

IV B.Tech I Semester Supplementary Examinations, February 2008
AUTOMATION IN MANUFACTURE

(Common to Mechanical Engineering and Production Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Discuss the following automation strategies that can be employed to improve productivity in manufacturing operations:
 - i. Specialization of Operations
 - ii. Increased Flexibility
 - iii. On-Line inspection
 - iv. Computer Integrated Manufacturing.
- (b) Explain the following types of Automation:
 - i. Programmable Automation
 - ii. Fixed Automation [8+8]
2. (a) Discuss the general methods of transporting work pieces on flow lines.
- (b) Discuss the advantages and limitations of the continuous transfer mechanisms. [10+6]
3. (a) Explain 'Upper bound approach' and 'Lower bound approach'. Enumerate the differences between these two approaches.
- (b) Explain the following terms used in the analysis of an automated flow lines:
 - i. Partial automation
 - ii. Lower bound approach [8+8]
4. (a) Explain the following terms in line balancing:
 - i. Manual rational work element
 - ii. Total work content
 - iii. Work Station Process Time
- (b) The total work content time of a certain assembly job is 7.8 min. The estimated downtime of the line is $D = 5\%$ and the required production rate is $R_p = 80$ units/h.
 - i. Determine the theoretical minimum number of workstations required to optimize the balance delay.
 - ii. For the number of stations determined in part (i), compute the balance delay d .
 - iii. What feed rate should be specified if a moving belt line is to be used? [6+10]

5. (a) Describe the following Automated Guided Vehicle System with the help of simple sketch:
 - i. Pallet Trucks
 - ii. Driverless Trains.
- (b) Explain the reasons for using asynchronous conveyor systems. [8+8]
6. (a) Sketch and explain the configurations of work-in-process storage systems and their relationship to manufacturing.
- (b) Discuss the problems encountered in the control of AS/RS operation. [8+8]
7. Draw the block diagram of Adaptive Control with Optimization system for milling and explain each block in detail. [16]
8. (a) Explain the solid based Rapid Prototyping process with the help of neat sketch.
- (b) Explain the objectives of Concurrent Engineering. [8+8]

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1. (a) Define 'Fixed Automation' and 'Flexible Automation'. Enumerate the differences between them.
(b) What are the important mechanical feeding devices used in automated systems? Discuss them briefly. [8+8]
2. (a) Discuss the general methods of transporting work pieces on flow lines.
(b) Discuss the advantages and limitations of the continuous transfer mechanisms. [10+6]
3. (a) Discuss the following terms used in automated flow lines:
 - i. Average Production Rate
 - ii. Average Production Time
 - iii. Down Time(b) The following data apply to a 12-station in-line transfer machine: $P = 0.01$ (all stations have an equal probability of failure)
 $T_c = 0.3$ min
 $T_d = 3.0$ min
Using the upper-bound approach, compute the following for the transfer machine:
 - i. the frequency of line stops,
 - ii. the average production rate
 - iii. the line efficiency. [6+10]
4. (a) What are the various assembly systems used in industry to accomplish the assembly processes.
(b) Explain the steps used in solving the line balancing problem by using Largest-Candidate Rule method. [8+8]
5. (a) Discuss the various material characteristics factors which influence the design of the material handling system.
(b) Discuss the following tasks to operate Automated Guided Vehicle Systems efficiently:
 - i. Traffic Control
 - ii. Vehicle Dispatching. [8+8]
6. What are the important categories of AS/RS? Describe them briefly. [16]

7. What is the objective of Adaptive Control with Constraints? Draw the block diagram of a typical computerized Adaptive Control with Constraints system for drilling operation and explain in detail. [16]
8. (a) Explain the following liquid based Rapid prototyping techniques:
- i. Solid Ground Curing
 - ii. Droplet deposition manufacturing
- (b) Discuss the benefits of Business Process Reengineering techniques. [8+8]

