Code No: **R204103G** **R20** **Set No. 1**

IV B.Tech I Semester Regular Examinations, January – 2024

AUTOMATION IN MANUFACTURING

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks
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UNIT - I

1 a) Draw the general structure of a pneumatic circuit and explain the importantcomponents involved in it. [7]

b) Explain the following automation strategies:
(i) Integration of operations (ii) On-line inspection [7]

(OR)

2 a) Define Encoders. Explain the working principles of various types of encoders with a neat sketch. [7]

b) What is automatics tool changer. Explain functioning of various types of ATCs with neat sketches. [7]

UNIT - II

3 a) Identify and briefly describe the three major categories of mechanized work transport systemsused in production lines. [7]

b) The company is considering replacing one of the current manual workstations with an automatic work head on a 10-station production line. The current line has six automatic stations and four manual stations. Current cycle time is 30sec.The limiting process time is at the manual station that is proposed for replacement.Implementing the proposal would allow the cycle time to be reduced to 24 sec. The new station would cost Rs.16/- per min. Other cost data: C_w = Rs.14/min, C_{as} = Rs.8.5/min, and C_{at} = Rs.11/min. Breakdowns occur at each automated station with a probability p = 0.01. The new automated station is expected to have the same frequency of breakdowns. Average downtime per occurrence T_d = 3.0 min, which will be unaffected by the new station. Material costs and tooling costs will be neglected in the analysis. It is desired to compare the current line with the proposed change on the basis of production rate and cost per piece. Assume a yield of 100% good product. [7]

(OR)

4 a) Explain the various conditions under which automated production lines are appropriate. [7]

b) A Geneva with six slots is used to operate the worktable of a dial-indexing machine. The slowest workstation on the dial-indexing machine has an operation time of 2.5sec, so the table must be in a dwell position for this length of time.
(i) At what rotational speed must the driven member of the Geneva mechanism be turned to provide this dwell time?
(ii) What is the indexing time each cycle? [7]

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UNIT - III

5 a) Illustrate the effects of poor-quality parts as represented by the fraction defect rate on the performance of an automated assembly system? [7]

b) What is inspection? List out the difference between off-line inspection and on-line inspection? [7]

(OR)

6 A manual assembly line operates with a mechanized conveyor. The conveyor movesat a speed of 5m/min, and the spacing between base parts launched onto the line is 4m.It has been determined that the line operates best when there is one worker per stationand each station is 6m long. There are 14 work elements that must be accomplished to complete the assembly and the element times and precedence requirements are listed in the table below. Determine (a) feed rate and corresponding cycle time (b) tolerance time for each worker and (c) ideal minimum number of workers on the line. (d) draw the precedence diagram for the problem (e) determine an efficient line balancing solution (f) For your solution, determine the balance delay.

Element	T_e *(min.)*	*Preceded by*	*Element*	T_e *(min.)*	*Preceded by*
1	0.2	---	8	0.2	5
2	0.5	---	9	0.4	5
3	0.2	1	10	0.3	6, 7
4	0.6	1	11	0.1	9
5	0.1	2	12	0.2	8, 10
6	0.2	3, 4	13	0.1	11
7	0.3	4	14	0.3	12, 13

[14]

UNIT - IV

7 a) Name and explain the five major categories of material handling equipment with neat sketches. [7]

b) Explain the basic components of nearly all automated storage/retrieval systems with a neat sketch. [7]

(OR)

8 a) Discuss the advantage of a vertical storage carousel over a horizontal storage carousel? [7]

b) Describe the five categories of material transport equipment commonly used to moveparts and materials inside a facility with neat sketches. [7]

UNIT - V

9 a) Define adaptive control. Explain the configuration and functions of adaptive control with a block diagram. [7]

b) Explain the principle and structure of adaptive control with constraints. [7]

(OR)

10 List out the various operation parameters that can be measured in drilling operation to use in adaptive control systems. [14]