B.E. PRODUCTION ENGINEERING 4TH YEAR 1ST SEMESTER EXAMINATION – 2019
CNC MACHINES AND ROBOTICS

Time: Three hours   Full Marks: 100

Use separate Answer-Script for each part

PART - I (70 marks)
Answer any **seven** questions

1. State the basic differences between CNC m/c tools and conventional m/c tools. Why is the use of robots & CNC machines economically justified in batch production where there is frequent changes of product?   3+7

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

3. 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

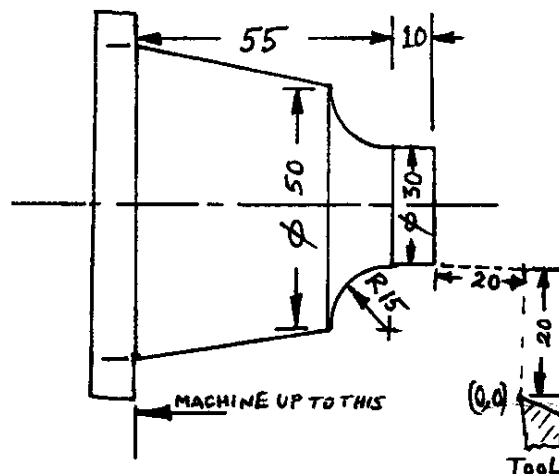4. Write a manual part program for turning a job for the finishing cycle as shown in fig.4 using a CNC lathe.   10

Fig. 4

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PART – I

5. Write a manual part program to machine a semicircular slot as shown in fig.5 with a CNC milling machine using a end-mill cutter. Depth of slot is 2 mm.   10
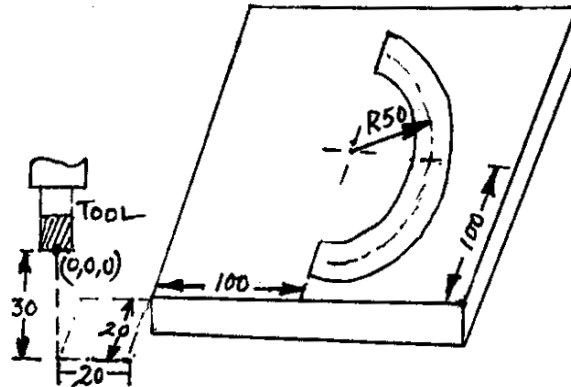

Fig.5

6. Show the basic components of a robot using a neat sketch of an industrial robot, indicating the locations of actuators and internal sensors for the various joints and the electrical interface between them & the various components of the robot controller.   10

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

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

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

10. Classify end effectors. Show two different types of mechanism of two fingered parallel jaw type robot grippers (with revolute & prismatic joints). What are the advantages & limitations of using these two types of robot gripper?   10

11. Calculate the minimum gripping force, to be exerted by each finger of a two-fingered parallel jaw type gripper of a SCARA type robot to hold an object of weight of 10 kgf using friction. Also calculate the same for picking up the same object vertically upwards with an acceleration of 2 m/sec^2 .The co-efficient of friction, u = 0.   10

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PART - II (30 marks)
Answer any **three** questions

1. Explain point-to-point control, paraxial and continuous path (contouring) control in the context of CNC machine tool. What types of drive are used for open loop and closed loop CNC systems?   9+1

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. What are the advantages of linear position sensors over angular position sensors in CNC machine tools? Explain the operation of one type of linear position sensor that can be used in CNC machines.   4+6

5. a) Explain the difference between internal and external sensors (with suitable examples) used in robots. What is meant by a binary sensor?   4+1

   b) What are meant by range and proximity sensors, and where are they used in robotic applications?   5