K25U 0163

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree (C.B.C.S.S. – OBE – Regular/Supplementary/ Improvement) Examination, April 2025
(2019 to 2022 Admissions)
DISCIPLINE SPECIFIC ELECTIVE IN MATHEMATICS
6B14B MAT : Operations Research

Time : 3 Hours Max. Marks : 48

PART – A

Answer **any 4** questions. **Each** question carries **one** mark.

1. Define the terms stack and surplus variables in an LPP.
2. Explain transportation problem.
3. What is degeneracy in a transportation problem ?
4. What do you mean by a balanced assignment problem ?
5. What is a sequencing problem ? **(4×1=4)**

PART – B

Answer **any 8** questions. **Each** question carries **2** marks.

6. What do you mean by a convex function ? Give an example for a convex function but not strictly convex.
7. Reduce the following LPP to its standard form : Maximize $Z = x_1 - 3x_2$ subject to the constraints $-x_1 + 2x_2 \leq 15$, $x_1 + 3x_2 = 10$, x_1 and x_2 being unrestricted in sign.
8. Find all the basic feasible solutions of the equations $x_1 + 2x_2 + x_3 = 4$, $2x_1 + x_2 + 5x_3 = 5$.
9. Write a note on loops in transportation problem.
10. Explain North-West corner method to solve a transportation problem.
11. What is an unbalanced transportation problem ? How to solve it ?
12. Give any two applications of assignment problem.

P.T.O.

13. Write the Mathematical formulation of an assignment problem.
14. Explain the principle assumptions made while dealing with sequencing problem.
15. What is game theory ? What are the properties of a game ?
16. Explain the Maximin and Minimax principles used in game theory. **(8×2=16)**

PART – C

Answer **any 4** questions. **Each** question carries **4** marks.

17. Let f(x) be a convex function on a convex set S. Prove that the set of points in S at which f(x) takes its global minimum is a convex set.
18. Using graphical method, solve the LPP : Maximize $Z = 3x_1 + 2x_2$ subject to the constraints $-2x_1 + x_2 \leq 1$, $x_1 \leq 2$, $x_1 + x_2 \leq 3$, $x_1, x_2 \geq 0$.
19. What do you mean by dual of an LPP ? Write the dual of the primal problem : Maximize $Z = 2x_1 + 5x_2 + 6x_3$ subject to the constraints $5x_1 + 6x_2 - x_3 \leq 3$, $-2x_1 + x_2 + 4x_3 \leq 4$, $x_1 - 5x_2 + 3x_3 \leq 1$, $-3x_1 - 3x_2 + 7x_3 \leq 6$, $x_1, x_2, x_3 \geq 0$.
20. Find an initial basic feasible solution to the following transportation problem using VAM method.

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	270	250	

21. Give a brief outline of the procedure for solving a transportation problem.
22. Write the optimal sequence algorithm for a sequence problem with n jobs and two machines.
23. Determine the range of value of p and q that will make the payoff element a_{22} a saddle point for the game whose payoff matrix (a_{ij}) is given below :

	Player B		
Player A	2	4	5
	10	7	q
	4	p	8

(4×4=16)

PART – D

Answer **any 2** questions. **Each** question carries **6** marks.

24. Using Simplex method solve the LPP : Maximize $Z = 3x_1 + 5x_2 + 4x_3$ subject to the constraints $2x_1 + 3x_2 \leq 8$, $2x_2 + 5x_3 \leq 10$, $3x_1 + 2x_2 + 4x_3 \leq 15$, $x_1, x_2, x_3 \geq 0$.
25. Solve the transportation problem.

	A	B	C	D	Available
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
Demand	6	10	12	15	

26. A departmental head has four subordinates and four tasks to be performed. The subordinates differ in efficiency and the tasks differ in their intrinsic difficulty. His estimate, of the time each men would take to perform each task, is given in the matrix below :

Tasks	Men			
	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

How should the tasks be allocated, one to a man, so as to minimize the total man-hour ?

27. Is the following two persons, zero-sum game stable ? Also, solve the game.

	Player B			
Player A	5	– 10	9	0
	6	7	8	1
	8	7	15	1
	3	4	– 1	4

(2×6=12)