Roll No. .....

22224

M. Tech. 1st Sem. Mechanical Egg.

(Machine Design)

Examination – December, 2013

METAL FORMING ANALYSIS

Paper : M-807-A

Time : Three hours] *[Maximum 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 examination.

Note : Answer any *five* questions.

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

$$\tau_{ij} = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

2. (a) Consider frictionless plane strain compression under conditions of homogeneous deformation.

strain tensor, principal stresses, principal strains, hydrostatic stress, deviatoric stress, effective stress, and effective strain. 10

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

3. (a) 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

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

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

5. (a) Whether the deformation theory may be used reasonably instead of flow theory for calculating stresses and strains in plastically deformed rotating disc. If yes why ? If no why ? 10

(b) What is upper bound theorem ? 10

6. (a) What roll load is required to roll 500mm×2.5mm mild steel strip previously rolled, 30% to 2.4mm thick with 350mm dia steel rolls ? 10

(b) Is the value of Poisson's ratio different for hot and cold working ? Justify your answer. 10

7. An aluminium alloy is hot extruded at 400°C through squares dies without lubrication from 125mm dia to 40mm dia. The extrusion speed is 45mm/s. The flow stress at 400°C is 250N/mm^2. The length of the billet is 450mm. Determine the extrusion load 20

8. Write short notes on the following : $5 \times 4 = 20$

(a) The effect of temp. in metal working

(b) Strain rate in Metal working

(c) Anisotropy in yielding

(d) Effect of friction and lubrication on metal working