

**B.Sc. (Mathematics) (Part III) (Semester – VI)**  
**Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)**  
**Syllabus to be implemented from Academic Year 2024-25**

Course code	:	DSE – F12
Title of course	:	Operations Research
Theory	:	32 Hrs. (40 lecturers of 48 min.)
Marks	:	50 (Credit: 02)

**Course Learning Outcomes: This course will enable the students to:**

**CO1:** define and explain the fundamental concepts of Operations Research.

**CO2:** identify and develop operations research model describing a real-life problem.

**CO3:** understand the mathematical tools that are needed to solve various optimization problems.

**CO4:** solve various linear programming, transportation, assignment problems related to real life.

**Unit 1: Linear Programming (LP)**

**(20 Lect.)**

- 1.1 Operations Research: Origin, Definition and scope.
- 1.2 Linear Programming: Introduction
- 1.3 Linear Programming Formulation: Examples
- 1.4 General Formulation of Linear Programming Problem
- 1.5 Some Important Definitions: Solution to linear programming problem, feasible solution, Basic feasible solution, Optimum basic feasible solution, unbounded solution
- 1.6 Graphical solution of LP Problems
- 1.7 Simplex method for LP Problems
- 1.8 Problems based on 1.7
- 1.9 Artificial Variable Techniques: Two Phase Method. Big M Method
- 1.10 Problems based on 1.9

**Unit 2: Assignment Problem and Transportation problem**

**(20 Lect.)**

- 2.1 **Transportation Problem:** Introduction
- 2.2 Mathematical Formulation of the Transportation Problem
- 2.3 Definitions: Feasible Solution, Basic Feasible Solution, Optimal Solution
- 2.4 Theorem (Existence of Feasible Solution): Statement and Proof
- 2.5 Methods for Initial Basic Feasible Solution: North – West Corner Rule (NWCR), Lowest Cost Entry (Matrix Minima) Method (LCM), Vogel's Approximation Method (VAM) (Unit Cost Penalty Method)
- 2.6 Problems based on 2.5
- 2.7 Definition: Non – degenerate solution of Transportation Problem
- 2.8 Optimality Test: MODI Method.
- 2.9 Problems based on 2.8
- 2.10 Unbalanced Transportation Problem
- 2.11 Problems based on 2.10
- 2.12 **Assignment Problem:** Introduction
- 2.13 Mathematical Formulation of the Assignment Problem
- 2.14 Reduction Theorem: Statement and Proof
- 2.15 Method for solving the Assignment Problem: Hungarian Assignment Method
- 2.16 Problems based on 2.15

- 2.17 Maximization Case in Assignment Problem
- 2.18 Unbalanced Assignment Problem
- 2.19 Travelling Salesman Problem
- 2.20 Problems based on 2.17 to 2.19

**Recommended Book:** S. D. Sharma, Operations Research - Theory Methods and Applications”  
Kedar Nath, Ram Nath Meerut, Delhi Reprint 2019.

**Reference Books:**

1. J. K. Sharma: Operations Research Theory and Applications, Mac Millan Co.
2. J. K. Sharma: Mathematical Model in Operation Research, Tata McGraw Hill
3. R. K. Gupta: Operations Research, Krishna Prakashan Mandir, Meerut.
4. Hamady Taha: Operations Research: Mac Millan Co.
5. P.Rama Murthy: Operations Research, New Age International (P) Limited, Publishers.