Roll No. .....

23052

M.Tech 1st Semester (Mech. Engg.) (Manufacturing and Automation) Examination–May, 2014

METAL FARMING ANALYSIS

Paper 831/M-601-A

Time : 3 hours ***Max. Marks : 100***

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

Note : Attempt any **five** questions.

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

$$\tau_{ij} = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

2. (a) Describe three dimensional Mohr's circle of stresses and strains. Also describe the stress tenors and stress invariants. 10

(b) Explain forming defects, their effects and remedies. 10

3. (a) What is yielding ? Explain yielding criteria for ductile materials. 10

(b) Derive the relationship of drawing operation of circular wire using slab method. A circular wire of 100 mm dia is compressed between two dies and the co-efficient of friction is 0.15 and h = 12.35, σ_0 = 25kgf/cm^2. Determine the maximum die pressure and die load ? 10

4. State and explain upper bound solution techniques. Derive the relationship for plain strain compression of a rectangular bar. 20

5. (a) Derive the expression of roll pressure for flat strip rolling in the leading and lagging zone. 5

(b) What are the various process variables which control the rolling process ? 5

(c) Derive the expression for rolling torque acting on the rolls, assuming all the possible parameters. 10

6. Explain in detail the schematic implementation of FEM for the solution of plastic flow problems. 20

7. A block of lead 25 mm × 25 mm × 150 mm is pressed between flat dies to a size 6.25 mm × 100 mm × 150 mm. If the uniaxial flow stress is σ_0 = 6.9Mpa and μ = 0.25. Determine the pressure distribution over 100 mm dimension and the total forging load. 20

8. Write short notes on any **four** of the following : 5 × 4 = 20

   (a) The effect of temp. in metal working

   (b) Strain rate in Metal working

   (c) Anisotropy in yielding

   (d) Effect of lubrication on metal working

   (e) Levy-Mises equations

   (f) Prandtl-Reuses equations

   (g) Elastic stress-strain laws
