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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER INTEGRATED MCA DEGREE EXAMINATION (S), FEBRUARY 2024
(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. Define Linear programming problem.
2. Differentiate slack and surplus variables.
3. Explain Big-M method.
4. What do you mean by dual of a Linear programming problem? Give an example.
5. Discuss degeneracy in transportation problem.
6. Define unbalanced assignment problem and prohibited assignment problem.
7. State Maximin principle and minimax principle.
8. Define the term saddle point with an example.
9. What are the basic characteristics of a queuing system?
10. Explain queue discipline.

PART B

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

MODULE I

11. Using graphical method solve the following LPP
Maximize Z= $5x_1 + 3x_2$
Subject to $2x_1 + 5x_2 \leq 10$
$2x_1 + 2x_2 \leq 10$
$2x_1 + 3x_2 \geq 6$
$x_1 \geq 0, 3x_2 \geq 0$ (6)

OR

12. Solve by simplex method
Maximize Z= $3x_1 + 2x_2$
Subject to $x_1 + x_2 \leq 4$
$x_1 - x_2 \leq 2$
$x_1 \geq 0, x_2 \geq 0$ (6)

MODULE II

13. Solve the following LPP by Big-M method
Minimize Z= $2x_1 + x_2 + 3x_3$
Subject to $-3x_1 + x_2 - 2x_3 \geq 1$
$x_1 - 2x_2 + x_3 \geq 0$
$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$ (6)

OR

14. Solve by two phase method
Maximize Z= $3x_1 - x_2$
Subject to $2x_1 + x_2 \geq 2$
$x_1 + 3x_2 \leq 2$
$x_2 \leq 4$
$x_1 \geq 0, x_2 \geq 0$ (6)

MODULE III

15. Solve the following assignment problem for minimum cost.

	1	2	3	4
A	32	26	35	38
B	27	24	26	32
C	28	22	25	34
D	10	10	16	16

(6)

OR

16. Solve the assignment problem for maximum profit.

	1	2	3	4
A	50	53	54	50
B	47	50	48	50
C	49	50	60	61
D	63	64	60	61

(6)

MODULE IV

17. Find the value of the game to the payoff matrix.

	B1	B2	B3
A1	3	2	4
A2	-2	1	-3
A3	0	-2	3

(6)

OR

18. Use graphical method to solve the following game

	B1	B2	B3	B4	B5
A1	2	-4	6	-3	5
A2	-3	4	-4	1	0

(6)

MODULE V

19. In a public telephone booth having one phone, the average arrival rate is 15 per hour and the average service rate is 3 mins. Calculate
    i. the average number of customers waiting in the system.
    ii. the average number of customers waiting in the queue.
    iii. probability that a person arriving at booth have to wait in the queue.
    iv. expected waiting time of the customers in the system.

(6)

OR

20. In a given M/m/1 queueing system the average arrivals is 4 customers per minute and traffic intensity, $\rho = 0.7$. Find
    i. mean number of customers in the system
    ii. mean number of customers in the queue
    iii. probability that the serves is idle
    iv. mean waiting time

(6)

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