[This question paper contains 8 printed pages.]

Your Roll No..............

Sr. No. of Question Paper : 2245 **H**

Unique Paper Code : 62367602

Name of the Paper : Integer Programming and Theory of Games

Name of the Course : **B.A. (Prog.)**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Attempt any **five** questions in all.

3. **All** questions carry equal marks.

1. (a) What is Integer programming problem (IPP)? Differentiate between two types of IPP. (5)

(b) What are the real-life applications of integer linear programming problems? Use the complete enumeration graphical method to solve the following integer linear programming problems:

$$\text{Max } z = x_1 + x_2$$

Subject to

$$2x_1 + 5x_2 \leq 16$$

$$6x_1 + 5x_2 \leq 30$$

x_1 and x_2 are non – negative integers

(10)

2. (a) Explain the decision under uncertainty and decision under risk. Name any two methods for dealing with decisions under uncertainty. (5)

(b) Use the following cost pay-off matrix to find :

No. of failures E_j	Probability	No. of Spares, A_i					
		0	1	2	3	4	5
0	0.1	0	400	800	1200	1600	2000
1	0.2	1800	400	800	1200	1600	2000
2	0.3	3600	2200	800	1200	1600	2000
3	0.2	5400	4000	2600	1200	1600	2000
4	0.1	7200	5800	4400	3000	1600	2000
5	0.1	9000	7600	6200	4800	3400	2000

(i) The optimal number of units of the spare part on the basis of the minimax principle, Laplace principle, and Hurwicz (take $\alpha = 0.5$)

(ii) The regret table, and the optimal choice on the basis of the least expected regret criterion and

(iii) EVPI (10)

3. (a) Explain the terms: Saddle point, Zero-sum game, and Payoff matrix. (6)

(b) Use graphical method to solve the game with the following pay-off : (9)

	Player B		
Strategy	b1	b2	b3
a1	**6**	**4**	**3**
a2	**2**	**4**	**8**

4. (a) For any two-person zero-sum game with $(a_{ij})_{m\times n}$ as its payoff, show that the maximin value, $\underline{v}$ of the matrix will always be less or equal to the minimax value, $\bar{v}$ of the matrix, i.e. $\max_i, \min_j(a_{ij}) \leq \min_j \max_i(a_{ij})$. (5)

(b) Use simplex method to solve the following game problem.

$$\begin{pmatrix} 6 & 7 \\ 4 & 5 \end{pmatrix}$$ (10)

5. (a) Give the mathematical formulation of a capital budgeting problem. (5)

(b) Use the branch and bound method to find an integer solution to the following problem :

$$\text{Max } z = 7x_1 + 9x_2$$

Subject to

$$-x_1 + 3x_2 \leq 6$$

$$7x_1 + x_2 \leq 35$$

$$x_2 \leq 7$$

x_1 and x_2 are non-negative integers

(10)

6. (a) Explain Gomory's cutting plane method for solving a mixed-integer linear programming problem. (5)

(b) Use the cutting plane method to find the solution to the following problem :

$$\text{Max } z = 5x + 2y$$

Subject to

$$2x + 2y \leq 5$$

$$3x + y \leq 11$$

$$x, y \geq 0; \text{ and are integers.}$$

The optimum LPP solution is given in the table below :

X_B	x	y	S_1	S_2	b
y	0	1	0.75	-0.5	1.25
x	1	0	-0.25	0.5	3.25
Z	0	0	0.25	1.5	18.75

(10)

7. (a) Implicit enumeration method to find the binary integer solution to the following problem: (7)

$$\text{Max } z = 25x_1 + 16x_2 + 22x_3$$

Subject to

$$4x_1 + x_2 + 5x_3 \leq 15$$

$$x_1 + 5x_2 + 6x_3 \leq 12$$

$$x_1 + x_2 + x_3 \leq 10$$

$$x_j = 0 \text{ or } 1 \ \forall\ j = 1, 2, 3$$

(b) Use principle of dominance to solve the following game problem : (8)

1	3	2	7	4
3	4	1	5	6
6	5	7	6	5
2	0	3	6	1