M. PRODUCTION ENGINEERING 1ST SEMESTER EXAMINATION – 2017

SUBJECT: CNC MACHINES, DNC AND ADAPTIVE CONTROL

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

ANSWER ANY FIVE QUESTIONS

1. a) 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

   b) Discuss on the generalized axis system in CNC Machine Tools. With neat sketches show the axis system in CNC lathe and CNC milling machine. 4+3+3

2. a) Explain, using schematic diagram, the open loop and closed loop systems for the control of slide movement of CNC machine tool, and discuss their relative merits and demerits. What types of drives are used for open loop and closed loop CNC systems? 6+2

   b) Discuss the differences between point-to-point, straight line (paraxial) and continuous path (contouring) control in the context of CNC machine tool. 5

   c) Explain the working principle of an optical incremental encoder for providing feedback for angular position of the axis leadscrew. 7

3. a) Explain the working principle of a single radial grating transducer used for positional feedback on CNC machine tools. What are the advantages of linear position measuring transducers over angular position measuring transducers 6+2

   b) What is the advantage of using Gray code over binary number in optical absolute encoder? 4

   c) What is a tachogenerator and where would it be used on a CNC machine tool? Show a schematic diagram of a closed loop speed control system using tachogenerator, and explain its operation. 1+7

4. a) Briefly explain the operating principle of a stepper motor and its control circuit, showing the switching sequence for both full-stepping and half-stepping. What are the advantages and disadvantages of using stepper motors in comparison to dc servo motors for the control of slide movement on CNC machine tools? 8+3

   b) Explain the preparatory functions G17, G18 and G19 used for plane selection in circular interpolation in CNC milling operation. 4

   c) What is canned cycle in CNC programming? Explain with an example. 5

5. a) Discuss the various types of formats used in manual part programming for a CNC machine. Interpret the following format classification in the Word Address Format provided by the manufacturer of a CNC machine tool:

N2.G3.X52.Y52.Z42.F3.S4.T2.M2 6+4

b) Write a manual part program for the finishing cycle of a turned job as shown in fig. 5(b) to be machined in a CNC lathe. 10

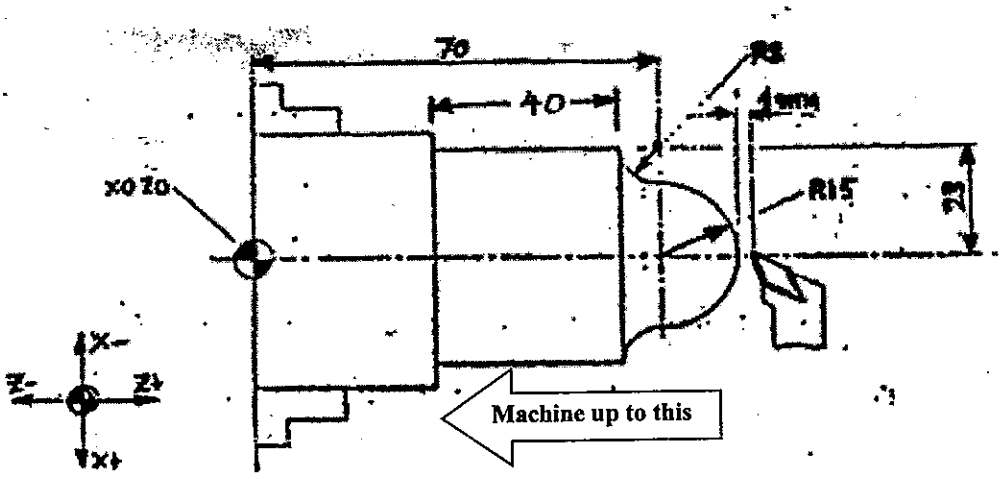

FIG. 5(b)

6. a) 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+8

b) Give a schematic representation of a DNC system. Describe the functions of different units. 8

7. a) What do you mean by drive surface, part surface and check surface in CNC part programming? Discuss with examples. 8

b) Write an APT program to completely machine the job as shown in fig. 7(b). The depth of drilled holes is 10 mm. 12

