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10ME61/10ME617

Sixth Semester B.E. Degree Examination, Jan./Feb. 2021
Computer Integrated Manufacturing

Time: 3 hrs.   Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART – A

1 a. Define the terms 'Automation' and 'CIM'. Explain the relationship between these two terms with a simple sketch. **(06 Marks)**
   b. Explain the mathematical modeling of the following production concepts for different types of production: (i) MLT   (ii) Production rate **(10 Marks)**
   c. A production machine operates 80 hrs/week at full capacity. Its production rate is 20 units/hr. During a certain week, the machine produced 1000 parts and was idle the remaining time.
   i) Determine the production capacity of the machine
   ii) What was the utilization of the machine during the week under consideration? **(04 Marks)**

2 a. Write the classification of work part transport based on the type of motion imported to the work piece by transfer mechanism. Explain them with the help of velocity-distance diagrams. **(10 Marks)**
   b. What is a Buffer storage? Write the schematic of a Buffer storage between two stages of an APL. List the reasons for using a Buffer storage in an APL. **(10 Marks)**

3 a. Explain the following terms used in the analysis of automated flow line:
   (i) Average downtime   (ii) Line efficiency
   (iii) Upper Bound Approach   (iv) Lower Bound Approach **(04 Marks)**
   b. A 30 station transfer line has an ideal cycle time of 0.75 min, and average downtime of 6 min/line stop and a station failure frequency of $p = 0.01$ for all stations. A proposal has been submitted to locate a storage buffer between stations 15 and 16 to improve line efficiency. If the capacity of storage buffer is 20 parts, determine:
   (i) Line efficiency   (ii) Production rate of the line.
   Use upper Bound Approach and assume that the downtime is a constant. **(12 Marks)**
   c. What are partially automated flow lines? What are the two important reasons for the occurrence of partially automated flow lines? **(04 Marks)**

4 a. What is Line Balancing? Enumerate four important objectives of line balancing. **(06 Marks)**
   b. Explain precedence constraints and precedence diagram. **(04 Marks)**
   c. A single model assembly line has to produce a component which has a annual demand of 1,20,000 units/year. The line will operate 48 wk/yr, 6 shifts/wk and 8 hours/shift. Manning level will be one worker per station. The work content is reduced to its corresponding work elements as listed in table. The efficiency of the line is 96% and repositioning time per cycle will be 0.06 min. Determine:
   (i) Total work content time   (ii) Hourly production rate to achieve the demand
   (iii) Cycle time   (iv) Theoretical minimum number of workers required
   (v) Service time to which the line must be balance

Sl. No. (element)	1	2	3	4	5	6	7	8	9	10	11	12
T_e (min)	0.3	0.4	0.8	0.1	0.2	0.15	0.38	0.6	0.5	0.25	0.18	0.32
Preceded by	-	-	1	1,2	2	3	3	3,4	6,7,8	5	9,10	11

Construct the precedence diagram. **(10 Marks)**

PART – B

5 a. With neat sketches, explain the classification of automated assembly systems according to physical configuration. **(12 Marks)**

b. A single station assembly machine performs 5 work elements to assemble 4 components to a base part. The elements are listed in the table below, together with the fraction defect rate (q) and probability of a station jam (m) for each of the component added.

Element	Operation	Time (sec)	q	m	p
1	Add gear	4	0.02	1.0	-
2	Add spacer	3	0.01	0.6	-
3	Add gear	4	0.015	0.8	-
4	Add gear and mesh	7	0.02	1.0	-
5	Fasten	5	0	NA	0.012

Time to load the base part is 3 sec and time to unload the completed assembly is 4 sec, giving a total load/unload time of $T_h = 7$ sec. when a jam occurs it takes an average of 1.5 mins to clear the jam and restart the machine. Determine:

(i) Production rate of all products

(ii) Yield of good product

(iii) Production rate of good products

(iv) Uptime efficiency of the assembly machine **(08 Marks)**

6 a. Explain Retrieval CAPP system with the help of a block diagram. **(12 Marks)**

b. What is MRP? Explain the inputs to the MRP system. **(08 Marks)**

7 a. Write a note on universal machining centre. **(04 Marks)**

b. List the steps involved in the development of a part program. **(08 Marks)**

c. Explain the following with respect to CNC part programming:

(i) Preparatory function

(ii) Absolute positioning

(iii) Incremental positioning

(iv) Miscellaneous functions **(08 Marks)**

8 a. Explain Robot configurations with the help of neat sketches. **(12 Marks)**

b. Explain different external sensors used in robots. **(08 Marks)**

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