

Question 1

- d) Discuss briefly the concepts of the upper and lower boundary approaches.

- e) Explain briefly the types of transfer mechanism of production flow line.
- f) What is the equipment used which feed components to assembly machine automatically?

Question 2

12-station flow line performs processing operations with cycle time of 1.0 minute. Each station operates 225 cycle and then fails. During the observed period, failure occurred on the average 10 times with average repair time 15 cycles. Determine the following:

- A) The period of observation **(2.5 marks)**
- B) The number of parts completed **(2.5 marks)**
- C) Failure and repair rate of stations **(6 marks)**
- D) Frequency of line stop per cycle **(4 marks)**
- E) If the system operate 75% under upper bound approach and 25% under lower bound approach:- Find (1) Production rate; (2) Line efficiency; (3) Acceptable number of parts; (4) Defect parts., (5) cost of the line, if the operating cost is equal 50 SR/hr and ignoring other costs. **(10 marks)**
- F) If the line is to be divided to 2, 3 & 4 stages, find the cost if the buffer cost is 900 SR/hr for parts produced during the studied period of production. Explain what the trend of the cost and efficiency values **(10 marks)**

Question 3

- A) An FMS consists of 2 turning center and 3 machining centers. The system will run 12 hr/day, 6 days/week, and the machines are available are 90% of the time. Machines will cost 150 SR/hr to operate. Using the data in table below, determine the set of part families to be produced on the FMS. **(25 marks)**

Part Family	1	2	3	4	5	6	7	8	9	10
Weekly Demand	22	25	30	50	30	15	14	18	20	30
Subcontracting cost SR/unit	800	620	700	1200	900	750	500	400	800	850
Material cost SR/unit	125	100	180	400	350	200	150	110	130	450
Turning time, hr	0.0	0.7	1.2	0.0	3.0	1.3	1.5	2.5	1.4	2.3
Machining Center, hr	2.0	1.2	1.7	1.6	0.0	1.6	1.5	0.0	2.2	2.2

B) 12 parts are to be manufactured in a FMS. Find the minimum number of batches and the product type for each batch according the data given in table below. The tool magazine capacity is 8 slots. . **(10 marks)**

Part Type	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Tool Type requirement	T1(1), T5(1)	T2(1)	T1(1), T3(1)	T3(1)	T1(1), T4(1)	T1(1), T2(1)	T3(1), T5(1)	T6(2), T7(1)	T1(1), T4(1), T7(2)	T1(1), T6(1)	T2(1), T4(2)	T3(1), T5(1)

Question 4

A) Formulate the loading problem for FMS. **(10marks)**

- B) A FMS consists of three stations is used to manufacturer three parts. The relative data is given in Table (3). Solve the loading of the stations in the FMS. **(20 marks)**

Table (3)

Part	Weekly Demand	Operation	Machine Processing time, min			Tool type
			A	B	C	
a	75	1	20	20	-	T1
		2	24	34	20	T2
		3	-	-	30	T3
b	80	1	-	30	25	T4
		2	35	-	-	T3
		3	25	-	30	T2
c	125	1	16	20	22	T1
		2	-	20	16	T7
Number of machines			2	1	2	
Number of tool's slot			2	2	2	
Available time, hr/day			12			