MTS 514	Operations Research	4 Credits (48 hours)

Course Outcome: This course is intended to impart knowledge in concepts and tools of Operations Research. Students will understand mathematical models/techniques used in Operations Research and apply these techniques constructively to make effective decisions in various applicable fields including business.

Course Specific Outcome: At the end of the course Students will have the knowledge and skills to understand, explain in depth and apply in various situations the concepts -

- Solving the OR Model
- Modeling with Linear Programming
- The Simplex Method and Sensitivity Analysis
- Duality and Post-Optimal Analysis
- Transportation Model and Its Variants
- Network Model.

Unit I - What Is Operations Research:
Introduction, Operations Research Models, Solving the OR Model, Queuing and Simulation Models, Art of Modeling, More than Just Mathematics, Phases of an OR Study.

(2 Hours)

Unit II - Modeling with Linear Programming:
Two-Variable LP Model, Graphical LP Solution, Solution of a Maximization Model, Solution of a Minimization Model, Selected LP Applications, Urban Planning, Currency Arbitrage, Investment Production Planning and Inventory Control, Blending and Refining, Manpower Planning, Additional Applications, Computer Solution with Solver and AMPL, LP Solution with Excel Solver, LP Solution with AMPL.

(6 Hours)

Unit III - The Simplex Method and Sensitivity Analysis:
LP Model in Equation Form, Transition from Graphical to Algebraic Solution, The Simplex Method, Iterative Nature of the Simplex Method, Computational Details of the Simplex Algorithm, Summary of the Simplex Method, Artificial Starting Solution, M-Method, Two-Phase Method, Special Cases in the Simplex Method Degeneracy, Alternative Optima, Unbounded Solution , Infeasible Solution, Sensitivity Analysis, Graphical Sensitivity Analysis, Algebraic Sensitivity Analysis—Changes in the Right-Hand Side, Algebraic Sensitivity Analysis—Objective Function, Sensitivity Analysis with TORA, Solver, and AMPL.

(10 Hours)

Unit IV - Duality and Post-Optimal Analysis:
Definition of the Dual Problem, Primal–Dual Relationships, Review of Simple Matrix Operations, Simplex Tableau Layout, Optimal Dual Solution, Simplex Tableau Computations, Economic Interpretation of Duality, Dual Variables, Dual Constraints, Additional Simplex Algorithms, Dual Simplex Algorithm, Generalized Simplex Algorithm, Post-Optimal Analysis, Changes Affecting Feasibility, Changes Affecting Optimality.

(10 Hours)

Unit V - Transportation Model and Its Variants:
Definition of the Transportation Model, Nontraditional Transportation Models, The Transportation Algorithm, Determination of the Starting Solution, Iterative Computations of the Transportation Algorithm, Simplex Method Explanation of the Method of Multipliers, The Assignment Model, The Hungarian Method, Simplex Explanation of the Hungarian Method, The Transshipment Model.

(10 Hours)

Unit VI - Network Model:
Scope and Definition of Network Models, Minimal Spanning Tree Algorithm, Shortest-Route Problem, Examples of the Shortest-Route Applications, Shortest-Route Algorithms, Linear Programming Formulation of theShortest-Route Problem, Maximal Flow Model, Enumeration of Cuts, Maximal Flow Algorithm, Linear Programming Formulation of MaximalFlow Mode, CPM and PERT, Network Representation Critical Path Method (CPM) Computations, Construction of the Time Schedule, Linear Programming Formulation of CPM, PERT Networks.

(10 Hours)

References

[1] Hamdy A Taha, *Introduction to Operation Research*, 10th Ed., Pearson Education Limited, 2017.

[2] F. S. Hillier, G.J. Lieberman, *Introduction to Operations Research*, Concepts and Cases, 8th Ed, 2010, TMH