M. E. PRODUCTION ENGINEERING 1ST SEMESTER EXAMINATION – 2018

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+6

2. a) Explain point-to-point control, straight line (paraxial) control and continuous path (contouring) control in the context of CNC machine tool. What type of operations may be done in each type of control in CNC machine tools? 7

   b) 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? 9+4

3. a) Explain the working principle of an optical absolute encoder for providing feedback for angular position of the axis leadscrew. What is the advantage of using Gray code over binary number in such encoder? 8+4

   b) What are the advantages of linear position measuring transducers over angular position measuring transducers? Explain the operation of one type of linear position measuring transducer that can be used for providing feedback of CNC tool slide position. 2+6

4. a) Explain the Word Address Format which is currently used in manual part programming in a CNC machine. Explain the preparatory functions (G-codes) G17, G18 and G19 used for plane selection in circular interpolation in CNC milling operation. 3+4

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

4. c) Write a manual part program to machine a slot as shown in fig. 4(c) in a CNC milling machine. The depth of slot is 5 mm. 8

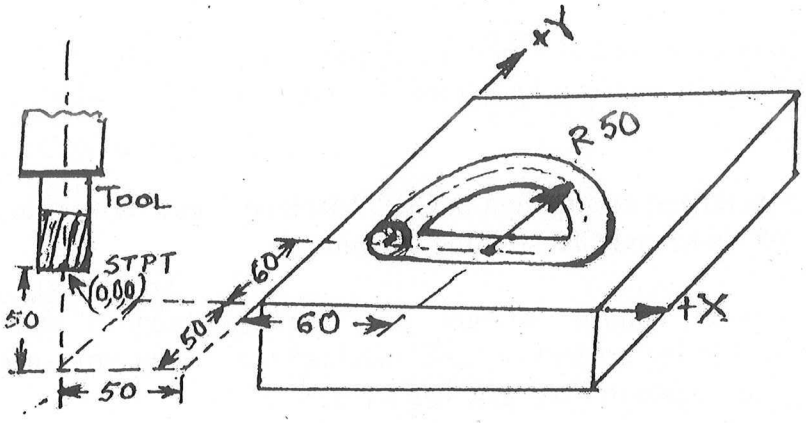

FIG. 4(c)

5. a) 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. 2+8

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

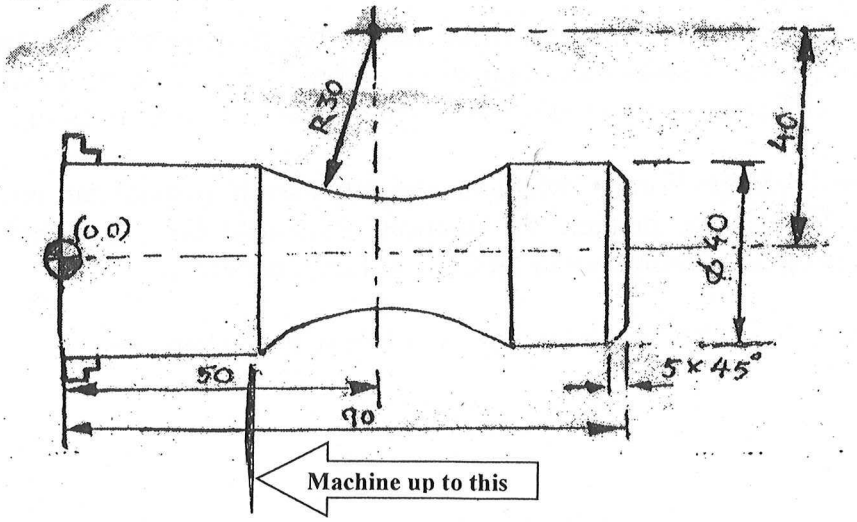

FIG. 5(b)

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

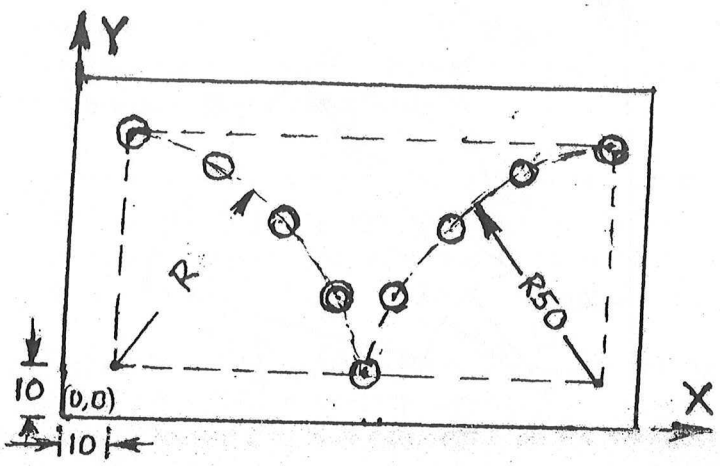

FIG. 7(b)

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

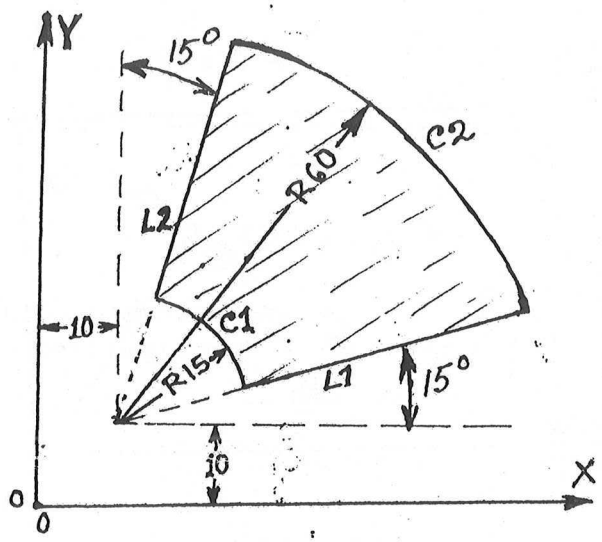

FIG. 8(c)