Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 51343

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Third/Fourth Semester

Mechanical Engineering

ME 3493 – MANUFACTURING TECHNOLOGY

(Common to : Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Mechatronics Engineering/Robotics and Automation)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out different types of cutting tool materials used for machining various engineering materials.

2. Draw 2D chip formation mechanism in orthogonal cutting. Mention all relevant nomenclatures.

3. What are the structural parts of basic lathe machine?

4. What are the primary considerations to avoid surface roughness on machined workpiece?

5. What are the factors that differentiate the action of a grit in a grinding wheel from that of a single point cutting tool?

6. Under what conditions higher cutting speeds can be used in milling operations? When it is necessary to reduce milling cutter feeds?

7. List out the additional features of CNC machines compared to traditional NC systems.

8. Draw a closed loop control of X-axis motion of CNC worktable and represent different components in it.

9. What are the differences between absolute and incremental coordinate systems?

10. Why do you prefer G91 while sending tool to its home position?

PART B — (5 × 13 = 65 marks)

11. (a) What are the advantages of using cutting fluids during machining? What are the basic requirements of cutting fluids? Name some of the commonly used types of cutting fluids.

Or

(b) Differentiate between oblique and orthogonal cutting with suitable schematic diagrams. Also write a note on types of chips produced during oblique cutting.

12. (a) Draw tool and workpiece geometry during turning operation. Mark all cutting forces. Describe how different factors influences cutting forces in turning operations.

If a 125 mm long, 10 mm diameter 304 stainless steel rod is being reduced in diameter to 9 mm by turning on a lathe. The spindle rotates at 360 rpm, and tool is travelling at an axial speed of 1.75 mm/min. Calculate the cutting time required to complete the machining. If specific energy required during machining stainless-steel is 4 W-s/mm^3, calculate the power dissipated during machining.

Or

(b) In a tool life calculation if the exponent n is 0.5 and constant C is 400, calculate the percentage change in tool life when the cutting speeds are reduced by 80%, 60%, 40% and 20%. Draw the nature of graph cutting speed vs tool life, comment on the nature of graphs. Also discuss the relevance of constant C on above mentioned scenario.

13. (a) Grinding wheel characteristics or the performance of a grinding wheel depends on type of abrasive, grain size, grade, structure and bonding materials. Discuss the effect of each. Also select proper grinding wheel for cylindrical grinding of cast iron work piece.

Or

(b) Draw the schematic representation of milling cutter, mark all necessary parts and angles. Also draw axis coordinate system for vertical and horizontal milling centres. Identify basic parts of milling machines.

14. (a) What are the basic components of NC system? Discuss with the help of their functions. With neat diagram differentiate between open and close loop control system, point-to-point and continuous positioning systems in CNC machines.

Or

(b) List out the basic CNC machine elements, discuss their functions. Also write a note on interpolation methods and their applications.

15. (a) Write a CNC program for following feature shown in Fig. 1 according to following data.

(i) Drill hole 12 mm dia. Depth 32 mm.

(ii) Bore to suit M24 × 1 pitch thread..

(iii) Cut internal thread M24 × 1 pitch.

(iv) Part off at 27 mm distance from datum.

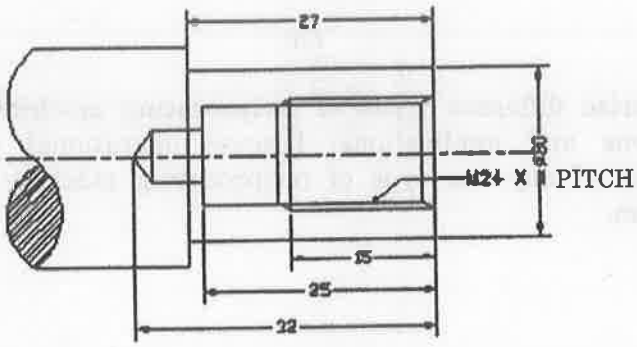

Fig. 1

Consider all dimensions are in mm.

Or

(b) Write a slot mill CNC program for the given profile shown in Fig. 2 taking suitable tool diameter.

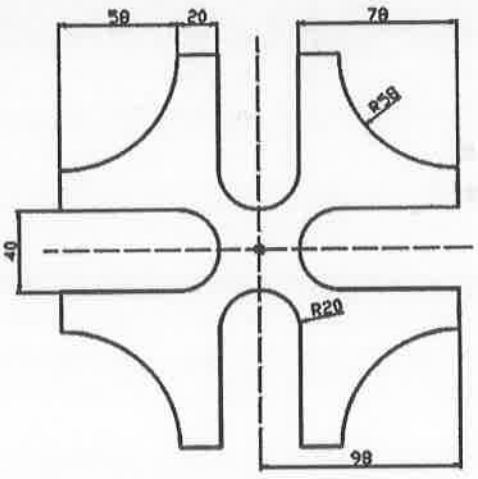

Fig. 2 : CNC program profile

PART C — (1 × 15 = 15 marks)

16. (a) A two-start external square thread of 10 mm pitch and outside diameter of 62 mm is to be cut on a centre lathe which has a 6 mm pitch lead-screw. Calculate:

(i) Depth of thread to give 0.12 mm clearance

(ii) Lead of thread

(iii) Core diameter

(iv) Helix angle at a core diameter and Helix angle of thread

(v) Gear ratio between headstock spindle and the lathe leadscrew

(vi) Tool width, angles at leading and trailing edges of the tool, its main dimensions and general shape

Also discuss the procedure to cut the screw on lathe.

Or

(b) Categorize different types of reciprocating machine tools using their functions and applications. Discuss operational and constructional features of any one type of reciprocating machine tool with suitable diagram.