Department of Mechanical Engineering
Birla Institute of Technology and Science, Pilani, Pilani campus

A

ME F316: Manufacturing Management
Comprehensive examination (26/12/2022)
Time: 180 min; Max. Marks: 70

NOTES:
(I) Answer all question in the space provided in the question paper itself.
(II) Answers should be brief, to-the-point and be supplemented with neat sketches, if necessary.
(III) Figures on the right-hand side within parentheses indicate full marks.
(IV) No clarification is encouraged.
(V) Your signature on pledge is mandatory.

NAME ……..... **ROLL NO.** ……

SUBJECT …… **SECTION** ……

Marks obtained:

I PLEDGE MY HONOR AS A GENTLEMAN/LADY THAT DURING THE EXAMINATION I HAVE NEITHER GIVEN ASSISTANCE NOR RECEIVED ASSISTANCE.

……
Signature

Q1. MCQs Answers

QUESTION NO.	ANSWER	QUESTION NO.	ANSWER
1		**8**	
2		**9**	
3		**10**	
4		**11**	
5		**12**	
6		**13**	
7		**14**	
Total			

Q1. Select the most appropriate answer and write down the correct option in above table:

1. For a set number of jobs to be processed on one machine the sequencing rule that will minimize average job completion time is **[1]**
   a. FCFS
   b. LPT
   c. SPT
   d. DDATE
2. Which of the statements concerning pure and mixed strategies for production planning is true? **[1]**
   a. pure and mixed strategies are difficult to evaluate
   b. pure strategies are always optimal but mixed strategies rarely are
   c. mixed strategies are always optimal but pure strategies rarely are
   d. pure and mixed strategies are easy to evaluate
3. The process of breaking an aggregate plan into more detailed plans is referred to as **[1]**
   a. collaborative planning
   b. hierarchical planning
   c. disaggregation
   d. rough-cut planning
4. Regression forecasting methods relate…….to other factors that cause demand behavior. **[1]**
   a) Supply
   b) Demand

c) Time
d) Money
e) Efficiency

5. The direct labor hours required to produce the first two units of a new product are 2,000 and 1,800, respectively. Using a 90% learning rate the company would estimate the direct labor hours for the 5^{th} unit to be **[2]**
   a. 1692.4 hours
   b. 1620.0 hours
   c. 1566.0 hours
   d. 1523.2 hours
6. A restaurant currently uses 62,500 boxes of napkins each year at a constant daily rate. If the cost to order napkins is $200.00 per order and the annual carrying cost for one box of napkins is $1.00, then the optimal order quantity (EOQ) for napkins would be **[2]**
   a. 62,500 boxes
   b. 10,000 boxes
   c. 5,000 boxes
   d. 2,500 boxes
7. A company is developing a linear programming model for its aggregate production plan. If I_t = units in inventory at the end of period t, P_t = units produced in period t, and D_t = demand in period t, then the company's demand constraint to ensure that demand is met in quarter 3 would be **[2]**
   a. $D_3 = I_2 - I_3 + P_3$
   b. $D_3 = I_3 + P_3$
   c. $D_3 = I_3 - I_2 + P_3$
   d. $D_3 = I_2 - I_3 + P_2$
8. Given the information below, the number of available-to-promise units in period 2 would be **[2]**

	Period					
On Hand = 100	1	2	3	4	5	6
Forecast	200	250	200	300	200	200
Customer Orders	150	125	100	250	150	250
Master Production Schedule	400		400		400	
Available-to-Promise						

   a. 400
   b. 350
   c. 225
   d. 125
9. Four products (1, 2, 3, and 4) must be processed on one of four machines (A, B, C, and D). The times required in minutes for each product on each machine are shown below **[3]**

