Student Exam No.: ____________

Ganpat University

M. Tech. Semester – I Mechanical Engineering (Advanced Manufacturing Techniques)

Regular Examination

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 the process principle of electro discharge machining for single discharge condition. Also draw the waveforms of relaxation power generator in EDM process with its all notations.

(b) 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.

OR

Q -1 12

(a) With the help of schematic diagram explain the roll of subsystems used in water jet machining process

(b) Prove that in machining of a brittle material by ultrasonic machining. Material removal rate can be express as: $MRR = 4.17\ D^{1/2} Y_0^{1/2} (\sigma/H) f$ (mm / second). Where D = Diameter of grit, σ = Stress, H= Hardness, f= Frequency, Y0= Amplitude of vibration.

Q – 2 11

(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 – 2 11

(a) Draw the schematic diagram and explain the working principle of laser machining with its important characteristics, advantages, limitations and fields of applications.

(b) Draw schematic diagram and explain the working of electro-stream drilling process.

Q – 3 Write short notes on the following: 12

(a) With concrete example justify the development requirements of unconventional machining process.

(b) Shaped tube electrolytic machining process

(c) Significance of mercury bearing used in electrochemical grinding process

SECTION II

Q -4 12

(a) Derive an expression for draw stress for wire drawing.

(b) With suitable example prove that, true strain is additive whereas convention strain are not.

(c) Find the principal stresses and the orientation of the axes of principal stress with the x- axes for the following situation:

$\sigma_x = -410\ MPa$

$\sigma_y = 34\ MPa$

$\tau_{xy} = 170\ MPa$

OR

Q -4 12

(a) Discuss the mechanism of hot working and cold working. State their advantages, limitations and field of applications.

(b) What is flow stress? Discuss the ideal flow curve for different materials.

(c) A 50 mm diameter forging billet is decreased in height from 125 to 50 mm

(a) Determine the average axial strain and true strain in the direction of compression

(b) What is the final diameter of the forging?

(c) What is the transverse plastic strain?

Q – 5 11

(a) Derive an expression for variation in forging pressure for forging a rectangular block in open die forging. Assume sticky friction condition.

(b) A strip 150 mm wide and 400 mm length and 10 mm thick is compressed in plane strain such that the dimension 400 mm remains same. The yield strength of material in uniaxial compression is equal to 200 N/mm2. Determine the average and maximum die pressure if the coefficient of friction on the interface between die and material is 0.10.

OR

Q – 5 11

(a) What are the different types of friction observed in forging process? Discuss the role of friction in metal forming process.

(b) Calculate the rolling load if steel is hot rolled 40 percent from a 40 mm thickness slab using a 900 mm diameter roll. The slab is 760 mm wide. Assume μ=0.30. The plain strain flow stress is 130 MPa at entrance and 190 MPa at the exit from the roll gap due to increasing velocity. What would be the rolling load if sticking friction occurs?

Q – 6 Write short note: 12

(a) Super plasticity of metal

(b) Yielding criteria in metal forming process

(c) Explosive forming

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