Student Exam No.: _____

Ganpat University

M. Tech. Semester – I Mechanical Engineering (CAD / CAM)

Regular Examination I

3ME112 Advanced Metal Forming and Machining Processes

Time: 3 Hours   Total Marks: 70

F - JAN 2013

Instructions:
(1) Answers of two sections must be written in the separate answer book.
(2) Draw neat sketches wherever necessary.
(3) Assume suitable additional data wherever necessary.

SECTION – I

1 (a)   Deduce the condition for charging and discharging wave form for pure resistive load in electro discharge machining process and sketch out derived waveform of power generator with its proper notations.   **12**

   (b)   Find out the time required to drill a M 12 hole in a 7 mm thick ceramic sheet having fracture strength of 140 kg/mm^2 by ultrasonic machining working at 20 KHz, Stress of 25 kg/mm^2 and using 35 microns SiC grit slurry with hardness π 160 kg/mm^2.

OR

1 (a)   Define electrical discharge machining. Briefly explain the process principle of single discharge condition using neat sketch and effect of process parameters on surface finish for electrical discharge machining.   **12**

   (b)   Briefly explain the working principle of Ultrasonic Machining process with the features of sub systems used in the same.

2 (a)   Draw schematic diagram of abrasive jet machining and derive the equation for material removal rate for ductile and brittle materials in an abrasive jet machining.   **11**

   (b)   With particular illustration enlist the requirements that lead the development of un-conventional machining processes and make classification of all possible processes.

OR

2 (a)   Considering energy transitions explain laser generation process and explain the working principle of laser machining with its important characteristics.   **11**

   (b)   Mathematically elaborate the mechanism of material removal during machining with abrasive water jet machining system using proper notations.

3   Write short notes on the following   **12**
  (a)   Electro-stream drilling process
  (b)   Commonly used industrial lasers with layouts
  (c)   Electrode materials with merits and demerits of electro discharge machining process

SECTION – II

4 (a) Show the constancy of volume results in $e_1+e_2+e_3=0$ and $\varepsilon_1+\varepsilon_2+\varepsilon_3=0$. Why is the relationship for conventional strain valid only for small strains but the relationship for true strain valid for all strains? **12**

(b) Derive an expression for state of stress in two dimensions.

(c) Write a short note on super plasticity of metal and alloys.

OR

4 (a) Explain the following terms with respect to rolling of metals. **12**
   1. Forward slip
   2. Neutral section
   3. Lagging zone
   4. Leading zone

(b) Explain role of friction in metal working operation.

(c) Differentiate between true strain and conventional strain. Discuss the need of true stress and strain in analysis of metal forming processes.

5 (a) Find the principal stresses and the orientation of the axes of principal stress with the x,y axes for the following situation: **11**

$\sigma_x = 340\ MPa$

$\sigma_y = 34\ MPa$

$\tau_{xy} = -55\ MPa$

(b) Determine the maximum force of a hydraulic press require to offset a low carbon cube of 100mm into rectangular size of 80x125x100mm between two flat dies. The yield stress of material is 100 N/mm² at 1000 °C. Assume μ=0.5.

OR

5 (a) A 40 mm thick plate is decreased in thickness according to the following schedule: 20,10,5 mm. compute the total strain on the basis of initial and final dimensions and the summation of the incremental strains using **11**

   (a) Conventional strain and
   (b) True strain

   How does this show an advantage for the use of true strain in metal forming work?

(b) A 200 mm wide, 500 mm long, 10 mm thick strip is compressed between to flat dies in plain strain such that the dimension 500 remains constant. The coefficient of friction between dies and the strip is 0.1 and yield strength of material in compression is $\sigma_0 = 200\ N/mm^2$. Determine the mean die pressure and the maximum die pressure. Determine the change in mean and maximum pressure when μ is changed to half.

6 Write a short note on the following: **12**

(a) High energy rate forming

(b) Yielding criteria in metal forming process

(c) Influence of process parameter on pressure distribution in rolling of metals

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