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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER INTEGRATED M.C.A DEGREE EXAMINATION (S), FEBRUARY 2023

(2020 SCHEME)

Course Code: **20IMCAT309**

Course Name: **Introduction to Operations Research**

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

PART A

(Answer all questions. Each question carries 3 marks)

1. Define operations research.
2. Give any three characteristics of LPP
3. Explain auxiliary LPP in two phase method.
4. Define artificial variables with an example.
5. What is unbalanced transportation problem? How it is solved?
6. Explain north west corner rule to find the solution of a transportation problem.
7. Define saddle point in game theory.
8. Explain maximin and minimax principle in game theory.
9. Explain Kendall's notation in queuing theory
10. Explain the various queue disciplines.

PART B

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

MODULE I

11. Solve the following LP problem using graphical method

$$Maximize\ , Z = 6x_1 + 8x_2$$

Subject to $5x_1 + 10x_2 \leq 60$

$4x_1 + 4x_2 \leq 40$ (6)

$x_1, x_2 \geq 0$

OR

12. Solve the following LPP using simplex method (6)

$$Maximize\ , Z = 7x_1 + 5x_2$$

$$\text{Subject to} \quad x_1 + 2x_2 \le 6$$

$$4x_1 + 3x_2 \le 12$$

$$x_1, x_2 \ge 0$$

MODULE II

13. Find the dual of the following primal (6)

$$\text{Maximize} \quad Z = 3x_1 + x_2 + 2x_3$$

$$\text{Subject to} \quad x_1 + x_2 + x_3 \le 5$$

$$2x_1 + x_3 \le 10$$

$$x_2 + 3x_3 \le 15$$

$$x_1, x_2, x_3 \ge 0$$

OR

14. Solve the following LPP by two phase method (6)

$$\text{Minimize} \quad Z = x_1 + x_2$$

$$\text{Subject to} \quad 2x_1 + x_2 \ge 4$$

$$x_1 + 7x_2 \ge 7$$

$$x_1, x_2, \ge 0$$

MODULE III

15. Find the initial solution to the transportation problem using least cost entry method (6)

	M1	M2	M3	M4	Supply
F1	3	2	4	1	20
F2	2	4	5	3	15
F3	3	5	2	6	25
F4	4	3	1	4	40
Demand	30	20	25	25	

OR

16. Solve the following assignment problem using Hungarian method (6)

	Employees					
Jobs		I	II	III	IV	V
	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

MODULE IV

17. Solve the game with payoff matrix $\begin{bmatrix} 6 & 9 \\ 8 & 4 \end{bmatrix}$ (6)

OR

18. Solve the following game graphically (6)

	Player B					
Player A		B1	B2	B3	B4	B5
	A1	3	0	6	-1	7
	A2	-1	5	-2	2	1

MODULE V

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

OR

20. A supermarket has a single cashier. During peak hours , customers arrive at a rate of 20 per hour. The average number of customers that can be processed by the cashier is 24 per hour. Calculate (6)

    1) The probability that the cashier is idle
    2) The average number of customers in the queuing system
    3) The average time a customer spends in the system.
    4) The average number of customers in the queue.
    5) The average time a customer spends in the queue

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