CBCS SCHEME

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17ME81

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Operations Research

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Briefly explain the scopes of operation research. **(05 Marks)**

b. A farmer has a 100 acre farm. He can sell all tomatoes, lettuce or radishes and can rise the price to obtain Rs.1.00 per kg for tomatoes, Rs.0.75 ahead for lettuce and Rs.2.00 per kg for radishes. The average yield per acre is 2000 kgs of tomatoes, 3000 heads of lettuce and 1000 kgs of radishes. Fertilizers are available at Rs.0.50 per kg and amount required per acre is 100 kgs each for tomatoes and lettuce and 50 kgs for radishes, labour required for sowing, cultivating and harvesting per acre is 5 man-days for tomatoes and radishes and 6 man-days for lettuce. A total of 400 man days of labour are available at Rs.20 per man-day. Formulate this problem as a linear programming model to maximize the farmer's total profit. **(15 Marks)**

OR

2 a. Describe briefly the procedure of for solving LPP by graphical method. **(10 Marks)**

b. Solve the following LPP using graphical method.

Minimize $Z = 20x_1 + 10x_2$

Subject to $x_1 + 2x_2 \leq 40$

$3x_1 + x_2 \geq 30$

$4x_1 + 3x_2 \geq 60$

$x_1, x_2 \geq 0$ **(10 Marks)**

Module-2

3 a. Define the following:

(i) Basic solution (ii) Feasible solution

(iii) Basic feasible solution (iv) Optimal solution **(04 Marks)**

b. Use Big-M method to solve the problem:

Maximize $Z = 6x_1 + 4x_2$

Subject to $2x_1 + 3x_2 \leq 30$

$3x_1 + 2x_2 \leq 24$

$x_1 + x_2 \geq 3$

$x_1, x_2 \geq 0$ **(16 Marks)**

OR

4 a. Obtain the dual of the following LP problem:

Minimize $Z = 2x_1 + 3x_2 + 4x_3$

Subject to $2x_1 + 3x_2 + 5x_3 \geq 2$

$3x_1 + x_2 + 7x_3 = 3$

$x_1 + 4x_2 + 6x_3 \leq 5$

$x_1, x_2 \geq 0$ and x_3 is unrestricted **(06 Marks)**

b. Solve the following LPP by using two phase simplex method.

Maximize, $Z = 3x_1 + 2x_2 + 2x_3$

Subject to, $5x_1 + 7x_2 + 4x_3 \leq 7$

$-4x_1 + 7x_2 + 5x_3 \geq -2$

$3x_1 + 4x_2 - 6x_3 \geq \frac{29}{7}$

$x_1, x_2, x_3 \geq 0$ **(14 Marks)**

Module-3

5 A company manufacturing air coolers has two plants located at Bombay and Calcutta with a capacity of 200 units and 100 units per week respectively. The company supplies the air coolers to its four showrooms situated at Ranchi, Delhi, Lucknow and Kanpur, which have a maximum demand of 75, 100, 100 and 30 units respectively. Due to difference in raw material cost and transportation cost, the profit per unit in rupees differs, which is shown in the table below:

	Ranchi	Delhi	Lucknow	Kanpur
Bombay	90	90	100	110
Calcutta	50	70	130	85

Plan the production program so as to maximize the problem. **(20 Marks)**

OR

6 A textile firm has three factories F_1, F_2 and F_3 and four ware-houses W_1, W_2, W_3 and W_4. The transportation cost, factory capacity and warehouse requirement are given in the following table. Find the optimal transportation cost.

	W_1	W_2	W_3	W_4	Capacity
F_1	15	24	11	12	500
F_2	25	20	14	16	400
F_3	12	16	22	13	700
Requirement	300	250	350	400	

(20 Marks)

Module-4

7 a. Define:

(i) Critical activity and critical path

(ii) Total float

(iii) Free float **(06 Marks)**

b. An R and D activity has activities for which the three time estimates are given below along with its preceding activity.

Activity	Preceding activity	Optimistic time (a)	Most likely time (m)	Pessimistic time (b)
A	-	4	6	8
B	A	6	10	12
C	A	8	18	24
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

(i) Draw PERT network.

(ii) Find EST, LST and Slack for each node.

(iii) Find critical path and expected project duration. **(14 Marks)**

OR

8 a. What is queue discipline? List the various queue discipline. **(05 Marks)**

b. At what average rate must a clerk at a supermarket work in order to ensure a probability of 0.9 that the customer will not have to wait longer than 12 minutes? It is assumed that there is only one counter to which customer arrive in a Poisson fashion at an average rate of 15 hr. The length of the service by the clerk has an exponential distribution. **(07 Marks)**

c. In a hair dress by saloon with one barber, the customer arrival follows Poisson distribution at an average rate of one every 45 minutes. The service time is exponentially distributed with a mean of 30 minutes. Find:

(i) Average number of customers in a saloon.

(ii) Average waiting time of a customer before service.

(iii) Average idle time of barber. **(08 Marks)**

Module-5

9 Players A and B play a game in which each player has three coins (20P, 25P and 50P). Each of them selects a coin without the knowledge of the other player. If the sum of the values of the coins is an even number, A wins B's coin. If the sum is an odd number, B wins A's coin.

(i) Develop a payoff matrix, with respect to player A.

(ii) Find the optimal strategies for the players. What is the value of the game? **(20 Marks)**

OR

10 a. Explain the assumptions made while solving sequencing problems. **(05 Marks)**

b. Find the sequence that minimizes the total elapsed time 'T' required to complete the following tasks. Each task can be processed in any two machines A, B and C in any order.

Tasks

Machines	1	2	3	4	5	6	7
A	12	6	5	3	5	7	6
B	7	8	9	8	7	8	3
C	3	4	11	5	2	8	4

(15 Marks)

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