

Automation and Computerized Manufacturing (ME-703)

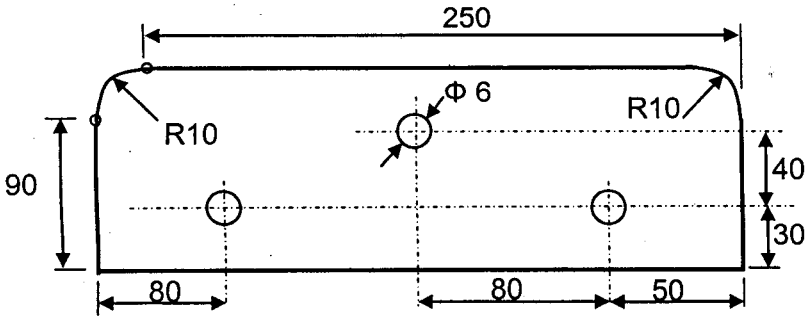
Full Marks: 70

Time: 3 hrs

**Use separate answer script for each half.
Answer SIX questions, taking THREE from each half.
All questions carry equal marks.**

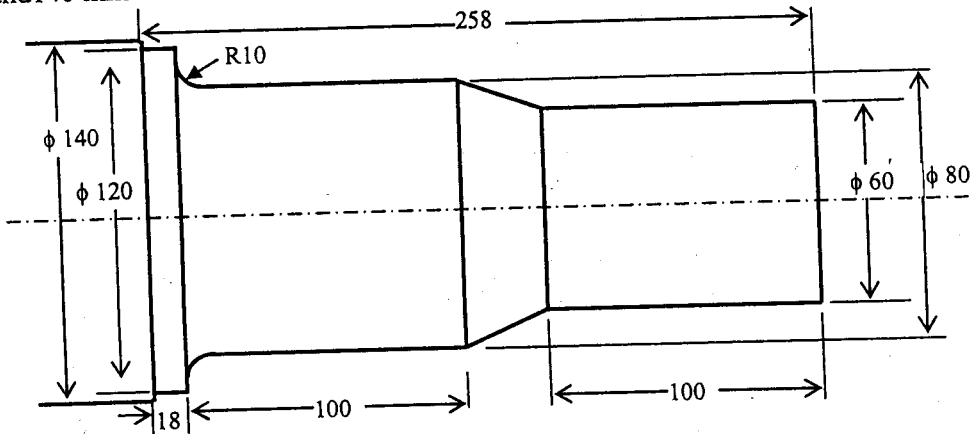
FIRST HALF

1. Why are numerically controlled (NC) machine tools are so called?
How is NC different from mechanical control of conventional machine tools?
Write a short note on the CNC machine movements.
2. How NC control systems are classified?
How 'closed loop control' is different from 'open loop control'? Explain with reference to numerical control of tool-work motions in machine tools.
Write a short note on the characteristics of machining centers.
3. What are block and word in CNC part programming, and basic length unit in CNC machine tool ? Explain with examples.
Write notes on G and M functions for CNC part programming.
Explain tool path compensation in CNC machining with suitable examples.
4. Prepare the CNC part program with suitable description for machining of a plate for the following configuration:



All dimensions are in mm unless otherwise specified.

5. Write a CNC part program with suitable description for turning a bar of 300 mm length and 140 mm diameter in a turning centre for the following configuration:



All dimensions are in mm unless otherwise specified.

Second Half

6. (a) What do you mean by nodal point? Draw the schematic diagram of the gear hobbing machine showing nodal points for cutting spur and helical gear.
- (b) In a typical gear hobbing machine, U_v (speed change gear) is located between the nodes 0 and 1 and U_i (index change gear) in-between locations 1 and 3. Draw the kinematic diagram and write the kinematic equations of the above change gears. If the location of U_v changed and placed between locations 2 and 1 and U_i is placed after the node 3. Are there any changes of the kinematic arrangement and kinematic equations of the above changed gears? If so, explain.
7. (a) Discuss in brief the application of differential mechanism for cutting helical gear.
- (b) In a gear hobbing operation, the hob is single start and rotated at 110 rpm and the gear to be cut is 54 teeth, normal module 2 and lead 1000 mm. The number of teeth of the gear fitted in the hob cutter axis is 60 and its corresponding matching gear is 30, the transformation constant of the differential is 0.5. The speed reduction of the bevel gear set fitted to the shaft of 30 teeth gear and output shaft of the motor are 3 and 2, respectively. The feed is to be 0.18 mm/rev of the gear blank. The worm and worm wheel set fitted in the job axis having double-start and 72 teeth, respectively. Draw the kinematic diagram and find the change gear ratio and the number of teeth

of the index change gears and speed change gears if the main motor rotates at 1440 rpm.

8.
 - (a) Compare the conventional material handling system with automated material handling system.
 - (b) An automated guided vehicle system is designed to satisfy demand by traveling in single delivery route and two empty-travel routes. Loads are picked up by the vehicles automatically at the load station and delivered to the unload station for drop-off. The system must be capable of making 50 deliveries per hour. The average travel distance per delivery is 600 m and the empty travel distance (quick return) is 300 m. The maximum empty travel is allowed to 400m. The load and unload times are both 1.2 minutes and the speed of the vehicle is 60 m/min. The traffic factor for the system is 0.85 and the traffic factor for the quick-return travel is unity. Compare the number of vehicles and the handling system efficiency of the above AGVS. Draw the layout diagram of the system.

9.
 - (a) Define CIM and its advantages and limitations.
 - (b) What is FMS? Write the various characteristics of FMS. Discuss in brief the various components of FMS. For what type of production system FMS is most suitable. Write few applications of FMS in Industry.

10. Write short notes in the followings:
 - (a) Industrial robot
 - (b) Automated flow lines
 - (c) Pallet fixtures