CBCS SCHEME

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15CS653

Sixth Semester B.E. Degree Examination, Feb./Mar. 2022
Operation Research

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define operation research. Explain the phases of operation research. **(08 Marks)**

b. Define the following with reference to LPP
i) Feasible solution
ii) Slack variables
iii) Degeneracy
iv) Optimal solution. **(08 Marks)**

OR

2 a. A firm manufactures 3 types of products A, B, C. These products are processed on 3 different machines. The time required to manufacture each of 3 products and the daily capacity of the 3 machines are given in the table.

Machine	Product A	Product B	Product C	Availability of machines
1	2	3	2	440
2	4	–	3	470
3	2	5	–	430

It is required to determine the daily number of units to be manufactured for each products. The profit per unit of a product A, B, C is Rs. 4, 3, 6 respectively. It is assumed that all the amount produced are consumed in a market. Formulate the mathematical model for a given LP. **(08 Marks)**

b. Solve graphically for given LP
Max $Z = 100x_1 + 40x_2$
Subject to the constraints $5x_1 + 2x_2 \leq 1000$
$3x_1 + 2x_2 \leq 900$
$x_1 + 2x_2 \leq 500$
where $x_1, x_2 \geq 0$. **(08 Marks)**

Module-2

3 a. Find all the basic solutions to the following problem.
Max $Z = x_1 + 3x_2 + 3x_3$
Subject to the constraints $x_1 + 2x_2 + 3x_3 = 4$
$2x_1 + 3x_2 + 5x_3 = 7$
Also find which of the basic solution are
i) Basic feasible
ii) Non degenerative basic feasible
iii) Optimal basic feasible. **(06 Marks)**

b. Solve the following LP by simplex method :
Max $Z = 3x_1 + 4x_2$
Subject to the constraints $x_1 + x_2 \leq 450$
$2x_1 + x_2 \leq 600$
Where $x_1, x_2 \geq 0$. **(10 Marks)**

OR

4 a. Solve the following LP by Big M – method :
Min $Z = 12x_1 + 20x_2$
Subject to the constraints $6x_1 + 8x_2 \geq 100$
$7x_1 + 12x_2 \geq 120$
Where $x_1, x_2 \geq 0$. **(08 Marks)**

b. Use 2-phse Simplex method to
Max $Z = 5x_1 - 4x_2 + 3x_3$
Subject to the constraints $2x_1 + x_2 - 6x_3 = 20$
$6x_1 + 5x_2 + 10x_3 \leq 76$
$8x_1 - 3x_2 + 6x_3 \leq 50$
Where $x_1, x_2, x_3 \geq 0$. **(08 Marks)**

Module-3

5 a. Explain the essence of duality theory. **(08 Marks)**

b. Write the dual of the following LPP
Minimize $Z = 3x_1 - 6x_2 + 4x_3$
Subject to the constraints $4x_1 + 3x_2 + 6x_3 \geq 9$
$1x_1 + 2x_2 + 3x_3 \geq 6$
$6x_1 - 2x_2 - 2x_3 \leq 10$
$x_1 - 2x_2 + 6x_3 \geq 4$
$2x_1 + 5x_2 - 3x_3 \geq 6$
where $x_1, x_2, x_3 \geq 0$. **(08 Marks)**

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OR

6 a. Write the working procedure of dual simplex method. **(06 Marks)**

b. Use the dual Simplex method to solve the following LPP
Minimize $Z = 2x_1 + 2x_2 + 4x_3$
Subject to the constraints $2x_1 + 3x_2 + 5x_3 \geq 2$
$3x_1 + x_2 + 7x_3 \leq 3$
$x_1 + 4x_2 + 6x_3 \leq 5$
where $x_1, x_2, x_3 \geq 0$. **(10 Marks)**

Module-4

7 a. Find the initial basic feasible solution of the following transportation problem by
i) Least cost method
ii) North West corner rule method.

	A	B	C	D	Supply
	19	30	50	10	7
	70	30	40	60	9
	40	8	70	20	18
Demand	5	8	7	14	

(10 Marks)

b. Find the optimal transportation cost by Vogeis method.

	A	B	C	Supply
	2	7	4	5
	3	3	1	8
	5	4	7	7
	1	6	2	14
Demand	7	9	18	

(06 Marks)

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OR

8 a. Write the procedure of Hungarian method. **(08 Marks)**

b. Consider the problem of assigning 5 jobs–to 5 persons. The assignment costs are given as follows :

	P_1	P_2	P_3	P_4	P_5
J_1	8	4	2	6	1
J_2	0	9	5	5	4
J_3	3	8	9	2	6
J_4	4	3	1	0	3
J_5	9	5	8	9	5

Determine the optimum assignment schedule for minimum cost. **(08 Marks)**

Module-5

9 a. Define the following :
i) Pay off
ii) Saddle point
iii)Maximin IV Minimax Principles. **(04 Marks)**

b. Use the principle of dominance to reduce the following game :

		B			
		I	II	III	IV
A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

(06 Marks)

c. Solve the following game graphically and find out saddle point and value of game.

		B		
		B_1	B_2	B_3
A	A_1	1	3	11
	A_2	8	5	2

(06 Marks)

OR

10 a. Explain in detail minimum spanning tree with constraints. **(08 Marks)**

b. Explain genetic algorithm and simulated annealing algorithm. **(08 Marks)**

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