

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER –IV • EXAMINATION – SUMMER • 2014****Subject code: 744701****Date: 04-06-2014****Subject Name: Automation and Computer Integrated Manufacturing****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain the following automation principle and strategy: **07**
1. USA principle
2. Automation migration theory
- (b) Illustrate the following terminology with its mathematical formulation for a production system on hand. **07**
1. Utilization of production system
2. Availability of machine
3. Manufacturing lead time of a product
- Q.2** (a) SNB enterprise has designed a new product line and is planning to build a new plant to manufacture this product line. The new line consists of 150 different product types, and the company wants to produce 11,500 units annually for each product type. The products average 700 parts each, and the average number of processing steps required for each component is 14. All parts will be made in the factory. Each processing step takes an average of 1 min. Determine (a) how many products, (b) how many parts, (c) how many production operations will be required each year? (d) How many workers will be needed for the plant, if it operates one eight-hour shift for 250 days/year? (e) Compare the outcome of this calculation with ofocused factoryô. **07**
- (b) Discuss in brief the following methods of Computer Aided Process Planning (CAPP). Bring out the relative advantages and disadvantages of them. **07**
1. Variant CAPP method AND 2. Generative CAPP method
- OR**
- (b) With the help of suitable examples, describe AAG (Attribute Adjacency Graph) method for feature recognition in Computer Aided Process Planning. **07**
- Q.3** (a) Explain the following demand forecasting approaches used in manufacturing planning and control system. **07**
1. Qualitative approach 2. Explanatory approach
3. Descriptive approach 4. Moving average approach

- (b) A flexible manufacturing system (FMS) consists of two machining stations and a load/unload station. Station 1 is the load/unload station. Station 2 performs the turning operation and consists of two identical CNC turning centers. Station 3 has one CNC drill press that performs drilling operation. The stations are connected by part handling system that has four work carriers. The mean transport time is 4 min. The FMS produces two parts, A and B. The part mix fractions and process routings for the two parts are presented in the table below. The operation frequency = 1.0 for all operations. Determine (a) maximum production rate of FMS (b) corresponding production rate of each product (c) utilization of each station. 07

Part (j)	Part Mix (P _j)	Operation (k)	Description	Station (i)	Process time t _{ijk} (min)
A	0.35	1	Load	1	3
		2	Turn	2	25
		3	Drill	3	10
		4	Unload	1	2
B	0.65	1	Load	1	3
		2	Turn	2	35
		3	Drill	3	20
		4	Unload	1	2

OR

- Q.3** (a) Explain in brief the following flexibilities of Flexible Manufacturing System (FMS). 07

Machine flexibility; Material handling flexibility; Volume flexibility; Expansion flexibility; Routing flexibility; Product flexibility; Operation flexibility.

- (b) Data on the expected aggregated sales of four products A, B, C and D, over a planning horizon of six 4-week periods are given in the following table. The company has developed machining-cell hours as a common unit for aggregation purposes. In this case products A and C require 2 cell-hours per unit whereas products B and D require only one cell-hour per unit. The company has a regular production capacity of 400 cell-hours per period. Overtime is permitted up to a maximum of 180 cell-hours per period. Requirements exceeding overtime capacity can be satisfied by subcontracting. Two alternative production policies are developed as follows: 07

Plan I: Produce at the constant rate of 600 cell-hours per period for the entire planning horizon.

Plan II: Produce at the rate of 700 cell-hours per period for the first four periods and then at the rate of 400 cell-hours per period for the subsequent periods.

Period	Product A	Product B	Product C	Product D
1	50	60	70	80
2	80	80	40	100
3	110	40	120	70
4	70	210	190	40
5	160	180	200	50
6	100	60	70	110

- Q.4 (a)** Consider the AGVS layout shown in the following figure. Vehicles travel counter clockwise around the loop to deliver the loads from the load station to unload station. Loading time at load station = 1.0 min, and unloading time at unload station = 0.75 min. The demand for this layout is 50 deliveries per hour to be satisfied by AGVS. Performance parameters are given as follows: vehicle velocity = 50 m/min, availability = 0.90, traffic factor = 0.88, and operator efficiency does not apply. Determine (a) travel distance loaded and empty (b) ideal delivery cycle time (c) total work load (d) total available time (e) rate of delivery per vehicle (f) number of vehicles required to satisfy the delivery demand. **07**

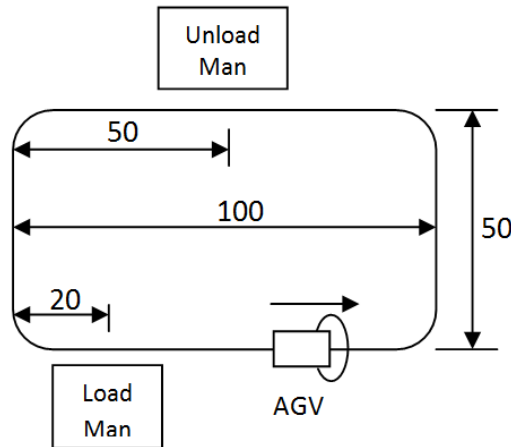


Figure.
All dimensions are in meter.

- (b)** Explain following work transport systems with the help of graphical representation and suitable example/s: **07**
1. Continuous transport
 2. Synchronous transport
 3. Asynchronous transport

OR

- Q.4 (a)** The table below defined the precedence relationships and element times for a new product. (a) construct precedence diagram for this job (b) If the ideal cycle time = 1.1 min, repositioning time = 0.1 min, and service time is assumed to be 1.0 min, what is the theoretical minimum number of work stations required to minimize the balance delay under the assumption that there will be worker per station? (c) Use Kilbridge and Wester method to assign work elements to stations (d) Compute balance delay after assigning work elements to station. **07**

Work element	Element time T_e (min)	Immediate Predecessor	Work element	Element time T_e (min)	Immediate Predecessor
1	0.5	-	6	0.6	3
2	0.3	1	7	0.4	4, 5
3	0.8	1	8	0.5	3, 5
4	0.2	2	9	0.3	7, 8
5	0.1	2	10	0.6	6, 9

- (b)** Briefly explain the following measures used to assess the performance of a storage system: **07**
- storage capacity, storage density, accessibility, throughput, utilization, reliability

- Q.5 (a)** Explain the following terms of Just-in-Time (JIT) manufacturing system: **07**
- Muda, Mura and Muri

- (b) Discuss and describe technologies used in vehicle guidance for Automated Guided Vehicle System (AGVS). Compare and contrast them with respect to each other. **07**

OR

- Q.5** (a) What is MRP lot sizing problem? Explain the working of any one algorithm of MRP lot sizing problem. **07**
- (b) Compare and contrast serial engineering versus concurrent engineering. Also bring out the relative merits and demerits of it. **07**