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1. (a) What are the different types automation? Discuss them briefly.
(b) Draw the simple block diagram of pneumatic circuit and discuss it briefly. [8+8]

2. (a) Explain the salient factors on which the most appropriate type of transport system for a given application depends.
(b) A Geneva with eight 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 2.5 seconds, 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? [6+10]

3. (a) What is 'partial automation' and what are the reasons for the existence of partially automated production lines in the shop floors?
(b) Discuss the following terms used in the automated flow lines:
 - i. Starving of stations
 - ii. Blocking of stations. [8+8]

4. A moving belt assembly line is to be designed for an assembly job that has a total work content of 21 min. From consideration of human factors the length of each station will be 6.0 ft. The belt speed is variable and can be set between 1.1 and 2.0 ft/min. The required production rate for the line must be 30,000 units/yr (assume 2000 h of operation per year). From past experience on similar lines, the uptime proportion of this assembly line (line efficiency), E is expected to be 95%. Production management demands that the line be for a balance delay within this range.
 - (a) Determine the number of stations that should be designed on the assembly line.
 - (b) With good design practice in mind, determine the belt speed, spacing between parts on the line and the tolerance time to be used. [16]

5. What are the three important categories of Automated Guided Vehicle Systems? Discuss them briefly with the help of neat sketches and explain their applications. [16]

6. (a) Explain the various applications of carousal storage systems.
(b) Explain the various objectives for installing an automated storage system in a factory. [8+8]
7. What is Adaptive Control with Optimization? Draw the block diagram of Adaptive Control with Optimization for milling and explain the various parameters measured. [16]
8. (a) Explain the following liquid based Rapid prototyping techniques:
i. Solid Ground Curing
ii. Droplet deposition manufacturing
(b) Discuss the benefits of Business Process Reengineering techniques. [8+8]

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1. (a) Draw the simple block diagram of pneumatic circuit and discuss it briefly.
(b) Discuss the following types of automation:
 - i. Flexible Automation
 - ii. Programmable Automation. [8+8]

2. Draw the neat sketches of the following mechanisms and discuss briefly:
 - (a) Ratchet and Pawl mechanism
 - (b) 'Over and Under' type chain drive mechanism
 - (c) Cam mechanism
 - (d) Walking Beam mechanism. [16]

3. (a) Define the following terms used in automated flow lines and write the mathematical expressions for each term:
 - i. Production Time
 - ii. Theoretical Production Rate
 - iii. Average Production Rate
(b) An eight-station rotary indexing machine operates with an ideal cycle time of 30 s. The frequency of line stop occurrences is 0.06 stops/cycle on the average. When a stop occurs, it takes an average of 3 min to make repairs. Determine the following:
 - i. Average production time
 - ii. Average production rate
 - iii. Line efficiency
 - iv. Proportion of downtime [6+10]

4. The following list defines the precedence relationships and element times for a new model toy:

Element	T_e (min)	Immediate predecessors
1	1.0	–
2	0.6	1
3	1.6	1
4	0.4	2
5	0.2	2
6	1.2	3
7	0.8	4,5
8	1.0	3,5
9	0.6	7,8
10	1.2	6,9

Determine the assignment of work elements to stations using the Largest-Candidate rule. Also determine

- (a) How many stations are required?
 - (b) Compute the balance delay. [16]
5. (a) Explain briefly the important principles of material handling.
- (b) Describe the following conveyors used in material transport systems:
- i. Roller and Skate wheel conveyors
 - ii. Belt conveyors. [8+8]
6. What are the important categories of AS/RS? Describe them briefly. [16]
7. Draw the block diagram of Adaptive Control with Optimization system for grinding operation and explain each block in detail. [16]
8. (a) Which type of Rapid Prototyping systems use a liquid as starting material? Discuss any one such RP system.
- (b) Define ‘Business Process Reengineering’. Discuss how the Business Process Reengineering tool will enhance the performance of companies to survive in the emerging competitive environment. [8+8]
