 & 30 & -100 \end{bmatrix} \text{MPa}$$

Calculate :

i) Stress in variants ii) Principal stress

iii) Direction of maximum principal stress iv) Spherical and deviator stress tensor. **(08 Marks)**

OR

2 a. Enumerate the various type of materials encountered in practice from plastic point of view. Also sketch the corresponding mechanical models. **(10 Marks)**

b. Explain the term cubical dilation. **(06 Marks)**

Module-2

3 a. What do you understand by a yield criteria? Explain the two yield criteria's commonly used. **(08 Marks)**

b. A thin walled tube of mean radius 100mm of wall thickness 4mm is subjected to a torque of 10kN-m. If the yield strength of the tube material is 122.5MPa. Determine the valve of axial load 'P' to be applied to the tube so, that the tube starts yielding according to Von-Mises yield criteria. **(08 Marks)**

OR

4 a. Explain Taylor and Quinney's experiments in support of yield criteria's. What are the important conclusions to be drawn from these experiments? **(08 Marks)**

b. Explain Haigh –Westergaard stress space. **(08 Marks)**

Module-3

5 a. Explain the Saint – Venant's theory of Plastic flow in detail. What are the limitations of this theory? **(10 Marks)**

b. What are the advantages of true stress strain diagram? **(06 Marks)**

OR

6 a. Explain the PrandtL – Reuss theory of plastic flow in detail. **(08 Marks)**

b. Brief out clearly the experimental verification of St. Venant's theory of plastic flow. **(08 Marks)**

Module-4

7 a. What are the assumptions made in the plastic analysis of beam and derive equations for bending moment of a beam subjected to i) Incipient yielding ii) Elasto – Plaster yielding iii) Fully Plastic yielding for an idelised stress strain curve. **(10 Marks)**

b. A Hollow circular shaft of inner radius 50mm and outer radius 100mm is subjected to a twisting couple of 5000 N-m. If the shear stress – strain diagram for the shaft material is given by $\tau = 350\ \gamma^{0.3}$, determine the maximum shear stress induced in the shaft and the angle of twist per unit length. **(06 Marks)**

8 a. Determine an expression for the maximum reduction possible in wire drawing considering friction. **(10 Marks)**

b. An Aluminium rod 6.25mm in diameter is drawn in to wire 5.60mm in diameter. The half die angle $\alpha = 10°6'$. Find the drawing stress considering friction, if $\mu = 0.04$ and $\sigma_0 = 35$MPa. Also calculate the maximum reduction possible. **(06 Marks)**

Module-5

9 a. Derive Geiringer's continuity equations. **(10 Marks)**

b. Explain the various properties of slip lines. How these properties help us in drawing the slip line field. **(06 Marks)**

OR

10 a. What do you understand by a slip line? How slip line Nets can be drawn? **(08 Marks)**

b. What do you understand by a hodograph? How a hodograph can be drawn? **(08 Marks)**

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