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

2. Discuss about the general axis system in CNC m/c tools. With neat sketches show the axis system in CNC lathe and CNC milling machine. 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

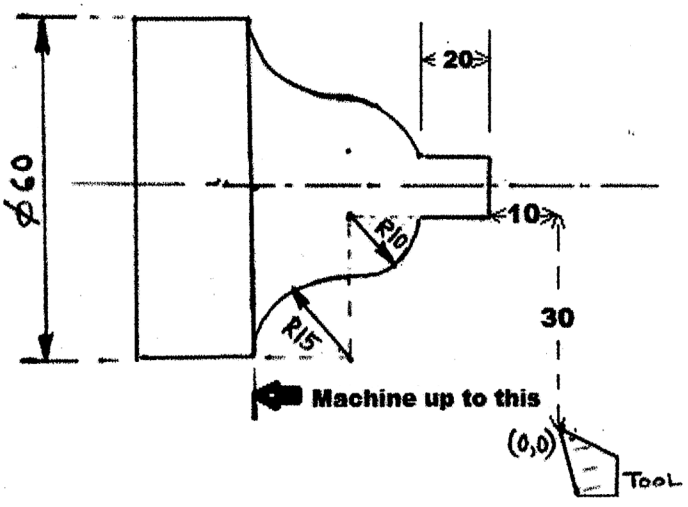

FIG. A

[Turn over

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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

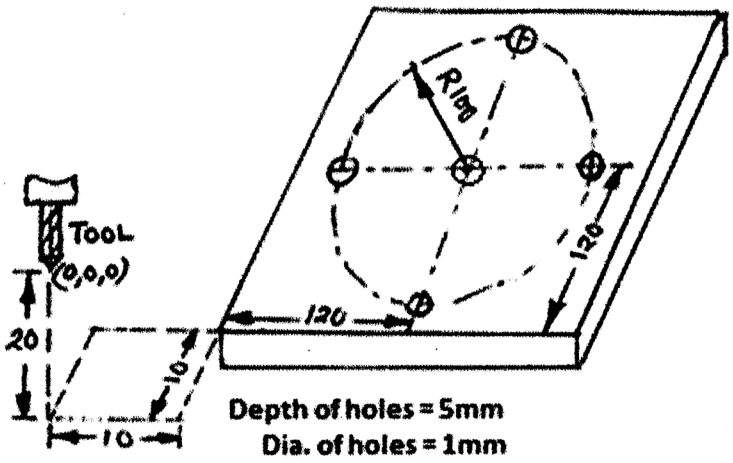

Fig. B

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

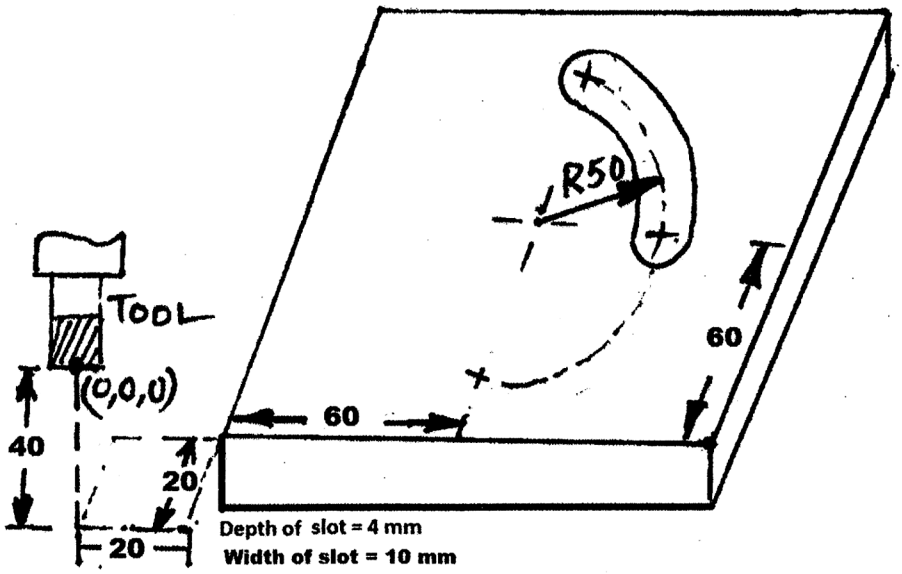

FIG. C

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

7. What do you mean by the working envelope of a robot? Draw the working envelopes for cartesian type & cylindrical type robot configurations. 10

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

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Part II (50 marks)

Answer any **five** questions

1. Explain point-to-point control, paraxial control and contouring control in the context of CNC machine tools. What type of operations may be done in each type of control in CNC machine tools? 10

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. Show and explain the operating principle of the control circuit with transistor switches used for controlling the operation of a bipolar stepper motor, showing the switching sequence for both full-stepping and half-stepping. 10

4. Explain the working principle of an optical incremental encoder used for providing feedback of angular displacement of the axis leadscrew in a CNC machine. How can it be used for measurement of angular velocity? 9+1

5. 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

6. 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

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