M.E. MECHANICAL ENGINEERING FIRST YEAR SECOND SEMESTER - 2019

ADVANCED METHODS OF MACHINING

Time: **Three Hours**   Full Marks: **100**

Answer any *five* questions.

Assume relevant data, if necessary.

1. a) In brief explain the process of CHM. Give a schematic schedule in PCM process.
    b) Write the classification of the maskants and mention there uses.
    c) Explain the ECG process. Give necessary sketch.   **8 + 6 + 6**

2. a) Discuss the tool design for ECM process.
    b) The geometry of a work piece surface with single curvature is given by the equation $y = 10 + 0.3x - 0.05x^2$ where x and y are in cm. The process data are
        Applied potential = 15 V
        Over voltage = 0.67 V
        Feed velocity = 0.75 mm/min (given to work in – y direction)
        Work material is copper with Z = 1, A = 63.57 and ρ = 8.96 g/cc
        Electrolyte conductivity = 0.2 Ω^{-1} cm^{-1}. (The symbols carry usual meaning)
        Determine the equation of the tool surface geometry.   **12 + 8**

3. a) State the factors on which the depth of penetration of melting temperature in EBM depends. Using Buckingham's π-theorem, find out an expression of the depth of penetration of melting temperature in EBM.
    b) For cutting 150 mm wide slot in a 1 mm thick tungsten sheet, an electron beam machine with 5 kW power is used. For tungsten, the value of specific heat is 2.71 J/cm^3-$^{\circ}$C, thermal conductivity is 2.15 W/cm-$^{\circ}$C and melting temperature is 3400 $^{\circ}$C. Determine the speed of cutting.   **14 + 6**

4. a) Explain the mechanics of EDM process.
    b) During an electric discharge drilling of a 10 mm square hole in low carbon steel plate of 5 mm thickness, brass tool and kerosene are used. The resistance and the capacitance in relaxation circuit are 50 Ω and 10 μF, respectively. The supply voltage is 200 V and the gap is maintained at such a value that the discharge (sparking) takes place at 150 V. Estimate the time required to complete the drilling operation.
    c) Explain the inaccuracies introduced during EDM operation.   **7 + 7 + 6**

5. a) Discuss the model proposed by M.C.Shaw in connection with work material removal rate and also derive an expression for the same in USM.

b) Show the variation of MRR with feeding force, frequency and amplitude in USM.

14 + 6

6. a) With the help of a neat sketch explain the LAM process.
   b) Discuss about high speed machining and hard machining.
   c) What is deformation machining? Explain it.

5 + 10 + 5

7. a) Explain IBM process. Discuss about electrode characteristics, discharge mechanism, cathode electron emission and cathode sputtering.
   b) Write the advantages and disadvantages of IBM process.

15 + 5

8. Write short notes on (any **four**):

5 x 4

   a) Peel grinding.
   b) Ductile regime machining
   c) PAM
   d) WEDM
   e) Tool electrode and dielectric fluids in EDM process.
   f) Functions of electrolytes in ECM process.
   g) Abrasive slurry and tool material in USM.
   h) Mechanics of EBM.