

- (d) Construct the network diagram for the data.
- (e) Compute the percentages of in-sequence, bypassing, and backtracking moves in the solution.
5. (a) Discuss various functions performed by the FMS computer control system. (10)
- (b) On what basis does an automated manufacturing system qualify as being flexible? (5)
6. Describe the different configurations of robots by suitably drawing their kinematic diagrams using standard joint notations. (15)
7. (a) Discuss in detail the Leadthrough method of Robot programming. (10)
- (b) Describe the functions usually performed by a robotic work cell controller. (5)

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May, 2023

B.Tech. (ME) - Vith Semester
FLEXIBLE MANUFACTURING SYSTEM
 (PEC-ME-621-21)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.
2. Answer any four questions from Part-B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.
4. A calculator is allowed.

PART-A

1. (a) Name the three basic elements of an automated system. (1.5)
- (b) What is a storage buffer as the term is used for an automated production line? (1.5)
- (c) What is the ideal cycle time for the single-station assembly machine? (1.5)
- (d) What is the purpose of escapement and placement devices in the parts delivery system? (1.5)
- (e) What is the key machine concept in cellular manufacturing? (1.5)

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- (f) Name the four tests of flexibility that a manufacturing system must satisfy in order to be classified as flexible. (1.5)
- (g) What is the work volume of a robot manipulator? (1.5)
- (h) What is an end effector? (1.5)
- (i) What is control resolution in a robot positioning system? (1.5)
- (j) What is the interlock of work cell control? (1.5)

PART-B

2. (a) Discuss various strategies employed for automation in production systems. (10)
- (b) Explain briefly the methodology to be adopted for implementing Low-Cost Automation. (5)
3. (a) A six-station dial-indexing machine assembles components to a base part. The operations, element times, q and m values for components added are given in the table below (NA means q and m are not applicable to the operation). The indexing time is 2 sec. When a jam occurs, it requires 1.5 min to release the jam and put the machine back in operation. Determine (a) hourly production rate for the assembly machine, (b) yield of good product (final assemblies containing no defective components), and (c) proportion uptime of the system. (10)

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Station	Operation	Element Time	q	m
1	Add part A	4 sec	0.015	0.6
2	Fasten part A	3 sec	NA	NA
3	Assemble part B	5 sec	0.01	0.8
4	Add part C	4 sec	0.02	1
5	Fasten part C	3 sec	NA	NA
6	Assemble part D	6 sec	0.01	0.5

- (b) What is a manual assembly line? What are the factors that favour the use of manual assembly lines? (5)
4. For the data given below : (15)
- (a) develop the part-machine incidence matrix, and
- (b) apply the rank-order clustering technique to the part-machine incidence matrix to identify logical part families and machine groups.

Part	Weekly Quantity	Machine Routing	Part	Weekly Quantity	Machine Routing
A	50	3 → 2 → 7	F	60	5 → 1 → 8
B	20	6 → 1 → 8	G	5	3 → 2 → 4
C	75	6 → 5	H	100	3 → 2 → 4 → 7
D	10	6 → 5 → 1	I	40	2 → 4 → 7
E	12	3 → 2 → 7 → 4	J	15	5 → 6 → 1 → 8

For each machine group formed above,

- (c) determine the most logical sequence of machines for the routing data.

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[P.T.O.]

