Ref. No.: EX/PROD/PC/B/T/414/2024(S)

B.E. PRODUCTION ENGINEERING 4TH YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION 2024

Subject : CNC MACHINES AND ROBOTICS

Time: Three hours **Full Marks: 100**

Use separate Answer-Script for each part

Part I (50 marks)

Answer any **five** questions

1. With neat sketches show the axis system for CNC lathe and CNC milling machine. 10

2. Show the basic components of a CNC m/c tool using a neat sketch indicating the locations of motors and internal sensors for the various movements of tool and job and the electrical interface between them & the CNC m/c controller. 10

3. Write a manual part program for turning a job for the finishing cycle as shown in fig. A using a CNC lathe. Show tool start point & axis system on figure. Indicate point-to-point, paraxial & continuous path control movements in the program. 10

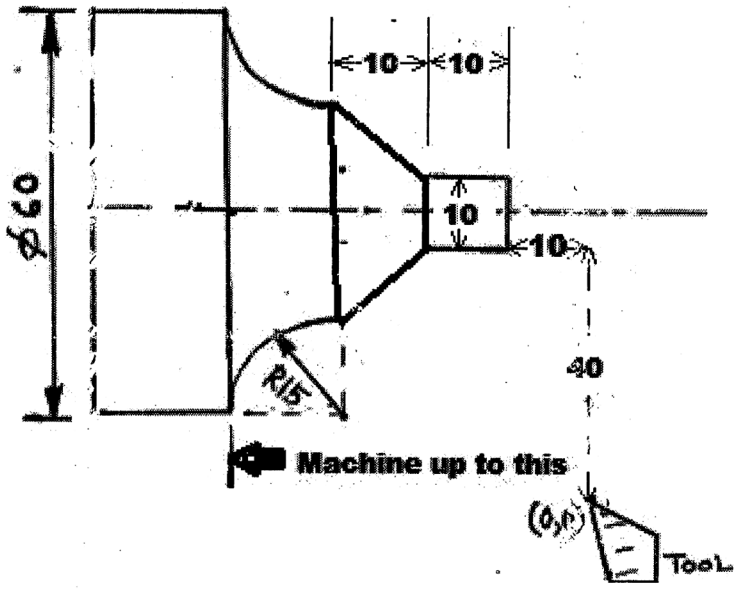

FIG. A

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4. Write a manual part program to drill five holes as shown in fig. B using a CNC machine. Show tool start point & axis system on figure. Indicate point-to-point, paraxial & continuous path control movements in the program. 10

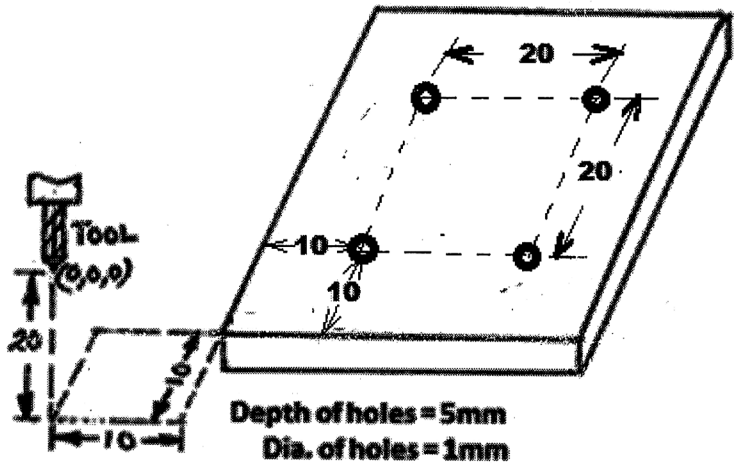

Fig. B

5. Write a manual part program to machine a quarter circular slot as shown in fig.C with a CNC milling machine using an end-mill cutter. Show tool start point & axis system on figure. Indicate point-to-point, paraxial & continuous path control movements in the program. 10

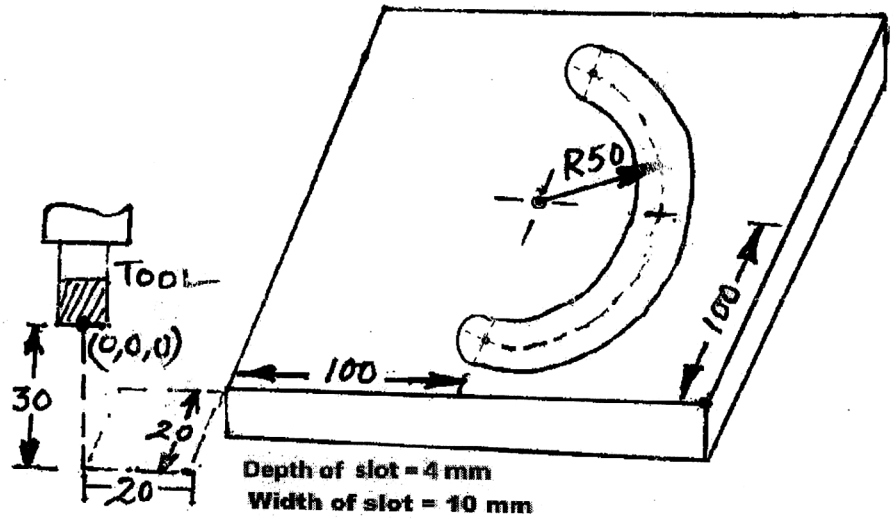

FIG. C

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6. Show the various robot configurations using neat sketches, stating their co-ordinate systems. 10

7. Why are additional 3 degrees of freedom required at the robot wrist? Show how this can be achieved, using a neat sketch. 10

Part II (50 marks)

Answer any **five** questions

1.a) Explain, using schematic diagram, the open loop and closed loop systems for the control of slide movement of CNC machine tool. What are the advantages and disadvantages of closed loop control systems? 6

b) Explain the difference between straight line (paraxial) control and continuous path (contouring) control in the context of CNC machine. 4

2. Explain the basic operating principle of a permanent magnet type stepper motor. What are the advantages and disadvantages of stepper motors in comparison to servo motors for the control of slide movement on CNC machine tools? 5+5

3. Explain the working principle of an optical absolute encoder used for providing feedback of angular position of the axis leadscrew in a CNC machine. 10

4. What are the advantages of linear position sensors over angular position sensors? Explain the working principle of a linear grating sensor used for providing feedback of linear displacement of the axis leadscrew in a CNC machine tool. 3+7

5. What are the reasons for using sensors in robots? Explain the difference between internal and external sensors used in robots with suitable examples. 5+5

6. What are meant by range and proximity sensors? Explain briefly the working principles of an inductive proximity sensor. 4+6