Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: COMPUTER INTEGRATED MANUFACTURING [MME 336]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL q**uestions.
- Missing data may be suitably assumed.

1A. Demonstrate the optimization of the machining process from different sources of variability. **2**

1B. Construct the linkage between driver shaft and driven shaft which are parallel in arrangement to transfer the power. What all errors can be compensated by using such linkages? **3**

1C. Write an APT program for the contour milling operation for the depth of cut 10mm as shown in fig.1 **5**

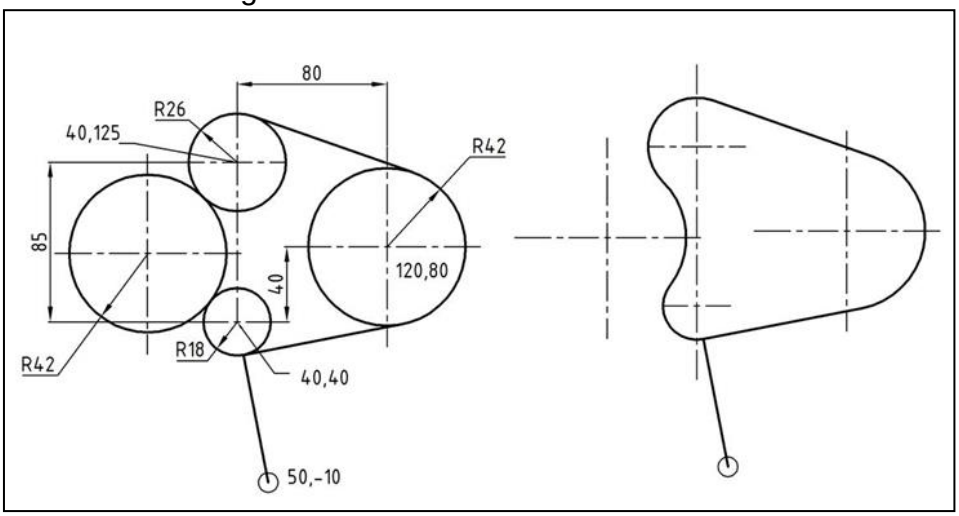

Fig.1: Milling profile for APT programming (Dimensions are in mm)

2A. Describe how circular interpolation can be achieved. On what parameters interpolation is dependent? **2**

2B. What are the primary functions of Shop Floor Control? Discuss how flow of operation's information takes place in shop floor. **3**

2C. A flexible manufacturing cell has just been created. After considering a number of designs, the system engineer chose a layout that consists of two machining workstations along with a load/unload station. In detail, the layout consists the load/unload station 1. Station 2 performs milling operations and consists of one CNC horizontal milling machine. Station 3 has one CNC radial drill press and one multispindle drilling machine. The three stations are connected by a part handling system that has 2 work carriers. The mean transport time in the system is 2.5 min. The FMC produces three parts, A, B, and C. The part mix fractions and process routings for the three parts are presented in the table below. Determine (a) maximum production rate of the FMC, (b) corresponding production rates of each product, (c) utilization of each machine in the system, and (d) number of busy servers at each station. **5**

Table 1: Process routings in FMC

Part (j)	Part Mix (Pj)	Operation (k)	Description	Station (i)	Process Time (t_{ijk}) min.	Frequency (F_{ijk})
A	0.2	1	Load	1	3	1.0
		2	Mill	2	20	1.0
		3	Drill	3	12	1.0
		4	Unload	1	2	1.0
B	0.3	1	Load	1	3	1.0
		2	Mill	2	15	1.0
		3	Drill	3	7	0.5
		4	Drill	3	9	0.5
		5	Unload	1	2	1.0
C	0.5	1	Load	1	3	1.0
		2	Dill	3	6	1.0
		3	Drill	3	6	1.0
		4	Unload	1	2	1.0

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3A. Summarize different types of tooling materials which can be used in CNC machining with their characteristics. **3**

3B. Demonstrate how interactive graphic system works in computer aided part programming. **3**

3C. Discuss any four applications of robots relating to service industry. **4**

4A. Illustrate how optical encoder can be used to measure the rotations of lead screw carrying work table in a CNC machine. **4**

4B. ASRS system has been planned to setup near the production area. According to company requirements design the ASRS system considering the following data. The unit load of length, width and height of 1.5m contains equal clearance of 0.5m height, width and length. The number of unit load per storage unit is 4. The average cycle time of operation of S/R machine is 4min. The system has to handle total number of storage space equal to 5000. The ASRS throughput expected is 60 operations/hr. Take the desired height to be less than 60m. Take center to center rack support and bay side support allowance as 0.20m, clearance for the crane runout as 4m, clearance for pickup/deposit area as 5m. Aisle width as 3m. **6**

