BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
II Semester 2022 – 2023

Course No: ME F320/MF F320 **Course Title:** Engineering Optimization
Date: 13th March 2023 **Max Time:** 90 min
Max Marks: 105 **Mid-semester Exam (Closed Book)**

1. A gambler plays a game that requires dividing bet money among four choices. The game has three outcomes. The following table gives the corresponding gain or loss per dollar for the different options of the game.

	Return per dollar deposited in choice			
Outcome	1	2	3	4
1	-7	9	-5	20
2	13	-10	11	8
3	3	-9	10	-8

The gambler has a total of \$2500, which may be played only once. The exact outcome of the game is not known a priori. Because of this uncertainty, the gambler's strategy is to maximize the *minimum* return produced by the three outcomes. How should the gambler allocate the \$2500 among the four choices? Formulate as LPP (*Hint:* The gambler's net return may be positive, zero, or negative.) [20]

2. Show how the following objective function can be presented in equation form: Minimize $z = \max\{|x1 - x2 + 4x3|, |-x1 + 6x2 - 3x3|\}$, $x1, x2, x3 \geq 0$, [10]
3. Consider the LPP: Maximize $z = x1 + 3x2$ subject to $x1 + x2 \leq 2$, $-x1 + x2 \leq 4$, x1 unrestricted, $x2 \geq 0$, [15]
   (a) Determine all the basic feasible solutions of the problem.
   (b) Use direct substitution in the objective function to determine the best basic solution.
   (c) Solve the problem graphically, and verify that the solution obtained in (c) is the optimum.

4. Consider the LPP solved by two phase: Maximize $z = 2x1 + 2x2 + 4x3$ subject to $2x1 + x2 + x3 \leq 2$, $3x1 + 4x2 + 2x3 \geq 8$, $x1, x2, x3 \geq 0$ [20]

5. Use *generalized simplex procedure* for LPP Maximize $z = x1 - 3x2$, subject to $x1 - x2 \leq 20$, $x1 + x2 \geq 40$, $x1, x2 \geq 0$ [20]

6. Central Workshop uses three operations to assemble three types of products—A, B, and C. The daily available times for the three operations are 430, 460, and 420 mins, respectively, and the revenues per unit of product A, B, and C are \$3, \$2, and \$5, respectively. The assembly times per A at the three operations are 1, 3, and 1 mins, respectively. The corresponding times per B and per C are (2, 0, 4) and (1, 2, 0) mins (a zero time indicates that the operation is not used). The optimal solution is given below:

Basic	x1	x2	x3	x4	x5	x6	Solution
z	4	0	0	1	2	0	1350
x2	-1/4	1	0	½	-1/4	0	100
x3	3/2	0	1	0	1/2	0	230
x6	2	0	0	-2	1	1	20

In the above model, suppose that the company can reduce the unit times on operations 1, 2, and 3 for product A form the current levels of 1, 3, and 1 minutes to .5, 1, and .5 minutes, respectively. The revenue per unit is changed to \$4. Determine the new optimum solution. (use post optimality) [20]

------------good luck------------