

Reg. No. :

Name :

**Third Semester B.B.A. LL.B. (Five Year Integrated) Degree Examination,
October 2024**

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 exceed 50 words each.

1. What is optimal solution?
2. What is triangular matrix?
3. What is minimax decision criterion?
4. What is degeneracy in Transportation problem?
5. Distinguish Slack and Float.
6. What is PERT?
7. What do you mean by rank of a matrix?
8. Define event and activity.

(5 × 2 = 10 Marks)

P.T.O.

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

1. What are the features of operations research?
2. What are the characteristics of Game?
3. What is Group Replacement? Give an example.
4. Explain steps involved in Critical Path.
5. Find adjoint of the matrix A

$$A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{pmatrix}$$

6. Solve the following using Crammer's Rule.

$$3x + y + z = 8$$

$$x + y + z = 6$$

$$2x + y - z = 1$$

(4 × 4 = 16 Marks)

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

1. Define operations Research. What are the phases of operations Research?
2. Distinguish between Basic and Non-basic Variables.
3. What is meant by sequencing? Explain and illustrate.

4. A Chocolate manufacturing company produces two varieties of Chocolates such as A and B. For the manufacture of both the chocolates require milk and Choco. The details of quantities of Milk and Choco required for the manufacture of each unit of A and B are given below :

Each unit of A requires 1 unit milk and 3 units of Choco

Each unit of B requires 1 unit milk and 2 units of Choco

The company's kitchen has a total stock of 5 units of Milk and 12 units of Choco only.

The company makes a profit of Rs. 6 per unit in the case of Product A and Rs. 5 per unit in the case of product B.

Formulate a mathematical model to the above.

5. Solve the game with the pay-off matrix for player A as given below :

		Player B		
		B1	B2	B3
Player A	A1	-4	0	4
	A2	1	4	2
	A3	-1	5	-3

6. If $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ -1 & 1 & 2 \end{pmatrix}$ $B = \begin{pmatrix} 0 & 2 & -1 \\ 1 & 3 & 4 \\ 0 & -2 & -3 \end{pmatrix}$.

Find AB and BA . Show that $AB \neq BA$.

(4 × 6 = 24 Marks)

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

1. Discuss the scope and role of operations Research in decision making.
2. What are the assumptions of Linear Programming Problems? Formulate a mathematical model to maximize total profit of an electric company from the following information :

The electric company is engaged in the production of two components P and Q in T.V. Sets. Each unit of P costs the company Rs. 25 in wages and Rs. 25 in material, while each unit of Q costs the company Rs. 125 in wages and Rs. 75 in material. The company sells both products on one-period credit terms, but the company's labour and material expenses must be paid in cash. The selling price P is Rs. 150 per unit and of Q is Rs. 350 per unit. Because of the strong monopoly of the company for these components, it is assumed that the company can sell at the prevailing prices as many units as it produces. The company's production capacity is, however, limited by two considerations. First, at the beginning of period 1, the company has an initial balance of Rs. 20,000 (cash plus bank credit plus collections from past credit sales). Second, the company has available in each period Rs. 4000 hours of machine time and 2800 hours of assembly time. The production of each P requires 6 hours of machine time and 4 hours of assembly time, where as the production of each Q requires 4 hours of machine time and 6 hours of assembly time.

3. Solve the following transportation problem :

To →	W1	W2	W3	W4	W5	Available
From ↓						
F1	3	4	6	8	9	20
F2	2	10	1	5	8	30
F3	7	11	20	40	3	15
F4	2	1	9	14	16	13
Required	40	6	8	18	6	78

4. Machine A costs Rs. 9,000. Annual operating costs are Rs. 200 for the first year, and then increases by Rs. 2,000 every year. Determine the best age at which to replace the machine. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine?

5. A project has the following time schedule :

Activity :	1-2	1-3	1-4	2-5	3-6	3-7	4-6	5-8	6-9	7-8	8-9
Duration (months) :	2	2	1	4	8	5	3	1	5	4	3

Construct network diagram. Find critical path and project duration.

(3 × 10 = 30 Marks)