

Discipline Specific Elective (DSE) Course 3b: Operational Research

Structure 1: PG Curricular Structure with only Course Work

Structure 2: PG Curricular Structure with Course Work + Research

Structure 3: PG Curricular Structure with Research only

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Prerequisite of the course (if any)
		Lecture (45 Hours)	Tutorial (00 Hours)	Practical (30 Hours)		
DSE 3b: Operational Research	4	03	00	01	NIL	NIL

Course objectives:

- To introduce quantitative and model-based techniques for solving real-world problems.
- To develop the ability to formulate models and enhance skills in using models for effective and evidence-based decision-making.

Course Learning Outcomes: After successful completion of this course, students will be able to:

- Identify and develop operational research models from the verbal description of the real system.
- Understand the characteristics of different types of decision-making environments and decision making approaches.
- Understand the mathematical tools that are needed to solve optimization problems.
- Analyze the queueing and inventory situations.
- Understand discrete event simulation and decision analysis with inclusion of modelling based on random events involving uncertainties.
- Conceptualize optimum event management through Network scheduling.

Unit I (12 Hours)

Definition and Scope of Operational Research, Phases in Operational Research, Different types of models and their construction. Simulation: Types and classifications. Pseudorandom Number Generation, Using random numbers to evaluate integrals, Generating discrete and continuous random variables: Inverse Transform Method, Acceptance-Rejection Technique, Composition Approach. Simulating discrete events.

Unit II (12 Hours)

Introduction to Decision Analysis: Pay-off table for one-off decisions and discussion of Decision criteria, Decision trees. Quadratic programming: Beale's and Wolfe's methods. Network Scheduling: CPM, PERT.

Unit III (11 Hours)

Queueing Theory: Steady state analysis of M/M/1, M/M/C queues, Method of stages for steady state solution of M/Er/1 and Er/M/1 queues.

Unit IV (10 Hours)

Inventory Management: Characteristics of inventory systems. Classification of items. Deterministic inventory systems with and without lead-time. All units and incremental discounts. Single period stochastic models.

Essential Readings:

1. Gross, D., Shortle J.F., Thompson J.M. and Harris, C.M. (2008). *Fundamentals of Queueing Theory*, John Wiley & Sons.
2. Hadley, G. and Whitin, T.M. (1963). *Analysis of Inventory Systems*, Prentice Hall.
3. Ross, S. M. (2013). *Simulation*, Academic Press.
4. Taha, H. A. (2016). *Operations Research: An Introduction*, Prentice Hall.
5. Winston, W.L. and Goldberg, J.B. (2004). *Operations Research: Applications and Algorithms*, Thomson Brooks/Cole.

Suggested Readings:

1. Banks J. (1998). *Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice*, John Wiley and Sons.
2. Hillier, F.S. and Lieberman, G.J. (2001). *Introduction to Operations Research*, Irwin.

List of Practicals:

1. Random number generation of continuous distributions by using different methods like: Inverse Transform Method, Acceptance-Rejection Technique, Composition Approach.
2. Random number generation of discrete distributions by using different methods like: Inverse Transform Method, Acceptance-Rejection Technique, Composition Approach
3. Critical Path Method.
4. Program Evaluation and Review Technique.
5. Queueing Theory.
6. Inventory Management.