(Pages : 3) **W – 1260**

Reg. No. : .....

Name : .....

Third Semester B.B.A. LL.B. (Five Year Integrated) Degree Examination, October 2025

Paper III — OPERATIONS RESEARCH

(2013 Admission Onwards)

Time : 3 Hours Max. Marks : 80

I. Answer any **five** of the following. Each question carries **2** marks. Answer should not exceeds 50 words each.

1. Define the Rank of a matrix.

2. What is linear programming problem?

3. What is mean by transportation problem?

4. Distinguish the incoming vector and outgoing vector in simplex method

5. Distinguish between minor and cofactor of a matrix.

6. What is mean by an optimal solution in LPP?

7. Distinguish between diagonal and triangular matrices.

8. Define surplus variables.

(5 × 2 = 10 Marks)

P.T.O.

II. Answer any **four** of the following. Each question carries **4** marks. Answer should not exceeds **120** words each.

9. Discuss different models of Operations Research.

10. Find the value of $2A+3B$ if $A=\begin{bmatrix}2 & 1 & 0\\ -1 & 4 & 2\\ 0 & 5 & -3\end{bmatrix}$ and $B=\begin{bmatrix}0 & -3 & 2\\ 9 & 2 & 7\\ 8 & -2 & 6\end{bmatrix}$.

11. Explain any five applications of linear programming problem in management.

12. Discuss the technical constraints and the non negativity constraints in linear programming

13. Explain the steps in formulating a mathematical model for a given linear programming problem.

14. Find the determinant of the matrix, $A=\begin{bmatrix}5 & 7 & 2\\ 2 & 3 & 1\\ 4 & 6 & 2\end{bmatrix}$.

(4 × 4 = 16 Marks)

III. Answer any **four** of the following. Each question carries **6** marks.

15. If $A=\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 4\\ -1 & 1 & 2\end{bmatrix}$ and $B=\begin{bmatrix}0 & 2 & -1\\ 1 & 3 & 4\\ 0 & -2 & -3\end{bmatrix}$ find the products AB and BA. Show that find $AB \neq BA$.

16. Write down the steps for solving a linear programming problem by graphical method with an example.

17. Explain the Hungarian Method for solving and Assignment problem.

18. Write a notes on :
    (a) North-West corner rule and
    (b) Lowest cost entry method

19. Distinguish between PERT and CPM in network analysis.

20. A manufacturer of a line of patent medicine is preparing a production plan on medicine A and B. There are sufficient ingredients available to make 20,000 bottles of A and 40,000 bottles of B but there are only 45,000 bottles into which either of the medicines can be put. Furthermore it takes three hours to prepare enough materials to fill 1000 bottles of A, it takes 1 hour to prepare enough material to fill 1,000 bottles of B and there are 66 hours available for this operation. The profit is rupees 8 per bottle for A and rupees 7 for B. Formulate this problem as a linear programming problem.

(4 × 6 = 24 Marks)

IV. Answer any **three** of the following. Each question carries **10** marks.

21. The prices of three commodities X, Y and Z are not known. A sells 5 units of X, 4 units of Z and purchase 6 units of Y. B sells 7 units of X, 4 units of Y and purchase 3 units of Z. C sells 2 units of X, 1 unit of Y and 6 units of Z. In this process A, B and C earn respectively Rs.15, Rs. 19 and Rs. 46. Find the price of the commodities X, Y and Z using Cramer's Rule.

22. Solve the following minimal assignment problem.

		Man			
		1	2	3	4
Job	I	12	30	21	15
	II	18	33	9	31
	III	44	25	24	21
	IV	23	30	28	14

23. Explain sequencing problems.

24. Briefly explain Game Theory in decision making.

25. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ show that $A^2 - 4A - 5I = 0$.

(3 × 10 = 30 Marks)