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M.E. PRODUCTION ENGINEERING 1ST YEAR 1ST SEMESTER EXAMINATION 2024
Subject : CNC MACHINES, DNC AND ADAPTIVE CONTROL (PT)

Time: 3 hours **Full Marks: 100**

Answer any **10** questions

1. Show the basic components of a CNC m/c tool using a neat sketch of a CNC Lathe or Milling Machine, indicating the locations of motors and internal sensors and the electrical interface between them & the CNC m/c controller. 10

2. Under what circumstances and in what type of automation can CNC be best employed? State some economic benefits that can be gained by adopting CNC machine in a manufacturing industry. 5+5

3.(a) Explain, using schematic diagrams, the open loop and closed loop systems for the control of slide movement in CNC machine tool, and discuss their relative advantages and disadvantages. 6

b) Explain the main difference between paraxial control and contouring control in CNC machine tool. 4

4.(a) State the different types (only mention) of stepper motors, and explain the basic operating principle of a permanent magnet type stepper motor. 1+5

b) What are the advantages of stepper motors in comparison to dc servo motors for the control of slide movement on CNC machine tools? 4

5. 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

6. Explain the working principle of a single radial grating transducer used for providing feedback of angular position of the axis leadscrew in a CNC machine tool. What are the advantages of linear position measuring transducers over angular position measuring transducers? 7+3

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7. Distinguish between absolute and incremental encoders. Explain the working principle of an optical absolute encoder for providing feedback for angular position of the axis leadscrew in a CNC machine tool. 2+8

8. 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

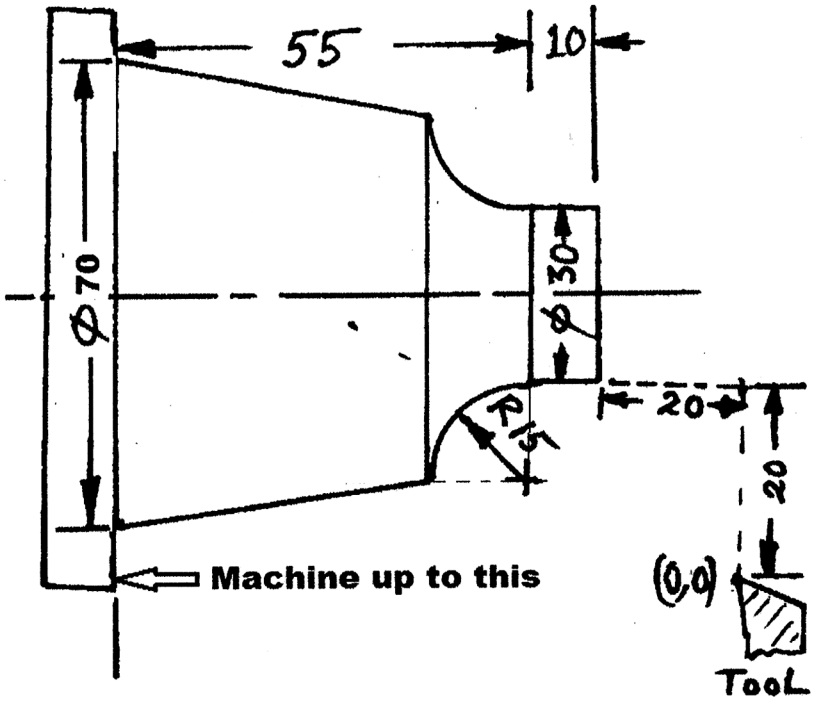

FIG. A

9. Write a manual part program to machine a slot as shown in fig. B 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

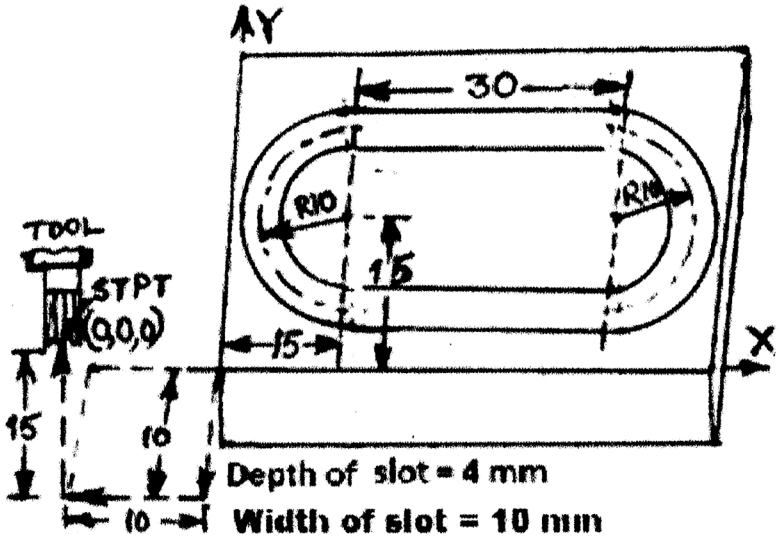

FIG. B

10. Write a manual part program to drill five holes as shown in fig. C 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

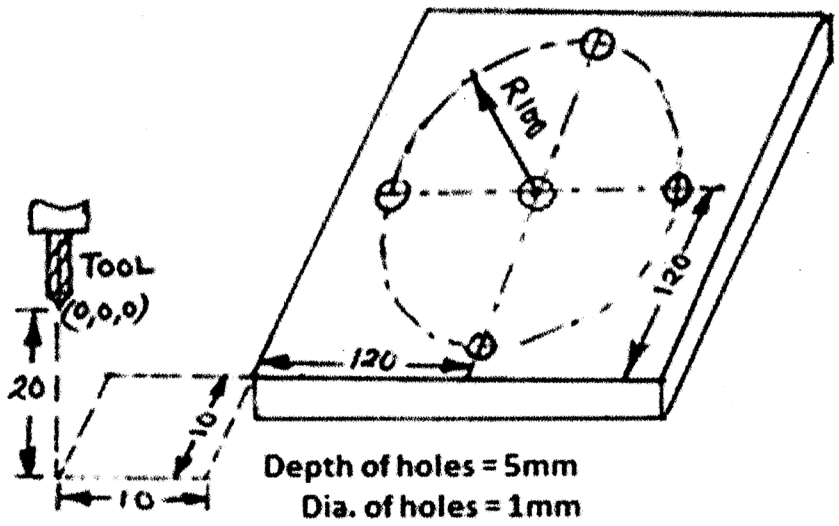

FIG. C

11. What is Adaptive Control? With the help of necessary sketches illustrate different situations in the area of machining where Adaptive Control finds its applications. 4+6

12. Give a schematic representation of a DNC system. Describe the functions of different units. 10