Core XVIII Fundamentals of Operation Research and Quantitative Technique

Course Objectives

- Understand the fundamental concepts and principles of operations research and quantitative techniques.
- Learn mathematical modeling techniques for representing real-world problems in OR.
- Develop proficiency in optimization methods, including linear programming, integer programming, and nonlinear programming.
- Gain practical skills in applying quantitative techniques to analyze and solve business, engineering, and management problems.
- Learn simulation techniques for modeling stochastic systems and uncertainty in decision-making.
- Explore applications of OR and quantitative techniques in diverse fields such as supply chain management, logistics, finance, and healthcare.
- Develop critical thinking and problem-solving skills through hands-on exercises and case studies.
- Communicate quantitative analysis results effectively through written reports and presentations.

Course Outcomes

After completion of the course, learners will be able to:

- Foundational Knowledge of Operations Research.
- Proficiency in Mathematical Modeling.
- Competence in Optimization Techniques.
- Understanding of Simulation Modeling.
- Applications of OR in Diverse Fields.
- Critical Thinking and Problem-Solving Abilities.
- Effective Communication of Analysis Results.
- Practical Skills for Decision Support

Unit- 1: Introduction to Operations Research

Definition and scope of operations research, Historical development of OR and its applications, Role of quantitative techniques in decision-making. Mathematical Modeling; Formulation of mathematical models for real-world problems, Linear and nonlinear models, Objective functions, decision variables, and constraints

Unit-2: Optimization Techniques and Network Analysis

Linear programming: formulation, graphical solution, simplex method, Integer programming: branch and bound, cutting planes, Nonlinear programming: gradient-based methods, convex optimization. Network modeling techniques: critical path method (CPM), program evaluation

and review technique (PERT), Shortest path problems, minimum spanning trees, maximum flow problems

Unit-3: Simulation Modeling

Simulation methodology: discrete event simulation, Monte Carlo simulation, Random number generation, input modeling, output analysis, Applications of simulation in business and engineering. Decision Analysis; Decision trees: construction, analysis, and evaluation, Utility theory and risk analysis, Sensitivity analysis and decision-making under uncertainty

Unit-4: Applications of Operations Research

Supply chain optimization, Inventory management, Production planning and scheduling, Transportation and logistics. Case Studies and Practical Applications, Real-world case studies applying OR and quantitative techniques, Group projects analyzing and solving complex problems using quantitative methods, Presentation and communication of analysis results

Suggested Readings

- ✓ Operations Research, 4th Edition , Kalavathy S.   Vikas Publishing