ADVANCED MANUFACTURING AND AUTOMATION
(MECH 4111)

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

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one 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) In CNC programming "F30", F relates to
(a) Force (b) Feed (c) Feedback (d) Form factor.

(ii) Circular Interpolation (counter-clockwise) in CNC is implemented by the G-code is
(a) G00 (b) G01 (c) G02 (d) G03.

(iii) Dielectric is used in
(a) EDM (b) ECM (c) LBM (d) USM.

(iv) In CNC programming "S1500", S relates to
(a) Spindle speed (b) Tool speed
(c) Longitudinal speed (d) Transverse speed.

(v) Which of the followings can be used as EDM tool material?
(a) Copper (b) Graphite (c) Glass (d) Both (a) and (b).

(vi) Group technology is related to
(a) product layout (b) functional layout
(c) fixed position layout (d) cellular layout.

(vii) In Optiz system, 2nd digit indicates
(a) type and shape
(b) external shape and external shape elements
(c) external plane surface finishing
(d) auxiliary hole and gear teeth.

(viii) Which one is NOT related to rapid prototyping definition?
(a) Layer by layer (b) Physical model
(c) From 3D CAD data (d) Production line.

(ix) The machining system of USM contains which of the following components?
(a) Magnetostrictor (b) Concentrator
(c) Tools and slurry (d) All of the mentioned.

(x) Which of the following material removal mechanisms is implemented by electro-chemical machining (ECM)?

(a) Mechanical abrasion (b) Electrochemical dissolution
(c) Chemical corrosion (d) Mechanical erosion.

Group – B

2. (a) Describe with the help of a block diagram the traditional design and manufacturing procedure and indicate the activities where computer integration has been done to develop a CAD/CAM system. [(CO1)(Analyze/IOCQ)]
   (b) Illustrate any two types of robot used in manufacturing environments. [(CO1)(Apply/IOCQ)]

6 + 6 = 12

3. (a) Explain types and advantages of flexible manufacturing system. [(CO3)(Understand/LOCQ)]
   (b) Differentiate between CSG and B-Rep type of solid models. [(CO2)(Analyze/IOCQ)]

6 + 6 = 12

Group – C

4. (a) Differentiate between fixed and flexible automation. [(CO4)(Analyze/IOCQ)]
   (b) Justify the reason to choose closed loop over open loop numerical control system. [(CO4)(Evaluate/HOCQ)]

6 + 6 = 12

5. (a) Develop a CNC part program with diagram to remove 2 mm material from one end of the work piece by facing operation in two cuts (1 mm in each cut). Also do the chamfering at edge (1mm x 45 degree) considering the following conditions:
   Material : Mild steel
   Work piece diameter = 80 mm
   Work piece length = 60 mm
   Feed rate = 0.55 mm/ revolution
   Spindle speed is 800 rpm. [(CO4)(Create/HOCQ)]
   (b) Explain the velocity feedback sensors used in CNC. [(CO4)(Understand/LOCQ)]

6 + 6 = 12

Group – D

6. (a) List the various benefits of implementing a Group Technology (GT) in a firm. Also write down the limitation of using GT. [(CO5)(Understand/LOCQ)]
   (b) Describe the factors should be consider while selecting the best Computer Aided Process Planning (CAPP) system. [(CO2)(Understand/LOCQ)]

6 + 6 = 12

7. (a) Specify and explain the different process parameters and different materials which may used in manufacturing of products in rapid prototyping technique. [(CO5)(Analyze/IOCQ)]

(b) What is a Coordinate Measuring Machine (CMM) and also explain the working principle with some applications? [(CO2)(Remember/LOCQ)]

6 + 6 = 12

Group – E

8. (a) Briefly explain about the mechanisms involved in material removal by Abrasive Jet Machining (AJM). [(CO6)(Remember/LOCQ)]

(b) Write down the purpose of acoustic head used in ultrasonic machining (USM) process also list the name of different types of concentrator used in USM. [(CO6)(Remember/LOCQ)]

6 + 6 = 12

9. (a) Draw the basic electrical waveform and briefly describe spark initiation and material removal mechanism in Electric-Discharge Machining (EDM) process. [(CO6)(Create/HOCQ)]

(b) Summarize the commonly used gas mixtures and application areas of the Plasma Arc Machining (PAM) process. [(CO6)(Remember/LOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50	31.25	18.75

Course Outcome (CO):

After the completion of the course students will be able to

CO 1 Explain working knowledge on computer integration with mechanical systems.

CO 2 Discuss about computer aided design, manufacturing, process planning and quality control.

CO 3 Explain cellular, flexible manufacturing system and automated material handling, storage, retrieval system.

CO 4 Distinguish Automation, types of Automation and Production, NC and CNC system, Motion transmission, Slides and guides, CNC programming.

CO 5 Implement reverse engineering, group technology, rapid prototyping in industrial application

CO 6 Compare non-traditional machining processes and their application.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.