K22U 0418

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – OBE – Regular) Examination, April 2022

(2019 Admission)

CORE COURSE IN MATHEMATICS

Discipline Specific Elective

6B14B MAT : Operations Research

Time : 3 Hours

Max. Marks : 48

PART – A

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

1. Give an example of a simplex in 3-dimension.
2. Write the standard form of a LPP.
3. Write the necessary and sufficient condition for the existence of a feasible solution to the general transportation problem.
4. What is no passing rule in a sequencing problem ?
5. What is saddle point in game theory ?

PART – B

Answer **any eight** questions. **Each** question carries **two** marks.

6. Show that the function $f(x) = |x|$ is a convex function on $\mathbb{R}$.
7. Define slack and surplus variable in LPP.
8. Write down the duel of the LPP.

   Maximise $Z = x_1 + 6x_2$

   Subject to $x_1 + x_2 \geq 2$

   $x_1 + 3x_2 \leq 3$

   $x_1 \geq 0, x_2 \geq 0$

P.T.O.

9. Give the general form of a transportation table.
10. Write the steps in Vogel's Approximation method of finding the solution of a transportation problem.
11. Give an example of an unbalanced transportation problem.
12. Write any two basic assumptions of sequencing problem.
13. How will you solve minimization problem using assignment techniques ?
14. Write optimal sequence algorithm of processing n-jobs through 2 machines.
15. State the maximini-minimaxi principle.
16. State principle of dominance in game theory.

PART – C

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

17. Write the following quadratic form in the form X^TAX.
    a) $x_1^2 + 8x_1x_2 + 16x_2^2 - 3x_3^2$
    b) $2x_1^2 - 6x_1x_2 + 2x_1x_3 + 2x_2^2 + 6x_2$.
18. Consider the following problem faced by a production planner in a soft drink plant. He has two bottling machine A and B. A is designed for 18 ounce bottles and B is designed for 16 ounce bottles. However, each can be used on both type with some loss of efficiency. The following data is available

Machine	8 ounce bottle	16 ounce bottle
A	100/minute	40/minute
B	60/minute	75/minute

Both machine can be run 8 hours per day, 5 days per week. Profit on a 8-ounce bottle is 25 paise and on a 16-ounce bottle is 35 paise. Weekly production of the drink cannot exceed 30,00,000 ounce and the market can absorb 25,000 8-ounce bottles and 7000 16-ounce bottles per week. The planner wishes to maximize his profit subject, of course, to all the production and marketing restrictions. Formulate this as a LPP.

19. Solve the following LPP graphically.

Maximize $Z = 3x_1 + 5x_2$, subject to $x_1 + 2x_2 \leq 2000$, $x_1 + x_2 \leq 1500$, $x_2 \leq 600$, $x_1 \geq 0$ and $x_2 \geq 0$.

20. Solve the following transportation problem by north west corner rule.

	Destinations			
Origins	D_1	D_2	D_3	**Supply**
O_1	2	7	4	5
O_2	3	3	1	8
O_3	5	4	7	7
O_4	1	6	2	14
Demand	7	9	18	

21. Solve the following transportation problem by Vogel's approximation method.

	Destinations				
Sources	1	2	3	4	**Supply**
A	21	16	15	3	11
B	17	18	14	23	13
C	32	27	18	41	19
Demand	6	10	12	15	

22. Solve the following minimal assignment problem.

	Job			
Man	I	II	III	IV
1	2	3	4	5
2	4	5	6	7
3	7	8	9	8
4	3	5	8	4

23. Solve the game whose pay off matrix is given by

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \end{array} \begin{array}{c} \begin{array}{ccc} B_1 & B_2 & B_3 \end{array} \\ \begin{bmatrix} 1 & 7 & 2 \\ 6 & 2 & 7 \\ 5 & 1 & 6 \end{bmatrix} \end{array}$$

PART – D

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

24. Solve the following LPP by simplex method :

Maximize $Z = x_1 + x_2$

Subject to $2x_1 + x_2 \geq 4$

$x_1 + 7x_2 \geq 0$

$x_1, x_2 \geq 0$.

25. Find the starting solution to the following transportation problem by Vogel's approximation method, also obtain the optimum solution.

	D_1	D_2	D_3	D_4	Supply
S_1	3	7	6	4	5
S_2	2	4	3	2	2
S_3	4	3	8	5	3
Demand	3	3	2	2	

26. Determine the optimal sequence of jobs that minimize the total elapsed time based on the following information processing time on machine is given in hours and passing is not allowed.

Job	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Machine M_1	3	8	7	4	9	8	7
Machine M_2	4	3	2	5	1	4	3
Machine M_3	6	7	5	11	5	6	12

27. Solve the following game problem by graphical method.

Player B

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