Student Exam No.:_____

Ganpat University

M. Tech. Semester – I Mechanical Engineering (Advanced Manufacturing Techniques)
Regular Examination November / December – 2013
3ME103 Analysis of Metal Forming and Machining Processes

Time: 3 Hours   Total Marks: 70

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

Q -1   12
   (a)   With neat sketch explain all phases of material removal mechanism during electrochemical grinding process.
   (b)   With automatic electrode re feed concept explain the importance of servo-controlled system in electro discharge machining also brief out the importance of flushing system in electro discharge machining.

OR

Q -1   12
   (a)   Draw the schematic diagram and explain the working principle of laser machining with its important characteristics, advantages, limitations and fields of applications.
   (b)   With specific example enlist the necessities that contribute the development of non-traditional machining processes also make possible classification.

Q – 2   11
   (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.
   (b)   Significance of mercury bearing used in electrochemical grinding process

OR

Q – 2   11
   (a)   With suitable assumption derive the condition for material removal rate for brittle material machined by ultrasonic machining. material removal rate can be express as: $5.9 \, R^{1/2} Y_0^{1/2} (\sigma/H) \, f$ (mm/second).
       Where R = Radius of grit, σ = Stress,
       H = Hardness, f = Frequency, Y_0 = Amplitude of vibration.
   (b)   With the help of schematic diagram explain the roll of subsystems used in water jet machining process

Q – 3   **Write short notes on the following:**   12
   (a)   Photo chemical machining process
   (b)   Electro discharge wire cutting process
   (c)   Significance of different transducers used in ultrasonic machining process

SECTION II

Q -4   **12**
(a) Explain role of friction in metal working operation.
(b) 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?
(c) Write a short note on super plasticity of metal and alloys.

OR

Q -4   **12**
(a) Explain in detail the effect of front and back tension in rolling of metals.
(b) What would be the effect of the section thickness h on the forging load if the friction were reduced to zero.?
(c) Differentiate between true strain and conventional strain. Discuss the need of true stress and strain in analysis of metal forming processes.

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

$\sigma_x = 300\ MPa$
$\sigma_y - 30\ MPa$
$\tau_{xy} = -65\ MPa$

(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.

OR

Q – 5   **11**
(a) A 50 mm thick plate is decreased in thickness according to the following schedule: 25,12.5,5 mm. compute the total strain on the basis of initial and final dimensions and the summation of the incremental strains using
     (a) Conventional strain and
     (b) True strain
How does this show an advantage for the use of true strain in metal forming work?
(b) Determine the maximum force of a hydraulic press require to offset a low carbon cube of 120mm into rectangular size of 80x125x100mm between two flat dies. The yield stress of material is 100 N/mm2 at 1000 °C. Assume µ=0.45.

Q – 6 Write short note (Any Three):   **12**
(a) Explain the basic requirement for lubricants in rolling.
(b) Yielding criteria in metal forming process
(c) Explosive forming
(d) Discuss the roll flattening and bending in rolling of metal.

=============== **End of Paper** ===============