Student Exam No.:_____

Ganpat University
M. Tech. Semester – I Mechanical Engineering (CAD / CAM)
Regular Examination November / December – 2013
3ME112 Advanced 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

1 (a) Prove the condition for equal material removal rate for any ductile and brittle materials, assuming suitable failure mechanism in an abrasive jet machining. **12**

  (b) Find out the time required to drill a M 12 hole in a 6 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) Prove that in machining of a brittle material by Ultrasonic Machining. Material removal rate can be express as: $5.9\ R^{1/2} Y_0^{1/2} (\sigma/H)\ f$ (mm/second). **12**

Where R = Radius of grit, σ = Stress,

H = Hardness, f = Frequency, Y_0 = Amplitude of vibration.

  (b) With suitable example list out the necessities that contribute the development of non-traditional machining processes and classify non-traditional machining processes.

2 (a) Draw schematic diagram and explain the roll of subsystems used in water jet machining process **11**

  (b) With the help of neat sketch explain all phases of material removal mechanism during electrochemical grinding process.

OR

2 (a) Deduce the condition for charging and discharging wave form for pure resistive load in electro discharge machining process and sketch out the waveforms of relaxation power generator with its proper notations. **11**

  (b) Automatic electrode re feed concept with servo-controlled system in electro discharge machining

3   Write short notes on the following **12**

  (a) Significance of different transducers used in ultrasonic machining process

  (b) Photo chemical machining process

  (c) Electro discharge wire cutting process

SECTION – II

4 (a) Derive an expression for state of stress in two dimensions. **12**

(b) Derive the condition of neutral entry of strip into rolls and discuss the role of friction in metal forming.

(c) Explain hysteresis behavior and bauschinger effect of plastic theory.

OR

4 (a) Differentiate between true strain and conventional strain. Discuss the need of true stress and strain in analysis of metal forming processes. **12**

(b) Derive an expression for the pressure distribution in rolling strip in plain strain condition.

(c) Enlist and explain the defects occur in rolling of metal.

5 (a) 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. **11**

(b) A 24 mm thick plate is decreased in thickness according to the following schedule: 12,6,3 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?

OR

5 (a) Calculate the rolling load if steel is hot rolled 25 percent from a 40 mm thickness slab using a 750mm diameter roll. The slab is 800 mm wide. Assume μ=0.30. The plain strain flow stress is 150 MPa at entrance and 200 MPa at the exit from the roll gap due to increasing velocity. What would be the rolling load if sticking friction occurs? **11**

(b) The stress at a point is given by

$$\begin{bmatrix} 80 & 20 & -50 \\ 20 & -40 & 30 \\ -50 & 30 & 60 \end{bmatrix}$$

Determine the principal stresses and maximum shear stress. Also Determine the orientation of any one of principal stress.

6 Write a short note on following:(any three): **12**

(a) Superplastic Forming
(b) Analysis of wire drawing process
(c) Effect of strain rate in metal forming
(d) High velocity rate forming

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