



ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name: B.Sc. (Hons) Mathematics						
Semester	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
VI	32357616	DSE-4 (ii): Linear Programming and Applications	5	1	0	6
Teacher/Instructor(s)		Dr. Priyanka Yadav				
Session		2021-2022				

Course Objective: The purpose of the course is to acquaint students with the ideas underlying the Simplex Method for Linear Programming Problem. The course covers Linear Programming with applications to transportation, assignment and game problem. Dual linear problems are also studied.

Course Learning Outcomes: After studying this course the student will be able to:

- Solve two variable linear programming problems graphically. Learn the important concepts of convex sets, polyhedral sets, extreme points and basic feasible solutions.
- Comprehend the theory of Simplex method to solve linear programming problems including two-phase and big-M methods to deal with linear programming problems involving artificial variables.
- Learn about the relationships between the primal and dual problems.
- Learn applications of linear programming problems namely, transportation problems, assignment problems and two-person zero-sum game problems and methods to solve them.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.	Unit 1: Introduction to Linear Programming	1-2	Standard and canonical form of linear programming problem (lpp) and it's matrix form
		3	Graphical solution to solve lpp
		4-5	Examples for unbounded solution, alternate solution and no solution of lpp.
		6-7	Convex and polyhedral sets, Hyperplanes

		8-9	Extreme points, Basic solutions, Basic feasible solutions
		10-12	Reduction of any feasible solution to a basic feasible solution
		13-15	Correspondence between basic feasible solutions and extreme points.
2.	Unit 2: Methods of Solving Linear Programming Problem	16-17	Optimal solution, Termination criteria for optimal solution of the lpp.
		18-20	Unique and alternate optimal solutions, Unboundedness theorem
		21-25	Simplex algorithm with examples
		26-30	Table format of simplex method with examples
		31-32	Artificial variables with examples
		33-36	Two-Phase method with cases and examples
		37-40	Big-M method with cases and examples
3.	Unit 3: Duality Theory of Linear Programming	41-43	Standard and canonical form of duality, equivalence of the two forms
		44-45	Derivation of mixed duality and examples
		46-48	Weak duality, related corollaries with counter examples
		49-50	Strong Duality
		51-52	Statement of the fundamental theorem of duality with examples
		53-55	Complementary slackness theorem with examples
4.	Unit 4: Applications	56	Transportation problem and its Mathematical form
		57-58	Three methods to find initial basic feasible solution
		59-60	UV method to find optimal solution of Transportation problem
		61	Assignment problem and its Mathematical form
		62-64	Hungarian method
		65	Different cases in Hungarian method
		66	Basic concept, Formulation and solution of two-person zero-sum games.
		67-68	Games with mixed strategies
		69-70	Linear programming method of solving a game.

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz		
	• Class Test		
	• Attendance		

	• Assignment		
2.	End Semester Examination	3 Hrs.	75

Details of the Course		
Unit	Contents	Contact Hours
1	Standard and canonical form of linear programming problem (lpp) and it's matrix form, Graphical solution to solve lpp, Examples for unbounded solution, alternate solution and no solution of lpp, Convex and polyhedral sets, Hyperplanes, Extreme points, Basic solutions, Basic feasible solutions, Reduction of any feasible solution to a basic feasible solution, Correspondence between basic feasible solutions and extreme points.	15
2	Optimal solution, Termination criteria for optimal solution of the lpp, Unique and alternate optimal solutions, Unboundedness theorem, Simplex algorithm with examples, Table format of simplex method with examples, Artificial variables with examples, Two-Phase method with cases and examples, Big-M method with cases and examples	25
3	Standard and canonical form of duality, equivalence of the two forms, Derivation of mixed duality and examples, Weak duality, related corollaries with counter examples, Strong Duality, Statement of the fundamental theorem of duality with examples, Complementary slackness theorem with examples	15
4	Transportation problem and its Mathematical form, Three methods to find initial basic feasible solution, UV method to find optimal solution of Transportation problem, Assignment problem and its Mathematical form, Hungarian method, Different cases in Hungarian method, Basic concept, Formulation and solution of two-person zero-sum games, Games with mixed strategies, Linear programming method of solving a game.	15
	Total	70

Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
1.	Bazaraa, Mokhtar S., Jarvis, John J., & Sherali, Hanif D. (2010). Linear Programming and Network Flows (4th ed.). John Wiley and Sons.	2010
2.	Hadley, G. (1997). Linear Programming. Narosa Publishing House. New Delhi.	1997
3.	Taha, Hamdy A. (2010). Operations Research: An Introduction (9th ed.). Pearson.	2010
4.	Hillier, Frederick S. & Lieberman, Gerald J. (2015). Introduction to Operations Research (10th ed.). McGraw-Hill Education (India) Pvt. Ltd.	2015
5.	Thie, Paul R., & Keough, G. E. (2014). An Introduction to Linear Programming and Game Theory. (3rd ed.). Wiley India Pvt. Ltd.	2014

Mode of Evaluation:	Internal Assessment / End Semester Exam
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