

Semester-VII

Discipline Specific Elective-DSE-II 7.4

Linear Programming

Offered by Department of Economics

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Semester	Course title & Code	Credits	Duration (per week)			Eligibility Criteria	Prerequisite
			Lecture	Tutorial	Practical/ Practice		
VII	Linear Programming	4	3	1	0	Class 12th Pass	Nil

Learning Objectives:

Linear programming is an important modelling technique used to determine the best way to use available resources. Managers, analysts and entrepreneurs often face the problem of decision-making when resources are limited. The aim of this course is to brush up linear algebra and then introduce students to linear programming with emphasis on mathematical formulation and finding solutions to practical problems. Linear programming helps them to achieve various goals like cost minimization, money and time management, reducing waste and improving financial portfolio. The course includes simplex method for solving the transportation and assignment problems. Some of these topics are illustrated by means of Microsoft excel solver.

Learning Outcomes:

The students will be able to:

- Mathematically formulate and model fundamental decision-making problems.
- Geometrically solve a linear programming problem in two variables.
- Apply simplex algorithm to solve a linear programming problem.
- Utilize computer software to find solutions of a linear programming model.
- Produce a dual of a linear program.
- Understand and appreciate the practical ways to implement a linear programming model.

Unit I: Linear Algebra: Matrices and vectors, matrix operations, matrix operations using excel, systems of linear equations, finding solution using Gauss Jordan method, linear independence and dependence, rank of a matrix, matrix inversion and finding the solution using excel, determinant.

Wayne L. Winston: Chapter 2

(10 hours)

Unit II: Introduction to Linear Programming: The linear programming model, assumptions, examples, formulating and solving linear programming models using excel.

Hillier and Lieberman: Chapter 3 excluding section 3.6

(11 hours)

Unit III: Simplex Method: Understanding simplex method, setting up the simplex method, algebra of the simplex method, simplex method in tabular form, postoptimality analysis.

Hillier and Lieberman: Chapter 4 excluding sections 4.5, 4.6 and 4.9 (12 hours)

Unit IV: Duality: Understanding Duality theory, economic interpretation of duality theory, primal-dual relationships, role of duality theory in sensitivity analysis.

Hillier and Lieberman: Chapter 6 excluding sections 6.4. (12 hours)

Practical Exercises:

The learners are required to:

1. solve problems given in class on applying matrix multiplication in cryptography with the use of Microsoft excel. (Unit I)
2. make a group presentation of case studies of companies where linear programming is used for minimizing costs, optimizing capacity, managing financial portfolios, asset management through fieldwork or surveys. (Unit II)
3. formulate any transportation problem or assignment problem and apply simplex method using excel solver. (Unit III)
4. identify any other decision-making problem which they face as students, then formulate and solve it using simplex method. (Unit III)
5. engage in a group discussion on how duality theory enhances the ability to analyse linear programming problems, particularly in the field of economics and business. (Unit V)

Suggested Readings:

- Winston, W. L. (2022). *Operations Research: Applications and Algorithms*. (4th ed.). Cengage Learning.
- Hillier, F. S., & Lieberman, G. J. (2015). *Introduction To Operations Research*. (10th ed.). McGraw-Hill Education.

Additional Reading

- Thie, P. R., & Keough, G. E. (2008). *An Introduction to Linear Programming And Game Theory*. (3rd ed.). New Jersey: John Wiley and Sons, Inc., Hoboken.

Notes:

1. Suggested readings shall be updated and uploaded on the college website from time to time.
2. Examination scheme and mode shall be prescribed by the Examination branch, University of Delhi from time to time.