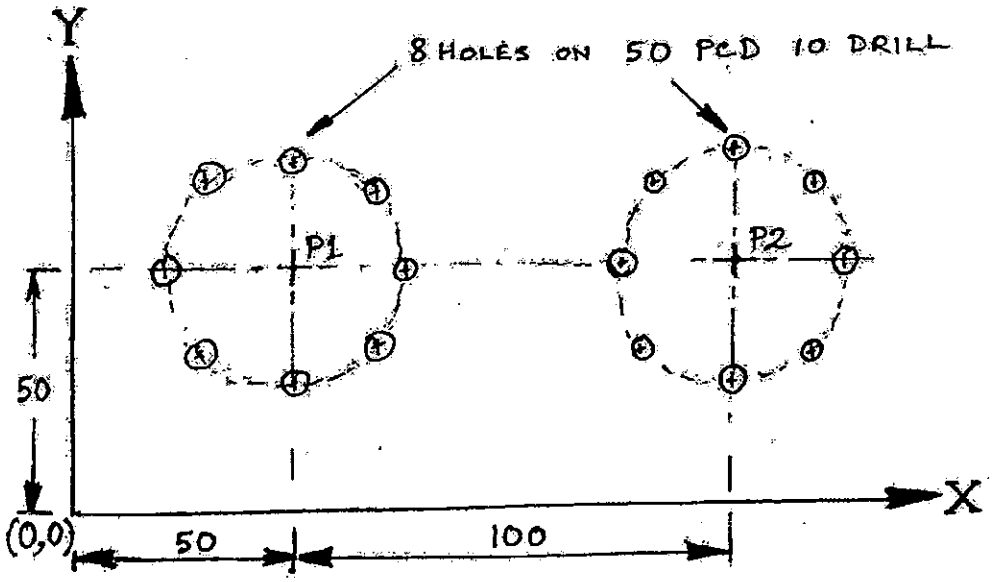

FIG. 7(b)

8. a) Compare manual part programming and computer aided part programming. Show the steps followed in computer aided part programming. 3+3

b) What is the function of Post Processor in a CNC machine? 2

c) Write a program in APT language for milling the edges of a job shown in fig. 8(c) using an end mill cutter in a CNC milling machine. 12

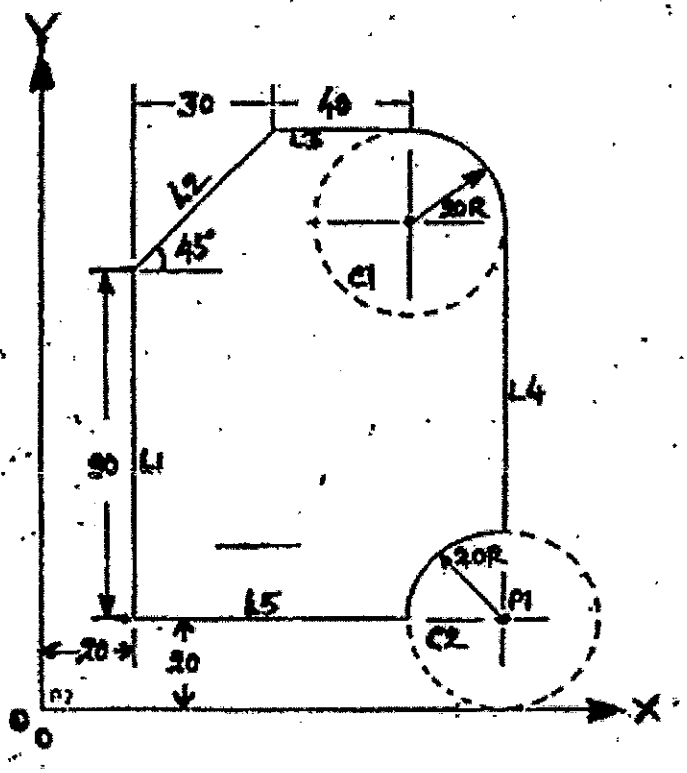

FIG. 8(c)