CBCS SCHEME

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21ME753

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Operation Research

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Operation Research. List and explain briefly the phases of operation research. **(08 Marks)**

b. A farmer has 100 acres form. He can sell all tomatoes, lettuce, or radishes he can raise. The price he can obtain is Rs. 1.00 per kg for tomatoes, Rs. 0.75 a head for lettuce and Rs. 2.0 per kg for radishes. The average yield per-acre is 2000 kg of tomato, 3000 heads of lettuce and 1000 kg of radishes. Fertilizer is available at Rs. 0.50 per kg and the 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-day for tomatoes and radishes, and 6 man-days for lettuce. A total of 400 man-days of labour are available at Rs. 20.00 per man-day. Formulate this problem as a linear programming model to maximize the formers total profit. **(12 Marks)**

OR

2 a. Discuss the limitations of operation research and scope/applications of OR. **(08 Marks)**

b. Solve the following LPP by graphical method and indicate the solution.

Maximize $z = 2x_1 + x_2$

Subject to $x_1 + 2x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1 - 2x_2 \leq 1$

$x_1, x_2 \geq 0.$ **(12 Marks)**

Module-2

3 a. Define slack variable, surplus variable and artificial variable. **(06 Marks)**

b. Solve the following LPP by simplex method :

Maximize $Z = 12x_1 + 16x_2$

Subject to constraints $10x_1 + 20x_2 \leq 120$

$8x_1 + 8x_2 \leq 80$

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

OR

4 a. Solve the following linear programming problem using Big-M-Method :

Minimize $Z = 7x_1 + 15x_2 + 20x_3$

Subject to $2x_1 + 4x_2 + 6x_3 \geq 24$

$3x_1 + 9x_2 + 6x_3 \geq 30$

$x_1, x_2, x_3 \geq 0.$ **(10 Marks)**

b. Solve the following by Dual Simplex method :

Min $Z = x_1 + 2x_2 + 3x_3$

Subject to $2x_1 - x_2 + x_3 \geq 4$

$x_1 + x_2 + 2x_3 \leq 8$

$x_2 - x_3 \geq 2$

x_1, x_2 and $x_3 \geq 0$ **(10 Marks)**

Module-3

5 a. Write a brief note on 'Degeneracy in transportation problem'. **(06 Marks)**

b. Obtain the optimum solution to the following transportation problem to minimize the total transportation cost. Initial solution by Vogel's approximation method (VAM).

		Destination			
		D1	D2	D3	Supply
Origin	O_1	2	7	4	5
	O_2	3	3	1	8
	O_3	5	4	7	7
	O_4	1	6	2	14
	Demand	7	9	18	

(14 Marks)

OR

6 a. Differentiate between transportation problem and assignment problem. **(06 Marks)**

b. A company has one surplus track in each of the cities A, B, C, D and E and one deficit truck in each of the cities 1, 2, 3, 4, 5, and 6. The distance between the cities in kilo meters is shown in the matrix below Table Q6(b). Find the assignment of truck from cities in surplus to cities in deficit so that the total distance covered by vehicles in minimum.

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

Table Q6(b)

(14 Marks)

Module-4

7 a. Define Network , Event , Dummy Activity , Critical path. **(04 Marks)**

b. An assembly is to be made from two parts X & Y. Both parts need to be worked on a Lathe before being assembled. The sequence of activities along with their predecessor requirements is given in table Q7(b). Draw the network diagram.

Activity	A	B	C	D	E	F	G	H
Predecessor Activity	-	A	A	B	B, C	E	D, F	G

(04 Marks)

c. A project is composed of 07 Jobs whose time estimates are given in Table Q7(c).

Activity	Most likely time	Optimistic time	Pessimistic time
1-2	7	8	9
1-3	16	18	20
1-4	7	9	11
2-5	9	10	11
3-5	20	24	28
4-6	14	16	18
5-6	2	3	4

i) Draw the network and calculate the Length and variance along the critical path.

ii) Find the probability of completing the project one day earlier and 2 days later. **(12 Marks)**

OR

8 a. What are the operating characteristics of a Queuing system? **(10 Marks)**

b. A self – service store employs one cashier at its counter. 9 customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time find

i) Average number of customers in the system
ii) Average number or customers in the queue
iii) Average time a customer spends in the system
iv) Average time a customer waits before being served. **(10 Marks)**

Module-5

9 a. Define Saddle point, Zero sum game , Game value and Pay off Matrix. **(08 Marks)**

b. Reduce the game to either m × 2 or 2 × n by dominance and then solve graphically.

		B			
		B1	B2	B3	B4
A	A1	19	6	7	5
	A2	7	3	14	6
	A3	12	8	18	4
	A4	8	7	13	-1

(12 Marks)

OR

10 a. State assumptions made while applying Johnson's rule to n jobs on 2 machines. **(05 Marks)**

b. There are six jobs P, Q, R, S, T and U have been received by a manufacturing facility to be processed on a single machine. Their processing times have been given in table.

Jobs	P	Q	R	S	T	u
Processing time (min)	7	6	8	4	3	5

Determine :

i) Optimal sequence as per SPT rule
ii) Flow time or completion time of Jobs
iii) Mean flow time
iv) Average in process inventory **(05 Marks)**

c. Use graphical method to minimize the time required to process the following Jobs on the machines. For each machine specify the jobs which should be done first. Also calculate the total elapsed time.

Job 1	Sequence	A	B	C	D	E
	Time (hr)	6	8	4	12	4
Job 2	Sequence	B	C	A	D	E
	Time (hr)	10	8	6	4	12

(10 Marks)

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