Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER INTEGRATED MCA DEGREE EXAMINATION (R), DECEMBER 2023
(2020 SCHEME)

Course Code: **20IMCAT309**

Course Name: **Introduction to Operations Research**

Max. Marks: **60** **Duration: 3 Hours**

Non-programmable calculators may be permitted

PART A

(Answer all questions. Each question carries 3 marks)

1. Write any three basic assumptions in LPP.
2. Write any three applications of LPP.
3. Define artificial variable with an example.
4. Find the dual of

$$Max\ z = 3x_1 + x_2 + x_3$$
$$Subject\ to\ x_1 + x_2 + x_3 \leq 5$$
$$2x_1 + x_3 \leq 10$$
$$x_2 + 3x_3 \leq 15$$
$$x_1, x_2, x_3 \geq 0$$

5. What do you mean by an unbalanced Transportation Problem and explain how to convert the unbalanced Transportation Problem into a balanced one?
6. Find an initial basic feasible solution by North West Corner Cell method

Destinations

		A	B	C	Supply
Sources	W	2	7	4	5
	X	3	3	1	8
	Y	5	4	7	7
	Z	1	6	2	14
Demand		7	9	18	

7. What is two person zero sum game?
8. Find the saddle point of the following game.

Player B

Player A $\begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix}$

9. Explain customer's behaviour in a Queue.
10. Explain the various queue disciplines.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

11. Solve using Graphical method

$$Max\ z = 3x_1 + 4x_2$$
$$subject\ to\ x_1 + 2x_2 \leq 4$$
$$3x_1 + 2x_2 \leq 6$$
$$x_1, x_2 \geq 0$$

(6)

OR

12. Solve using Simplex method

$$Max\ z = 7x_1 + 6x_2$$
$$subject\ to\ x_1 + x_2 \leq 4$$
$$2x_1 + x_2 \leq 6$$
$$x_1, x_2 \geq 0$$

(6)

MODULE II

13. Solve by Two-Phase method

$$Min\ z = 6x_1 + 5x_2$$
$$subject\ to\ 2x_1 + x_2 \geq 80$$
$$x_1 + 2x_2 \geq 60$$
$$x_1, x_2 \geq 0$$

(6)

OR

14. Solve the following LPP using Big M method

$$Min\ z = 9x_1 + 10x_2$$
$$subject\ to\ x_1 + 2x_2 \geq 25$$
$$4x_1 + 3x_2 \geq 24$$
$$3x_1 + 2x_2 \geq 60$$
$$x_1, x_2 \geq 0$$

(6)

MODULE III

15. Solve the Transportation problem to maximize profit (6)

Profit in Rs/Unit

		Destinations A	B	C	D	Supply
Sources	X	15	51	42	33	23
	Y	80	42	26	81	44
	Z	90	40	66	60	33
Demand		23	31	16	30	

OR

16. Solve the following minimal assignment problem (6)

Job \ Man	1	2	3	4
A	12	30	21	15
B	18	33	9	31
C	44	25	21	21
D	14	30	28	14

MODULE IV

17. a) Write principle of dominance. (6)

b) Apply dominance rule and solve the following game problem (6)

Player A \ Player B	I	II	III	IV	V
1	2	4	3	3	4
2	5	6	3	7	8
3	6	7	9	8	7
4	4	2	8	4	3

OR

18. Solve the following game graphically (6)

Player A \ Player B	B_1	B_2	B_3	B_4	B_5
A_1	2	−4	6	−3	5
A_2	−3	4	4	1	0

MODULE V

19. Explain the basic characteristics of a queuing model. (6)

OR

20. In a public telephone booth having just one phone, the arrivals are considered to be Poisson with the average of 15 per hour. The length of a phone call is assumed to be distributed exponentially with mean 3 minutes. Find the (6)
    (i) average number of customers waiting in the system.
    (ii) average number of customers waiting in the queue.
    (iii) expected waiting time of a customer in the system.
    (iv) expected waiting time of a customer in the queue.
    (v) percentage of time that the telephone booth will be idle.

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