BSc. (Physical Sciences/ Mathematical Sciences) with Operational Research as one of the Core Disciplines

Category IV

DISCIPLINE SPECIFIC CORE COURSE – 3: Advanced Linear Programming

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Advanced Linear Programming DSC-3	4	3	0	1	Class XII pass with Mathematics	Basic Linear Programming

Learning Objectives

The Learning Objectives of this course are as follows:

- To enrich the knowledge of students with advanced concepts and techniques of linear programming problem along with real life applications
- To make students understand the theoretical basics of different computational algorithms used in solving linear programming and related problems.

Learning outcomes

Students completing this course will be able to:

- Explain the relationship between a linear program and its dual, including strong duality and complementary slackness, and understand the economic interpretation of duality.
- Learn an alternative method for solving linear programming problems.
- Perform sensitivity analysis to identify the direction and magnitude of change of a linear programming model's optimal solution as the input data changes.
- Formulate specialized linear programming problems, namely transportation and assignment problems and describe theoretical workings of the solution methods for transportation and assignment problems, demonstrate solution process by hand and solver.

SYLLABUS OF DSC-3

Unit I (12 Hours): Duality: Duality in linear programming, Duality theorems (Weak duality, Strong duality, Existence theorem and Complementary slackness conditions), Economic interpretation of duality, Dual simplex method.

Unit II (09 Hours): Sensitivity Analysis: Post Optimality Analysis (change in resource vector, change in cost vector, addition and deletion of a constraint, addition and deletion of a decision variable).

Unit III (15 Hours): Transportation Problem (TP): TP and its formulation, finding initial basic feasible solution of TP using North-West Corner rule, Least Cost method and Vogel's Approximation method, MODI method for finding optimal solution, Special cases in TP.

Unit IV (09 Hours): Assignment problem (AP): AP and its formulation, Hungarian method for solving AP, Special cases in AP, Transhipment and Travelling salesmen problem.

Practical component (if any) –

Practical/Lab to be performed on a computer using OR/Statistical packages

1. Solution to linear programming problem through dual simplex method.
2. Computational sensitivity analysis with respect to changes in the cost vector.
3. Computational sensitivity analysis with respect to changes in the resource vector.
4. Solution of transportation problem.
5. Solution of assignment problem.
6. Solution of travelling salesman problem.

Essential/recommended readings

- Bazaraa, M. S., Jarvis, J. J. and Sherali. H. D. (2011). *Linear Programming and Network Flows* (4th ed.). John Wiley & Sons.
- Chandra, S., Jayadeva, Mehra, A. (2009). *Numerical Optimization with Applications*. Narosa Publishing House.
- Hadley, G. (2002). *Linear Programming.* Narosa Publishing House.
- Ravindran, A., Phillips, D. T. and Solberg, J. J. (2007). *Operations Research-Principles and Practice* (2nd ed.) (WSE), John Wiley & Sons.
- Taha, H. A. (2017). *Operations Research-An Introduction* (10th ed.). Pearson.
- Winston, W. L. and Venkataramanan, M. (2002). *Introduction to Mathematical Programming: Applications and Algorithms* (4th ed.). Duxbury Press.

Suggestive readings-Nil

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.