Master of Mechanical Engineering 2nd Semester Examination 2018

Advanced Manufacturing Systems

Time: Three hours   Answer any **five** questions   Full marks: 100

1. (a) What are the four functions included within the scope of manufacturing support systems? Discuss any one of them.
   (b) Name five reasons why companies automate their operations.
   (c) What type of production does a job shop perform?
   (d) What is JIT production?
   (e) What is the difference between hard product variety and soft product variety?   [20]

2. (a) How does MRPII differ from MRP?
   (b) What are the advantages and disadvantages of ERP systems?
   (c) What are the dependent inventory model requirements?
   (d) One unit of A is composed of 3 units of B and three units of C. Each B is composed of one unit of F. C is made of one unit of D, one unit of E, and three units of F. items A, B, C, and D have 30, 60, 60, and 20 units of on-hand inventory. Items A, B, and C use lot-for-lot as their lot sixing technique, while D, E, and F require multiples of 50, 100, and 100, respectively, to be purchased. B has scheduled receipts of 40 units in period 1. No other scheduled receipts exist. Lead times are one period for items A, B, and D, and two periods for items C, E, and F. Gross requirements for A are 30 units in period 1, 10 units in period 2, 50 units in period 6, and 60 units in period 8. Find the planned order release for F.   [4+4+4+8]

3. (a) What is cellular manufacturing?
   (b) Explain Opitz parts classification and coding system.
   (c) Apply the rank order clustering technique to the following part-machine incidence matrix in the table that follows to identify logical part families and machine groups. Parts are identified by letters and machines are identified numerically. Determine the grouping efficacy of the solution.   [4+4+12]

Machines	Parts								
	A	B	C	D	E	F	G	H	I
1	1			1		1			1
2		1					1		
3			1		1			1	
4		1				1	1		1
5			1					1	
6	1			1		1	1		
7	1				1			1	
8			1		1				1

4. (a) What is a flexible manufacturing system?
   (b) What are the advantages of the FMS?
   (c) Name four tests of flexibility that a manufacturing system must satisfy in order to be classified as flexible.
   (d) A flexible manufacturing cell consists of a load/unload station and two machining workstations. The load/unload is station 1. Station 2 performs milling operations and consists of one server (one CNC milling machine). Station 3 has one server that performs drilling (one CNC drill press). The three stations are connected by a part handling system

that has one work carrier. The mean transport time is 3.0 mins. The FMC produces three parts, A, B, and C. The part mix fractions and process routings for the three parts are presented in the table below. The operation frequency $f_{ijk} = 1.0$ for all operations. Determine (a) maximum production rate of the FMC, and (b) corresponding production rates of each product. [4+3+3+10]

Part j	Part mix pj	Operation k	Description	Station i	Process time t_{ijk} (min)
A	0.2	1	Load	1	3
		2	Mill	2	20
		3	Drill	3	15
		4	Unload	1	2
B	0.3	1	Load	1	3
		2	Mill	2	15
		3	Drill	3	40
		4	Unload	1	2
C	0.5	1	Load	1	3
		2	Drill	3	14
		3	Mill	2	30
		4	Unload	1	2

5. (a) What are the constraints in assembly line balancing?

(b) What is the difference between independent demand and dependent demand?

(c) Two products use a single assembly line in a particular facility. Precedence diagrams for the two products A and B are given in the following tables 1 and 2 respectively. Given a cycle time of 25 minutes, determine the balance using the Helgeson-Birnie approach on the combined precedence network. Also, determine the line efficiency and station efficiencies for both products. [4+4+12]

Table 1 for Product A:

Activity No.	3	4	6	7	9	10	11	12	15
Immediate predecessor (s)	--	3	4	3	7	7	3	10,11	6,9,12
Activity time:	2	6	5	7	3	5	7	6	4

Table 2 for Product B:

Activity No.	1	2	3	4	5	7	8	9	10	12	13	14	15
Immediate predecessor (s)	--	1	2	3	4	1	7	4,8	9	1	12	13	5,10,14
Activity time:	6	2	4	6	5	7	10	3	3	6	7	8	4

6. (a) Define aggregate planning.

(b) What is the relationship between aggregate plan and master production schedule?

(c) Discuss the transportation method for aggregate planning.

(d) What are the different aggregate planning options? [4+4+8+4]

7. (a) A company is moving to kanbans to support its telephone switching-board assembly lines. Determine the size of the kanban for subassemblies and the number of kanbans needed. Setup cost = Rs 30; Annual holding cost subassembly = Rs 120 per subassembly; Daily production = 20 subassemblies; Annual usage = 2500 950 weeks x5 days each x daily usage of 10 subassemblies); Lead time = 16 days; Safety stock = 4 days' production of subassemblies.

(b) What is synchronous manufacturing?

(c) Discuss the concept of "drum-buffer-rope". [10+5+5]

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