(b) A particular item has a demand of 9000 units per year. The cost of one procurement is Rs. 100 and holding cost per unit is Rs. 2.40 per year. The replenishment is instantaneous and no shortages are allowed. Determine (i) the economic lot size (ii) the total cost per year if the cost of one unit is Rs. 6.00 8

Unit - V

9. (a) Solve the integer programming problem

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

Subject to

$$-x_1 + 3x_2 \le 6$$
$$7x_1 + x_2 \ge 35$$

$x_1 \ge 0$, $x_2 \ge 0$ and are integers by using Gomory's cutting plane method. 14

10. (a) Write the algorithm for Gomory's mixed integer programming problem. 4

(b) Solve the following LPP by using branch and bound technique

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

Subject to

$$3x_1 + 2x_2 \le 12$$
$$x_2 \le 2$$

$x_1, x_2 \ge 0$ and are integers. 10

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PG Even Semester Examination, May 2025

MATHEMATICS

2nd Semester

Course No. : MAT - 552

(Basic Operations Research)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer one question from each unit)

Unit - I

1. Solve by Revised Simplex Method : 14

$$\text{Max } z = 6x_1 - 2x_2 + 3x_3$$

subject to

$$2x_1 - x_2 + 2x_3 \le 2$$
$$x_1 + 4x_3 \le 4$$

and $x_1, x_2, x_3 \ge 0$

2. Find the optimum solution to the LPP 14

$$\text{Max } z = 15x_1 + 45x_2$$

subject to

$$x_1 + 16x_2 \le 240$$
$$5x_1 + 2x_2 \le 162$$
$$x_2 \le 50$$
$$x_1, x_2 \ge 0$$

If maximum z = e c; x ; j = 1, 2 and c_2 is kept fixed at 45, determine how mch c_1 can be changed without affecting the above solution.

Unit - II

3. (a) Find the range of values of p and q such that the entry (2, 2) will be a saddle point for the game:

$$\begin{array}{cc} & B \\ A & \begin{bmatrix} 2 & 4 & 5 \\ 10 & 7 & q \\ 4 & p & 6 \end{bmatrix} \end{array}$$

2

(b) Solve the following game by using the principle of dominance. 5

B

		I	II	III	IV	V	VI
	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
A	3	4	3	7	−5	1	2
	4	4	3	4	−1	2	2
	5	4	3	3	−2	2	2

(c) Solve the following game graphically whose payoff matrix for the player A is _ 7

B

		I	II
	1	2	4
	2	2	3
A	3	3	2
	4	-2	6

1 - 6	2	5	14
2 - 3	6	12	30
2 - 4	2	5	8
3 - 5	5	11	17
4 - 5	3	6	15
6 - 7	3	9	27
5 - 8	1	4	7
7 - 8	4	19	28

(i) Draw the project network

(ii) Calculate the length and variance of the critical path. 8

Unit - IV

7. (a) Describe the inventory model with uniform rate of demand having shortages. 8

(b) The details of a part to be machined are as follows:

Annual requirement = 2400 pieces,

Machine rate = 10 piece/shift

No. of working days in the year - 320 shifts

Cost of machining a component = Rs. 100 per piece

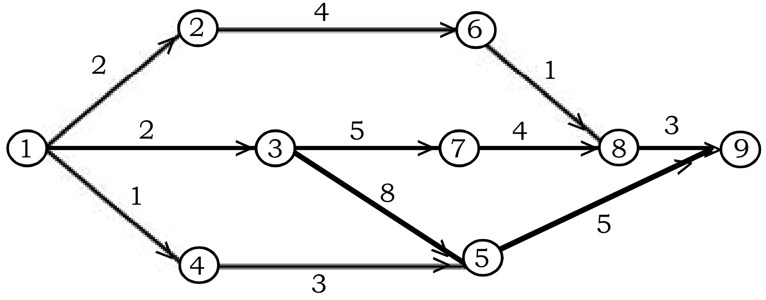
Inventory carrying cost per annum = 12% of value

Setup cost per prodcution run = Rs. 400/-

Find the optimum run size for machining. 6

8. (a) Deduce the economic litsize with finite replenishment rate without shortage. 6

(b) Find the critical path and calculate the total float for each event of the following network diagram. 6



6. (a) There are five jobs each of whcih is to be processed through three machines A, B and C in the order ABC. Processing times in hours are given in the following table 6

Job	A	B	C
1	3	4	7
2	8	5	9
3	7	1	5
4	5	2	6
5	4	3	10

Determine the optimum sequence for the five jobs and the minimum elapsed time. Also find the idle time for the three machines.

(b) The following table lists the jobs of a network with their estimates.

	Duration (in days)		
job (i - j)	Optimistics (t_o)	Most likely (t_m)	Ressimistic (t_p)
1 - 2	3	6	15

4. (a) Solve the game by using matrix method. 6

		B: I	II	III
	1	7	1	7
A	2	9	-1	1
	3	5	7	6

(b) Solve the following game by using graphical method. 8

		B: I	II	III	IV
	1	19	6	7	5
	2	7	3	14	6
A	3	12	8	18	4
	4	8	7	13	-1

Unit - III

5. (a) Use graphical method to minimise the time needed to process the following jobs on the machines shower below:

Job 1 →	Seegment machines	→	A	B	C	D	E
	Time	→	2	3	4	6	2
Job 2 →	Segment machines	→	C	A	D	E	B
	Time	→	4	5	3	2	6

Also calculate the total time needed to complete both the jobs. 8