	Machine			
Product	A	B	C	D
1	10	9	16	12
2	8	14	17	5
3	19	20	11	7
4	8	18	5	10

   If management wishes to assign products to machines so that the total time to complete all the products is minimized, then Product 4 would be assigned to
   a. Machine A
   b. Machine B
   c. Machine C
   d. Machine D
10. If the following jobs are sequenced according to the LPT rule then the mean tardiness (in days) for all jobs would be (assume today's date is day 0) **[3]**

Job	Processing Time (days)	Due Date
A	8	12
B	6	15

C	11	17
D	5	10
E	3	8

a. 62 days
b. 12.4 days
c. 15.5 days
d. 25 days

11. If the following jobs are sequenced according to the SLACK rule then the maximum job tardiness (in days) would be (assume today's date is day 0) **[3]**

Job	Processing Time (days)	Due Date
A	8	12
B	6	15
C	11	17
D	7	10
E	3	8

a. 20 days
b. 12 days
c. 10 days
d. 7 days

12. The following set of jobs must be processed serially through a two-step system. The times at each process are in hours. If Johnson's Rule is used to sequence the jobs then the makespan time (in hours) for all jobs would be **[3]**

Job	Process 1	Process 2
A	12	9
B	8	11
C	7	6
D	10	14
E	5	8

a. 42 hours
b. 53 hours
c. 90 hours
d. 95 hours

13. The following information relates to a company's aggregate production planning activities: **[3]**

Quarter	Demand Forecast
1	37,500
2	45,000
3	25,000
4	62,500

Beginning Workforce = 125 workers
Production per Employee = 500 units per quarter
Hiring Cost = $750 per worker
Firing Cost = $1,500 per worker
Inventory Carrying Cost = $10 per unit per quarter

If a chase demand strategy is used then the number of workers hired in quarter 4 would be

a. 0
b. 15
c. 75
d. 125

14. A forecasting model has produced the following forecasts: **[3]**

Period	Demand	Forecast	Error
January	120	110	
February	110	115	
March	115	120	

April	125	115	
May	130	125	

The mean absolute percentage deviation (MAPD) for the end of May is

a. 0.0250
b. 0.0583
c. 0.5830
d. 0.6670

Q2. Alice's Alterations has eight jobs to be completed and only one sewing machine (and sewing machine operator). Given the processing times and due dates as shown here, prioritize the jobs by SPT, DDATE, and SLACK. Today is day 5. Calculate mean flow time, mean tardiness, maximum tardiness, and number of jobs tardy for each sequence. Which sequencing rule would you recommend? Why? **[5+ 5+ 5]**

Task	Processing time (in days)	Due date
A	5	10
B	8	15
C	6	15
D	3	20
E	10	25
F	14	40
G	7	45
H	3	50

Q3. The bookstore at Tech purchases jackets emblazoned with the school name and logo from a vendor. The vendor sells the jackets to the store for $38 apiece. The cost to the bookstore for placing an order is $120, and the annual carrying cost is 25% of the cost of a jacket. The bookstore manager estimates that 1700 jackets will be sold during the year. The vendor has offered the bookstore the following volume discount schedule:

Order size	Discount
1-299	0%
300-499	2%
500-799	4%
800+	5%

(i) What is the bookstore's optimal order quantity, given this quantity discount information? **[8]**

(ii) Determine the optimal order quantity of jackets and total annual cost if the carrying cost is a constant $8 per jacket per year. **[7]**

Q4. Fabulous Fit Fibers produces a line of sweat-clothes that exhibits a varying demand pattern. Given the following demand forecasts, production costs, and constraints, design a production plan for Fabulous Fit using the transportation method of LP. Also, calculate the cost of the production plan. **[10]**

Maximum regular production =100 units/month, Maximum overtime production = 50 units/month, Maximum subcontracting = 50 units/month, Regular production costs = $10/unit, Overtime production costs = $25/unit, Subcontracting costs = $35/unit, Inventory holding costs = $5/unit/month, Beginning inventory = 0.

Period	Demand
September	100
October	130
November	200
December	300