

Bengal Engineering and Science University, Shibpur
B. E. (Mechanical) Part IV 7th Semester Final Examination, 2013
Subject: Computer Integrated Manufacturing Systems (ME-705/3, Elective-I)

Time: 3 Hours

Full Marks: 70

Answer SIX questions taking any THREE from each half
All questions carry equal marks, two marks in each half is reserved for overall quality.

FIRST HALF

- 1 (a) What is ladder diagram? Why there must not be two output in a single rung in a ladder diagram?
- (b) A flight simulation gaming station offers a video game as described below.
- When switch A is pressed by the operator, it switches on the game. Each player will be allowed to play for 300 seconds.
 - If the player can hit a particular target (i.e., a particular signal is ON) then he will win another 300 seconds bonus time to play. For this the operator cannot intervene and this operation has to be controlled by the PLC logic.
 - The game will stop after the stipulated time.

Draw a ladder diagram to allow the controller to:

- Reset time-counting at the start of a the game.(Switch-A)
- Stop the machine when switch E is pressed (operator presses an emergency STOP button) or the game is over, whichever occurs first.

[4+7]

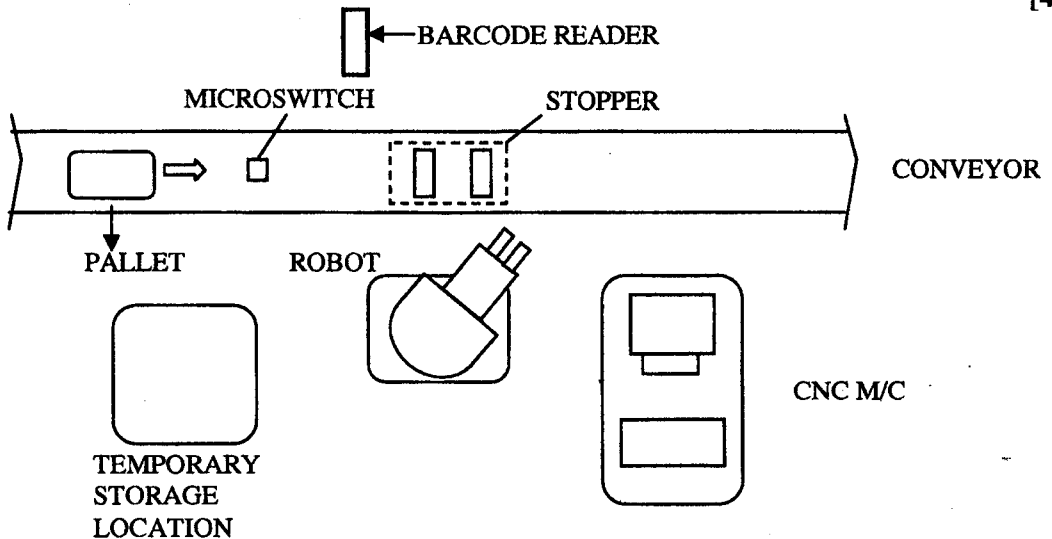


Fig. A: The Flexible Manufacturing System

- 2 a) Fig.A shows a part of a FMS where parts are automatically loaded on a CNC Machine with the help of a Robot. Parts are carried on pallets, which contains different barcode for different machines.

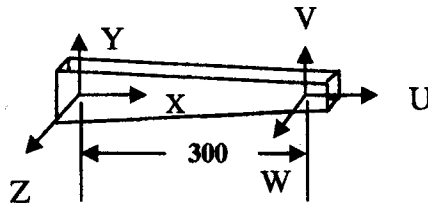
Write a ladder diagram to make the following sequence of operations (explain each step):

- A pallet is carried by the conveyor and as it touches the micro-switch the barcode reader is ON.

- If the barcode reader detects the pallet for this CNC machine, and there is no part is waiting in the temporary storage station (i.e., not busy), then activate the stopper to stop and raise the pallet with the part. (Otherwise the pallet will be carried away by the conveyor, even if it is the right part-pallet. Conveyors move in a circular fashion.)
 - If the stopper is up, then robot is activated to pick the part from stopper and place it to the temporary storage station. (assume that only one part is stored here)
 - If the CNC Machine is NOT busy then robot has to pick the part from temporary storage and place the part onto the CNC machine.
 - Here unloading of the final product from the CNC machine is done manually. (no programming required)
- b) Discuss with example, the difference between AND, OR logic in ladder diagram

[9+2]

- 3 a) What are lower pair and higher pair joints? Give examples
 b) Fig.B shows a robot link. Suppose a point P in U-V-W coordinates is [20 40 50]. Transform the coordinate in X-Y-X coordinates.
 c) Write a MATLAB program for any point and length of the link as user defined.



[2+4+5]

Fig.B A robot link

- 4 a) Discuss the joining criteria of two curves.
 b) Write a MATLAB program to draw a cubic Bezier curve with the four control points as user input to be taken from a data file.
 c) Write the program to plot the tangent at its mid-point.

[2+5+4]

5. a) Explain the Boolean operation by taking two regular solids.
 b) Discuss how a complete model is developed in CSG environment with an actual example.
 c) Explain Euler's law, for regular solids with actual example
 d) What is CAD/CAM? What are its main advantages?

[3+3+2+3]

SECOND HALF

[Answer any THREE questions]

6. (a) What do you understand by 'Work in progress (WIP)' ?
(b) Enumerate the characteristics of flexible automation.
(c) Illustrate the ten principles & strategies for automation.
7. (a) Write down the benefits of using Robots in manufacturing industries.
(b) Calculate the cycle time and production rate for a single-machine robotic cell for an 8-hour shift if the system availability is 85%. Also determine the percentage utilization of machine and robot. On average, the machine takes 35 seconds to process a part. The other robot operation times are as follows :

Robot picks a shaft from the conveyor	4.0 s
Robot moves the shaft to the lathe	1.5 s
Robot loads the shaft onto the lathe	1.0 s
Robot unloads the shaft from the lathe	0.5 s
Robot moves the conveyor	1.5 s
Robot puts the shaft on the outgoing conveyor	0.5 s
Robot moves from the output conveyor to the input conveyor	5.0 s

8. (a) Define Flexible Manufacturing System (FMS). What are the basic components of FMS?
(b) State and explain the three levels of manufacturing flexibility.
(c) Enumerate the different types of FMS layout and draw the schematic diagram of any two of them.
9. (a) What do you understand by Group Technology ?
(b) State the different design and manufacturing attributes for part classification and coding system.
(c) Discuss the benefits and problems of implementing of Group Technology.
10. Write short notes on the followings:
(i) Fixed automation
(ii) Assembly line AGVS
(iii) Aims of FMS