B.E. COMPUTER SCIENCE AND ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2022

Subject: OPTIMIZATION TECHNIQUES **Time:** Four hours

Full marks:70

CO1 (10 marks)

1. a. What do you mean by stochastic programming problems? Explain with an example. 3

   b. Why the methods of solving Linear Programming Problems are not applicable directly to solve Non-Linear Programming Problems? 2

   c. How does quadratic programming differ from geometric programming? 2

   d. When does revised simplex method prefer over the other simplex method and why? 3

CO2 (18 marks)

(Answer any one)

2. a. What is degeneracy in LPP? When does it occur? Explain with an appropriate example. 4

   b. V. K. Shipyard company makes three different kinds of boats. All can be made profitability in the company. The company's monthly production is constrained by the limited amount of labour, wood, and screws available each month. The director will choose the combination of boats that maximizes his revenue in view of the information given in the following table. 10

Input	Row Boat	Canoe	Kayak	Monthly available
Labour(Hours)	12	7	9	1,260hrs
Wood(Board feet)	22	18	16	19008 board feet
Screw(Kg.)	2	4	3	396 kg
Selling Price(in Rs.)	4000	2000	5000	

   Formulate the above as a linear programming problem.
   Solve it by any simplex method.
   From the optimal table of the solved linear programming problem, answer the following questions:

   i. How many boats of each type will be produced and what will be the resulting revenue?
   ii. Which, if any, of the resources are not fully utilized? If so, how much of spare capacity is left?
   iii. How much wood will be used to make all of the boats given in the optimal solution?

   c. What do you mean by Strong and weak Duality? How is sensitivity related to duality? 2+2

3. a. Solve the following equation using the revised simplex method 10

$$Maximize Z = 3x_1 + 5x_2$$
$$s.t. x_1 + x_2 \leq 4$$
$$5x_1 + 3x_2 \geq 8$$
$$x_1, x_2 \geq 0$$

b. The Hardrock Concrete Company has plants in three locations and is currently working on three major construction projects, each located at different sites. The shipping cost per truckload of concrete, daily plant capacities, and daily project requirements are provided in the accompanying table. 8

From \ To	Project A	Project B	Project C	Plant Capacities
Plant 1	$10	$ 4	$11	70
Plant 2	12	5	8	50
Plant 3	9	7	6	30
Project Requirements	40	50	60	150

i. Formulate an initial feasible solution.
ii. Then solve it using the MODI method.
iii. Is the initial solution optimal?

CO3 (15 marks)

4. a. What is the Convex problem? How does the convexity of a function related with optimization? Describe elaborately. 2+6

b. Is the following problem Convex? 7

$$\text{Min } z = -x1x2 - x2x3 - x1x3$$
$$\text{s.t. } x1 + x2 + x3 = 1$$

CO 4 (12 marks)

(Answer any one)

5. a. When will you use dynamic programming and why? How does Dynamic programming differ from branch and bound method? 3

b. A government space project is conducting research on a certain engineering problem that must be solved before a man can fly to moon safely. These research teams are currently trying three different approaches for solving this problem. This estimate has been made that, under present circumstances, the probability that the respective teams-call them A, B and C-will not succeed are 0.40, 0.60 and 0.80 respectively. Thus the current probability that all three teams will fail is $(0.40 \times 0.60 \times 0.80) = 0.192$. Since the objective is to minimize this probability, the decision has been made to assign two top scientists among the three teams in order to lower it as much as possible. The following table gives the estimated probability that the respective teams will fail when 0, 1 or 2 additional scientists are added to that team. 9

		Team		
		A	B	C
Number of Scientists	0	0.40	0.60	0.80
	1	0.20	0.40	0.50
	2	0.15	0.20	0.30

How should the additional scientists reallocated to the team? (Solve this using Dynamic programming)

6. a. How is the concept of dominance used to simplify the solution of a rectangular game? 2+
Solve the following game using the above principle. 7

	Player B			
Player A	B1	B2	B3	B4
A1	8	10	9	14
A2	10	11	8	12
A3	13	12	14	13

b. Explain the graphical method of solving 2 X N and m X 2 games. 3

CO5 (15 marks)
(Answer any one)

7. a. What is the Kuhn-Tucker condition(s) for maximization and minimization problem? What is the significance of it? 2+3
b. Explain the utility of the Lagrange multiplier concerning an optimization problem with sufficient and necessary condition. 6
c. What are the pros and cons of multi objective optimization problems? How would you solve multi-objective optimization problems? 4

8. a. $$Maximize\ z = -\sin(x1x2) + \cos(x1 - x2)$$ 7
using gradient descent search within the tolerance of 0.05.

b. Solve the following non-linear programming problem using the langrage multiplier method. 8

$$Minimize\ Z = 3.6x_1 - 0.4{x_1}^2 + 1.6x_2 - 0.2{x_2}^2$$
$$s.t.\ 2x_1 + x_2 = 10$$
$$x_1, x_2 \geq 0$$