**Name of the Programme : M.Sc.
in Data Science**

Course code	**: CSD-510**
Title of the Course	**: Optimization Techniques**
Number of Credits	**: 4(2L-2T-0P)**
Contact Hours	**: 60 hours (30L-30T-0P)**
Effective from AY	**: 2023-24**

Pre-requisites for the course	NIL
Course Objectives	1. To familiarize the students with some basic concepts of optimization techniques and approaches. 2. To formulate a real-world problem as a mathematical programming model. 3. To develop the model formulation and applications are used in solving decision problems. 4. To solve specialized linear programming problems like the transportation and assignment problems.
Content:	**Unit 1:** **Introduction to Operations Research :** Introduction-Mathematical models of Operation Research - Scope and applications of Operation Research - Phases of Operation Research study - Characteristics of Operation Research - Limitations of Operation Research. **Linear Programming:** Introduction –Properties of Linear Programming-Basic assumptions-Mathematical formulation of Linear Programming-Limitations or constraints-Methods for the solution of LP Problem-Graphical analysis of LP-Graphical LP Maximization problem-Graphical LP Minimization problem. **Linear Programming Models:** Simplex Method-Basics of Simplex Method - Formulating the Simplex Method-Simplex Method with two variables - Simplex Method with more than two variables - Big M Method. **Dual Linear Programming:** Introduction- Primal and Dual problem - Dual problem properties-Solution techniques of Dual problem - Dual Simplex method-Relations between direct and dual problemEconomic interpretation of Duality.	**15 hours**

	Unit2: **Transportation and Assignment Models:** Introduction: Transportation problem - Balanced - Unbalanced - Methods of basic feasible solution Optimal solution-MODI method. Assignment problem-Hungarian Method. **Network Analysis:** Basic concepts-Construction of Network-Rules and precautions-CPM and PERT Networks Obtaining of critical path. Probability and cost consideration. Advantages of Network.	**15 hours**
	Theory of Games : Introduction-Terminology-Two Person Zero-Sum game-Solution of games with saddle points and without saddle points-2X2 games-dominance principle – mX2 and 2Xn gamesGraphical method.	
Tutorial Sessions	Case Studies and Mini Projects based on concepts covered during theory lectures	**2*15= 30 hours**
Pedagogy:	Lectures/ Tutorials/Hands-on assignments/Self-study/Flipped classroom	
References/ Readings	**Text Book(s)** 1. Gupta, P. K., & Hira, D. S. (2022). Introduction to Operations Research. S. Chand Publishing. 2. J K Sharma (2007), Operations Research Theory & Applications, 3e, Macmillan India Ltd. 3. Maurice Solient, Arthur Yaspen, Lawrence Fridman, OR methods and Problems (2003), New Age International Edition. 4. P. Sankaralyer, (2008), Operations Research, Tata McGraw-Hill. 5. Philips, D. T. (2007). Operations research: Principles and practice. John Wiley & Sons, Incorporated. 6. S.D. Sharma (2000). Operations Research. Nath& Co., Meerut.	
Course Outcomes	1. Apply operations research techniques like linear programming problem in industrial optimization problems. 2. Solve allocation problems using various OR methods. 3. Understand the characteristics of different types of decision making environment and the appropriate decision making approaches and tools to be used in each type. 4. Recognize competitive forces in the marketplace and develop appropriate reactions based on existing constraints and resources.	