

**Bachelor of Mechanical Engineering 4th year 1st Semester *Supplementary*
Examination, 2017**

(Elective – II) Advanced Production Processes

Time: Three hours

Full Marks: 100

Answer any **five** questions

1. a) Briefly explain the reasons behind development of unconventional machining methods.
 b) Show the effect of each of the following process parameters on material removal rate in abrasive jet machining process
- i) jet velocity
 - ii) angle of impingement
 - iii) nozzle tip distance
 - iv) abrasive mass flow rate
 - v) mixing ratio.

10 + 10

2. a) Show the ionic representation of electrochemical machining of mild steel with NaCl electrolyte and copper electrode in an ECM cell. Write down the chemical reactions.
 b) Show that a constant feed ECM process is always self-regulating in nature. State the assumptions.

5 + 15

3. What are the major aspects of tool design in ECM? The geometry of work piece surface with single curvature is given by the equation

$$Y = 10 + 0.3x + 0.05x^2 \text{ where } x \text{ and } y \text{ are in cm}$$

The process data are

applied potential = 15 V
 overvoltage = 0.67 V
 feed velocity = 0.75 mm/min
 work material = Fe ($A = 55.85$, $\rho = 7.8 \text{ g/cm}^3$)
 electrolyte conductivity = $0.3 \Omega^{-1} \text{ cm}^{-1}$

Determine the equation of the required tool surface geometry. Deduce the formula used. State the field of application of the procedure. Assume the values of any other data, if necessary.

20

4. According to Prof. Shaw develop the expression of depth of indentation per impact of abrasives in USM. How and why does the theoretical material removal rate in USM vary from the experimental one for each of the input parameters; amplitude of vibration, grain diameter and feed force?

14 + 6

5. a) Using flow chart explain the stages of EDM action.
b) What do you mean by flushing in EDM process? Why is it so important? How could flushing be implemented in different ways?
c) How could a wide range of surface finish be obtained in EDM?
d) What are the effects of EDM on metal surfaces?

8 + 8 + 2 + 2

6. Derive an expression of the depth of penetration of melting temperature in the work-piece in EBM considering beam power, thermo physical properties of work-piece material, diameter of electron beam and velocity of beam traverse with respect to work-piece. Why is EBM done in vacuum? Mention its magnitude.

16 + 4

7. Write short notes on any two
a) Photo chemical machining
b) Surface finish in ECM
c) Plasma torches

10 + 10