Birla Institute of Technology & Science, Pilani || KK Birla Goa Campus
First Semester 2022-2023
Comprehensive Examination
ME F316 Manufacturing Management

Date: 28/12/2022 Time: (10:00 AM -1:00 PM)
MM 80 (weight 40%)

Note:
1. All questions carry equal marks. Each answer should start from a fresh page.
2. Assumptions made if any, should be stated clearly at the beginning of your answer.
3. Students must write their names on the answer sheets as it appears in the institute record.

1. There are four jobs, each of which has to be processed on machines A, B, C, D, E and F in the alphabetical order. Processing times in hours are given below. Find out the optimal sequence of jobs, minimum time required to process this batch of jobs, and the idle time for each of these machines. Draw the Gantt chart for the machines.

Jobs	Machines					
	A	B	C	D	E	F
1	15	8	6	14	6	26
2	17	7	9	10	15	12
3	21	7	12	9	11	19
4	18	6	11	12	14	17

2. A bakery received a contract this year as a supplier of cookies. It currently has five production lines, each of which is capable of handling all jobs, but with different processing times as the production lines differ by sophistication of machines, site, and experience of personnel. Given the following estimates of processing times (in hours), allocate the jobs to the production lines for completing the overall batch of jobs in the minimum time.

	Production Line				
Cookies	1	2	3	4	5
Chocolate Mint	30	18	26	17	15
Peanut Butter	23	22	32	25	30
Shortbread	17	31	24	22	29
Fudge Delight	28	19	13	18	23
Macaroons	23	14	16	20	27

Item: X	LLC: 0	Period							
Lot Size: Min 50	LT: 2	1	2	3	4	5	6	7	8
Gross Requirements		25	30	56	25	100	40	30	20
Scheduled Receipts			50						
Projected on Hand	30								
Net Requirements									
Planned Order Receipts									
Planned Order Releases									

3. Complete the above MRP matrix for item X. Determine when the orders should be released and the size of those orders.

4. A manufacturer of medical supplies produces a variety of items and a standard kit composed of basic supplies is used for planning purposes. Demand varies with seasonal illnesses and the quarterly ordering policies of hospitals. The average worker at the company can produce 1000 kits a month at a cost of $9 per kit during regular production hours and $10 a kit during overtime production. Completed kits can also be purchased from outside suppliers at $12 each. Inventory carrying costs are $2 per kit per month. Overtime capacity is equal to regular production, but subcontracting is unlimited. Hiring as well as firing costs are each $1500 per worker. The company currently employs 25 workers. Given the demand forecast below, develop a six-month aggregate production plan for the company using (a) chase demand, (b) Level Production and (c) a mixed strategy where the current workforce is kept for April through August so that the regular capacity is 25000, and supplemented with overtime and subcontracting as needed. (Do not use overtime and subcontracting in part a and b)

Month	Demand	Month	Demand
April	60000	July	46000
May	22000	August	80000
June	15000	September	15000

5. A tire company produces a brand of tire. The annual demand at its distribution center is 12,400 tires per year. The transport and handling costs are $2600 each time a shipment of tires is ordered at the distribution center. The annual carrying cost is $3.75 per tire.
   (a) Determine the optimal order quantity and the minimum total annual cost.
   (b) The company is thinking about relocating its distribution center, which would reduce transport and handling costs to $1900 per order but increase carrying costs to $4.50 per tire per year. Should the company relocate based on inventory costs?
6. The busiest time of the day at a fast-food restaurant is between 11:00 A.M. and 2:00 P.M. The restaurant is very labor-dependent, and a critical factor for providing quick service is the number of employees on hand during this three-hour period. In order to determine the number of employees it needs during each hour of the three-hour lunch period, the restaurant requires an accurate forecasting model. Following are the number of customers served at the restaurant during each hour of the lunch period for the past 20 weekdays. Develop a forecast for customer demand for the 21st day for the specific hours as given using 5-day Moving Average and an exponential smoothing forecast with alpha as 0.30. Compare the MAD values and identify which forecast seems to be more accurate.

	Hour				Hour		
Day	11–12	12–1	1–2	Day	11–12	12–1	1–2
1	90	125	87	11	57	114	106
2	76	131	93	12	68	125	95
3	87	112	99	13	75	206	102
4	83	149	78	14	94	117	118
5	71	156	83	15	103	145	122
6	94	178	89	16	67	121	93
7	56	101	124	17	94	113	76
8	63	91	66	18	83	166	94
9	73	146	119	19	79	124	87
10	101	104	96	20	81	118	115

	Processes														
Jobs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	X	X										X				
B						X		X								
C	X						X							X		
D	X	X					X							X		
E				X		X										
F						X		X			X					
G	X	X										X				
H					X					X					X	
I	X	X	X											X		
J						X					X					
K										X					X	X
L				X		X					X		X			
M		X							X			X				
N										X					X	X
O					X					X					X	X
P				X		X					X					
Q								X								

7. What is a cellular layout. What are its similarities with the process layout and the product layout. A small family-owned print shop deals with a range of jobs from simple copying to four-color printing, scanning, binding, and more. The company is moving into a new facility and would like some help arranging its 16 processes into an efficient, yet flexible, layout. A table of the most popular jobs is shown above with processing information. How would you arrange the processes to ensure an efficient and flexible operation?

8. What are the trade-off factors while crashing a project? For a project, five activities with different details are provided below. Draw the project network and find out, what is the expected normal completion time for the project. If there is a need to complete the project in 10 days, which activities need to be crashed to minimize the cost of crashing.

ACTIVITY	NORMAL TIME (DAYS)	CRASH TIME (DAYS)	NORMAL COST	CRASH COST	IMMEDIATE PREDECESSOR(S)
A	6	5	$ 900	$1,000	—
B	8	6	300	400	—
C	4	3	500	600	—
D	5	3	900	1,200	A
E	8	5	1,000	1,600	C