5A. How new part design can be processed under retrieval CAPP system to generate a process plan? And when do you prefer generative over retrieval CAPP system? **4**

5B. Write a CNC program in word address format for the shown profile in Fig.2, follow the dimensions as mentioned. Assume that work piece surface is rough, start the programming with end mill operation to remove 2mm layer. Also mention different tools you used in this programming along with tool numbers. **6**

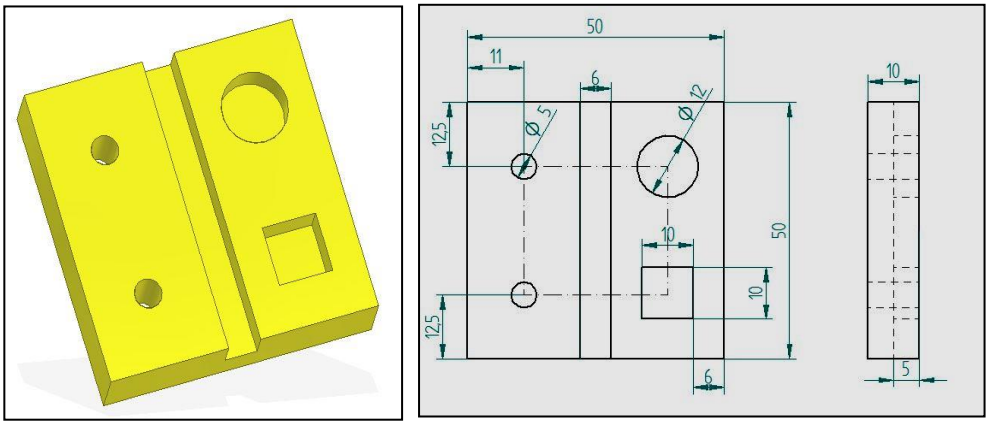

Fig.2: Required work piece profile (Dimensions are in mm)

6A. Write a note on Automated Inspection. Discuss how it will enhance the manufacturing process. **3**

6B. How do you justify installing CNC machines over conventional Machines? **2**

6C. Given the AGVS layout shown in Fig.3. Vehicles travel in a shown direction around the loop to deliver loads from the load station to the unload station. Loading time at the load station = 5.5 min, and unloading time at the unload station = 3.2 min. It is desired to determine how many vehicles are required to satisfy demand for this layout if a total of 25del/hr must be completed by the AGVs. Site 1 is ASRS system used for loading and unloading the components. Site 2, 3 and 4 are different machines. **5**

Calculate the total travel distance and empty distance for the sequence of i) 5 times 1-2-1, ii) 2 times 1-2-4-1, and iii) 1 time 1-2-3-1. The following performance parameters are given: vehicle velocity= 50m/min, availability = 0.92, traffic factor = 0.85,and E = 0.90 also Determine: (a) travel distances loaded and empty, (b) ideal delivery cycle time, and (c) number of vehicles required to satisfy the delivery demand.

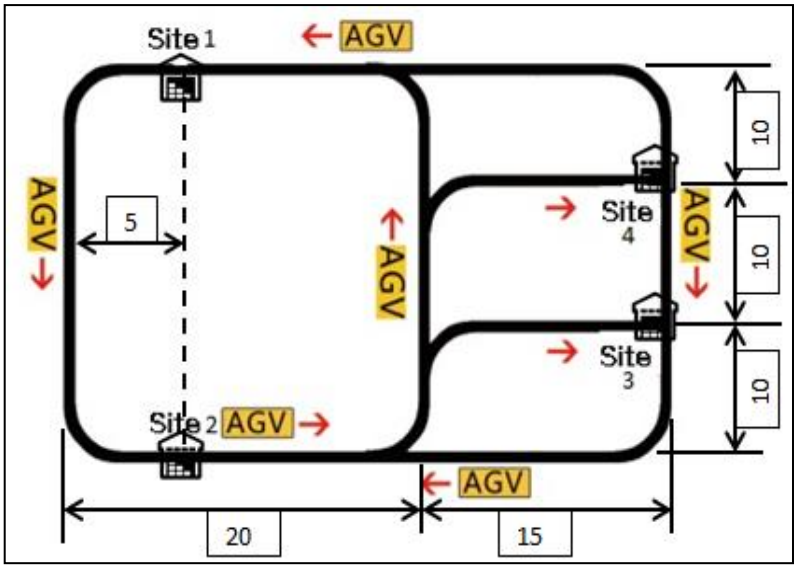

Fig. 3: AGV layout map (All distances are in meters)