

**P.E.S. College of Engineering, Mandya - 571 401***(An Autonomous Institution affiliated to VTU, Belagavi)***Fifth Semester, B.E. - Industrial and Production Engineering****Semester End Examination; February / March - 2022****Computer Integrated Manufacturing**

Time: 3 hrs

Max. Marks: 100

Course Outcomes*The Students will be able to:**CO1: Explain the mathematical models, the terms used in mathematical models, and different types of transfer mechanisms used.**CO2: Define the upper bond and lower bond approach, Work station process time, Cycle time, precedence constraints, Precedence diagram, Balance delay methods of line balancing, explain the effect of storage in industry.**CO3: Design the assembly systems and parts feeding devices.**CO4: Explain the role and importance of AGV, CAPP and MRP.**CO5: Explain the different elements of CNC, the steps involved in writing the CNC part programming and the concept of robots, robot configuration and different robot motion.***Note: I) PART - A is compulsory. Two marks for each question.****II) PART - B: Answer any Two sub questions (from a, b, c) for Maximum of 18 marks from each unit.**

Q. No.	Questions	Marks	BLs	COs
PART - A		10		
I a.	List any two features of fixed automation.	2	L1	CO1
b.	What are the objectives of Line balancing?	2	L1	CO2
c.	Define the ideal cycle time in single station assembly with a mathematical relation.	2	L1	CO3
d.	What are the objectives of capacity requirements planning?	2	L1	CO4
e.	Mention any two types of seasons used in industrial robot.	2	L1	CO5
II: PART - B		90		
UNIT - I		18		
1 a.	i) Define Automation and CIM with the aid of conceptual model of manufacturing.	6	L1	CO1
	ii) What are the different reasons for industrial automation?	3	L1	CO1
b.	Explain the following:			
	i) Utilization and Availability	9	L2	CO1
	ii) Manufacturing lead time			
	iii) Work in process			
c.	i) Explain in detail control functions in automated flow time.	6	L2	CO1
	ii) What are the objectives of the use of flow line automation?	3	L1	CO2

UNIT - II

18

- 2 a. i) What is storage buffer? What are the reasons for implementing storage unit in an automated production line?
- ii) Write a short note on the following:
- I) Precedence diagram
- II) Minimum rational work element
- b. The company is considering replacing one of the current manual work stations with an automatic work head on a 10-station production line. The current line has six automatic stations and four manual stations that is proposed for replacement. Implementing the proposal would allow the cycle time to be reduced to 24 seconds. The new station would cost ` 10/ min. Other cost data $C_w = ` 11/\text{min}$, $C_{as} = ` 7.5/\text{min}$, $C_{at} = ` 9/\text{min}$. Breakdowns occur at each automated station with probability $P = 0.01$. The new automated station is expected to have the same frequency of breakdown. Average downtime per occurrence $T_d = 3 \text{ mm}$. Material cost and tooling cost can be neglected. It is desired to compare the current line with the proposed change on the basis of production rate and cost per price. Assume a yield of 100% good product.
- c. The Demand of the assembly line with its elemental time and precedence is as given below. Construct the precedence diagram and find balance delay by largest candidate rule method. Five worker and stations are required in the solution

4 L1 CO2

5 L1 CO2

9 L2 CO2

(cycle time = 1 minute) Table 2(c)

Elements	Time (minutes) T_{ek}	Must be proceeded by
1	0.2	-
2	0.4	-
3	0.7	1
4	0.1	1, 2
5	0.3	2
6	0.11	3
7	0.32	3
8	0.6	3, 4
9	0.27	6, 7, 8
10	0.38	5, 8
11	0.5	9, 10
12	0.12	11

9

UNIT - III

18

- 3 a. Explain with neat sketch, different types of automated assembly systems. List any two applications of dial type automated assembly system.

9 L2 CO3

- b. A 10-station in-line assembly machine has an ideal cycle time = 6 seconds. The base part is automatically loaded prior to the first station and components are added at each of the stations. The fraction defect rate at each of the 10 station is $q = 0.01$ and the probability that a defect will jam is $m = 0.5$ when a jam occurs, the average downtime is 2 min. Cost to operate the assembly machine is ` 50/ min. Other costs are ignored. Determine :
- 9 L3 CO3
- i) Average production rate of all assemblies
 - ii) Yield of good assemblies
 - iii) Average production rate of good product
 - iv) Uptime efficiency of the assembly machine
 - v) Cost per unit
- c. With a neat sketch, explain part feeding and delivery systems. 9 L2 CO3

UNIT - IV

18

- 4 a. What are the difference between retrieval and generative computer aided process planning? Which is better? Explain with example. 9 L1 CO4
- b. i) List the objectives of material requirements planning. 3 L1 CO4
- ii) Explain the inputs to material requirement planning. 6 L2 CO4
- c. List the types of AGV's and write a note on the following technology/ methods to adopt to AGV's
- 9 L1 CO4
- i) Vehicle guidance and Routing
 - ii) System management

UNIT - V

18

- 5 a. i) Briefly explain the elements of CNC. 6 L2 CO5
- ii) List the advantages and disadvantages of CNC. 3 L1 CO5
- b. With a neat sketch, explain any three robot physical configuration. 9 L2 CO5
- c. i) Explain lead through method of robot programming. 4 L2 CO5
- ii) Mention the different types of robot grippers. 2 L1 CO5
- iii) List the industrial applications of robot. 3 L1 CO5

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