B.E. Food Technology and Bio-Chemical Engineering

Fourth Year (Second Semester), Supplementary Examination 2024

Industrial Management

Duration: 3 hours **Answer any five questions.** **Full Marks: 100**

1. (a) Historical demand for a product is:

Month	April	May	June	July	August	September
Actual demand	50	55	70	65	70	75

i. Using a three-month simple moving average, calculate a forecast for October.
ii. Using a three-month weighted moving average with weights 0.5, 0.3, and 0.2, calculate a forecast for October.
iii. Using a single exponential smoothing with $\alpha = 0.6$ and August forecast = 65, calculate a forecast for October.
(b) Develop two normal equations based on linear regression analysis and determine the constants' values. [12+8]

2. (a) Show graphically the angle of incidence and margin of safety in case of linear break-even analysis and state their importance.
(b) A project is broken down into the following activities along with their times (days) and precedence relationships. Develop the network based on AOA.

Activity	A	B	C	D	E	F	G	H	I	J	K
Immediate predecessor(s)	----	A	A	B	D	C	E, F	G	G	H, I	J
Normal time (days)	4	6	3	6	14	5	2	2	3	4	2

(c) Determine the critical path with the corresponding project duration.
(d) Determine the free float of each activity. [6+6+4+4]

3. Consider the following LP formulation.
Maximize $Z = 7x1 + 3x2$; subject to: $x1 + 2x2 \geq 3$; $x1 + x2 \leq 4$; $0 \leq x1 \leq 5/2$; $0 \leq x2 \leq 3/2$; and $x1, x2 \geq 0$
(i) Graphically illustrate the feasible solution region and apply the extreme point solution method to indicate which corner point produces the optimal solution. (ii) What is the optimal solution? (iii) Is there more than one optimal solution? Explain. [12+4+4]

4. (a) Use VAM to obtain the initial feasible solution to the following transportation problem.

		Destination				Supply
		D1	D2	D3	D4	
Source	S1	1	5	1	1	60
	S2	4	3	6	8	30
	S3	3	2	5	9	40
Demand		50	40	30	10	

[Turn over

(b) Determine the initial basic feasible solution of the above transportation problem using the North-West Corner rule and check for optimality. [10+(6+4)]

5. (a) The company XYZ has an annual demand of 4000 units of an item. The cost of each item is Rs. 90. The cost of placing an order is Rs. 25 and the inventory carrying cost is Rs. 9. Assume 250 working days per year. Determine (i) EOQ, (ii) the Optimal number of orders per year, (iii) The optimal order cycle time, and (iv) the total cost comprising the total annual ordering cost and the carrying cost if the EOQ is used.

(b) Derive the formula of the EOQ you use in (a).

(c) What is the purpose of the ABC classification system? [8+6+6]

6. (a) Determine the optimum sequence for processing the jobs shown below through two work centres in flow shop scheduling. Times at each centre are in hours.

Job	1	2	3	4	5	6	7
Work Centre 1	6	8	18	15	16	6	10
Work centre 2	12	7	9	10	8	8	5

Compute the throughput time for the optimum sequence of jobs obtained and the corresponding idle time at the two work centres. (b) What is the difference between flow shop scheduling and job shop scheduling? [14+6]

7. An oil refinery manager must decide on the optimal mix of two possible blending processes of which the inputs and outputs run are as follows.

Process (units)	Input (units)		Output (units0	
	Grade A	Grade B	Gasoline X	Gasoline Y
1	5	3	5	8
2	4	5	4	4

The maximum amounts available of crudes A and B are 200 units and 150 units respectively. Market requirements show that at least 100 units of gasoline X and 80 units of gasoline Y must be produced. The profits per production run for process 1 and process 2 are Rs. 300 and Rs. 400 respectively. Formulate the LP model and solve using a graphical method. [10+10]

8. (a) A work operation consisting of three elements has been subjected to a stopwatch time study. The recorded observations are shown in the following table. The allowances for tasks are personal 5%, fatigue 7%, and delay 2%. Determine the normal time and the standard time for the work operation.

Task element	Observations (minutes)					Performance rating (%)
	1	2	3	4	5	
1	0.8	0.6	2.1	0.7	0.8	90
2	0.4	0.5	3.2	0.3	0.6	110
3	1.0	4.1	0.9	1.0	0.9	80

(b) What is 'THERBLIGS'? [16+4]