ADVANCED MANUFACTURING TECHNOLOGY
(MECH 4102)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i)   As the stand off distance increases, the depth of penetration in AJM
   (a) increases   (b) decreases
   (c) does not change   (d) initially increases and then remains steady.

(ii) MRR in Electro-Chemical Machining (ECM) depends on
   (a) hardness of work material
   (b) atomic weight of work material
   (c) thermal conductivity of work material
   (d) ductility of work material.

(iii) Mechanics of material removal in EDM is
   (a) melting and evaporation   (b) mechanical cutting action
   (c) electrolysis   (d) brittle fracture.

(iv) The laser beam machining can be carried out, when the media for energy transfer between the tool and workpiece is
   (a) air   (b) liquid   (c) vacuum   (d) any one of the above medium.

(v) Explosive forming process is operated at a
   (a) high pressure   (b) low pressure
   (c) moderate pressure   (d) high temperature.

(vi) Water jet machining (WJM) can be classified as the following type of non-traditional machining processes
   (a) electrical   (b) optical   (c) mechanical   (d) chemical.

(vii) Cellular Manufacturing relates to
   (a) product layout   (b) process layout
   (c) group layout   (d) all of these.

(viii) CAPP is the short form for
   (a) Computer Aided Part Programming
   (b) Centralised Automated Program Platform
   (c) Computer Aided Process Planning
   (d) none of these.

(ix) In CNC programming M06 is used for
   (a) spindle start   (b) spindle stop   (c) tool change   (d) program end.

(x) OPITZ classification and coding system uses a
   (a) 5-digit code   (b) 6-digit code   (c) 8-digit code   (d) 9-digit code.

Group - B

2. (a) Describe with the help of a block diagram the traditional design procedure and indicate the activities where computer integration has been done to develop a CAD system.

(b) Define a Flexible Manufacturing System (FMS) giving a schematic representation of different components of the system.

(c) Explain with the help of a sketch the working principle of an Automated Guided Vehicle (AGV).

4 + 4 + 4 = 12

3. (a) Explain Point-to-Point control and Continuous Path Control in a CNC system.

(b) Write a manual part program for machining a component as shown in fig.1 in a CNC Machining Centre. Raw material is a rectangular Mild Steel plate 100mm x 80mm with 10mm thickness. A rectangular slot of 10mm width having corner radius as shown in the drawing has to be machined. Four through holes of 4mm diameter at locations shown in the drawing are also to be machined.
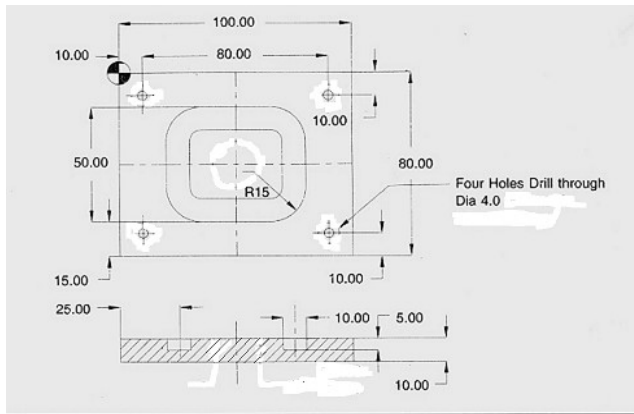
Fig. 1

4 + 8 = 12

Group - C

4. (a) Explain Group Technology (GT) with related examples. Name the different classification and coding methods used in GT.

   (b) Write down the demerits of traditional process planning. Discuss the Computer Aided Process Planning.

   (c) Giving a neat sketch describe the operating principle of a Co-ordinate Measuring Machine mentioning its uses.

(3 + 1) + (1 + 3) + 4 = 12

5. (a) Differentiate between high speed machining and conventional machining. Write down some applications of high speed machining.

   (b) Discuss any two modern cutting tools with reference to materials used and improved geometry.

   (c) Describe any one rapid prototyping method.

(3 + 1) + 4 + 4= 12

Group - D

6. (a) What are the different types of pulse generators used in Electric Discharge Machining process? Discuss the merits and demerits of each of them.

   (b) Explain the working principle of Abrasive Jet Machining (AJM) Process with the help of suitable diagrams.

(2 + 4) + 6 = 12

7. (a) In an ECM operation with a flat-ended tool, a 12 V dc supply is used. The conductivity of the electrolyte is 0.2 ohm^{-1}cm^{-1}, and a feed rate of 1.5 mm/min is used. The workpiece is of pure iron. Calculate the equilibrium gap. Consider the total overvoltage to be 3 V.

   (b) Explain function of the various components used in USM machining unit.

6 + 6 = 12

Group - E

8. (a) With a simple diagram explain the working principle of Plasma Arc Machining (PAM).

   (b) For cutting a 150 μm wide slot in a 1.25 mm thick tungsten sheet, an electron beam with 5 kW power is used. Determine the speed of cutting.

   (c) What are the applications of Water Jet Machining (WJM)?

6 + 4 + 2 = 12

9. (a) Describe with a neat sketch the working principle of Electro-Hydraulic Forming process.

   (b) Write down the applications of Explosive Forming process mentioning its advantages and limitations.

6 + 6 = 12