

Roll No. ....

**23001/23052**

**Mechanical Engg. Manufacturing  
Technology and Automation Ist Semester  
Examination – January, 2012**

**METAL FARMING ANALYSIS**

**Paper : M - 601**

***Time : Three hours ]***

***[ Maximum Marks : 100***

*Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complain in this regard, will be entertained after examination.*

**Note :** Attempt any *five* questions.

1. For the given state of stress, determine the principal stresses and their directions : 20

$$\tau_{ij} = \begin{bmatrix} 1250 & 800 & 0 \\ 800 & 850 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

2. (a) How stresses are calculated from Elastic strains. Strain-gage measurements made on the free

surface of a steel plate indicate that the principal strains are 0.004 and 0.001. What are the principal stresses ? 10

(b) Develop the equations of the displacement tensors for a condition of a strain at a point. Also explain the strain tensor and rotation tensor. 10

3. (a) Consider frictionless plane strain compression under conditions of homogeneous deformation. Describe the following quantities : stress and strain tensor, principal stresses, principal strains, hydrostatic stress, deviatoric stress, effective stress, and effective strain. 10

(b) Explain the process of work hardening. Mention its merits and demerits. 10

4. What is the difference between FDM and FEM. Explain in detail the schematic implementation of FEM for the solution of plastic flow problems ? 20

5. Using the simplified theory of rolling, plot the curves for the variation of rolling load with the rolling diameter, co-efficient of friction and mean strip thickness. 20

6. Derive the relationship of drawing operation of circular wire using slab method. A circular wire of 100mm dia is compressed between two dies and the co-efficient of friction is 0.15 and  $h = 12.35$ ,  $\sigma_0 = 25\text{kgf/cm}^2$ . Determine the maximum die pressure and die load ? 20

7. (a) Explain the flow curves for the following material conditions : 10
- (i) Rigid ideal plastic material
  - (ii) Ideal plastic with elastic regions
  - (iii) Strain hardening material
- (b) Explain octahedral shear stress and strain theory. 10
8. Write down a short explanation to express your understanding of the following terms : 10 × 2 = 20
- (a) Metal flow
  - (b) Physical metal forming simulator
  - (c) Inverse modeling
  - (d) Surface ring pattern
  - (e) Co-efficient of friction
  - (f) Damage parameter
  - (g) Dead zone
  - (h) Stagnant zone
  - (i) High-strain-rate zone
  - (j) Effective strain