Lok Jagruti Kendra University
University with a Difference

Diploma in Mechanical Engineering

LJ Polytechnic

Course Code: 025060603

Operation Research & Management

Programme / Branch Name	Diploma in Mechanical Engineering					
Course Name	Operation Research & Management				**Course Code**	025060603
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Basic Mathematics
- ✓ Critical Thinking Skills
- ✓ Analytical Skills

3. Rationale

Operation Research (OR) is to improve decision-making processes in various industries by using mathematical models and optimization techniques. OR involves the use of mathematical models and techniques to find the best solutions to complex problems. The key objective of OR is to optimize performance, minimize costs, and improve efficiency in various systems, including manufacturing, transportation, healthcare, finance, and many other fields. OR provides a systematic approach to problem-solving, uses mathematical models and optimization techniques to improve decision-making processes, and helps in analyzing complex systems and optimizing resource allocation. Therefore, it is an important tool for various industries and fields that seek to improve their performance, minimize costs, and increase efficiency.

4. Objectives

- ✓ To analyze and solve complex problems using mathematical models and optimization techniques.
- ✓ To improve decision-making processes by providing a quantitative basis for decision-making.
- ✓ To optimize performance, minimize costs, and increase efficiency in various systems, including manufacturing, transportation, healthcare, finance, and many other fields.
- ✓ To identify and evaluate risks associated with different decisions and recommend risk mitigation strategies.
- ✓ To apply mathematical models and optimization techniques to real-world problems in various fields and industries, such as healthcare, transportation, logistics, finance, and manufacturing.
- ✓ To provide a systematic approach to problem-solving that can help organizations improve their performance, minimize costs, and increase efficiency.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Introduction to Operation Research**	1.1. Origin of Operation Research 1.2. Historical Standpoint. 1.3. Uses and Scope 1.4. Application of Operations Research in Managerial Decision-Making. 1.5. Some Definitions of Operation Research. 1.6. Operations Research in India. 1.7. Advantages of Operations Research Study. 1.8. Difficulties in Operations Research. 1.9. Limitations of Operations Research.	• Basic concept of operations research. • The ability to formulate real-world problems in mathematical terms. • Learn Various optimization techniques. • Learn how to make effective decisions by anlysing decision making techniques. • Learn about the diverse range of applications of operations research.	10	4
2.	**Linear Programing**	2.1. Introduction. 2.2. Requirement of a Linear Programming Problem. 2.3. Basic Assumptions in Linear Programming. 2.4. Areas of Application of Linear Programming. 2.5. Formulation of Linear Programming Problems. 2.6. Advantages of Linear Programing Methods. 2.7. Limitations of Linear Programming Methods. 2.8. Graphical Method of Solution.	• Studying linear programming concept. • Optimization of a function of variables. • Learn about the duality principle and its application in linear programming. • Learn about the diverse range of application of linear programming in various industries. • Advantages of CAPP.	25	12
3.	**Transportation and Assignment Model**	3.1. Introduction to the Transportation Model. 3.2. Definition in the Transportation Model. 3.3. Assumptions of the Transportation model. 3.4. Matrix Terminology. 3.5. Formulation and Solution of Transportation Model. 3.6. Definition of Assignment Model.	• Formulate transportation and assignment problems based on real-world scenarios. • Understanding of transportation and assignment problem structure and the differences between them.	30	12

		3.7. Comparison with Transportation Model. 3.8. Solution of the Assignment Models. 3.9. Formulation and Solution of the Assignments Models.	• Knowledge of optimization techniques. • Methods for solving transportation problems and the Hungarian methods for solving assignment problems.		
4.	**Game Theory**	4.1. Introduction. 4.2. Characterisitcs of Game Theory. 4.3. Terms used in Game Theory. 4.4. Two person zero sum games. Pure strategy. 4.5. Arithmetic Method 2X2 Games.	• Develop strategic thinking skills by analyzing interation between decision maker in situations. • Develop mathematical models to present different games and analyze their properties. • Understanding of the diverse range of application of game theory in various fields.	15	8
5.	**Network Analysis**	5.1. Introduction. 5.2. Terms used in Network Analysis. 5.3. Fulkerson's Rule 5.4. Network or Arrow Diagram. 5.5. Critical Path Method(CPM) 5.6. Programme Evaluation and Review Technique (PERT)	• Understand the principles of network analysis. • Knowledge of different network measures such as centralty, degree etc… • Analyze the structure of networks and identify the nodes or links in the network. • Understanding of project scheduling and identifying critical activities. • Use CPM and PERT techniques to plan, schedule, and monitor complex projects.	20	6
				Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises have been properly designed and implemented in an attempt to develop different types of skills, so that students can acquire the competencies/program outcomes. Following is the list of practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	Formulation of linear programming models and solution using graphical.	Model real-world problems using LP techniques, Interpret and analyze LP models and solutions, Apply graphical method to solve LP models, Validate LP models and ensure their consistency with real-world problems.	6
2.	Formulation of transportation model and solution using optimization techniques.	Formulate transportation problems mathematically by defining decision variables, objective function, and constraints. Apply optimization techniques such as the transportation simplex method to solve transportation problems.	6
3.	Formulation of assignment model and solution using optimization techniques.	Formulate assignment problems of assignment models and solution using optimization techniques. Validate the assignment model and ensure its consistency with real-world assignment problems.	4
4.	Analysis of network diagrams using different network measures and network or arrow diagram.	Understand and interpret network or arrow diagrams to identify the relationships between activities and the flow of the project.	4
5.	Use of CPM and PERT techniques for project planning, scheduling, and control.	Develop project plans and schedules using CPM and PERT techniques to identify critical activities, estimate project duration and identify potential project risks.	4
6.	Seminar presentation	Prepare the seminar and make presentation on power point.	4
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	Ap %	C %	E %	An %
1.	Introduction to Operation Research	28	35	21	-	8	8
2.	Linear Programming	15	30	30	-	7	18
3.	Transportation and Assignment Model	20	25	21	-	18	16
4.	Game Theory	15	22	-	22	20	21
5.	Network Analysis	15	25	15	10	10	25

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Operations Research by P K Gupta and D S Hira, S. Chand and Company Limited.
2) Operation Research by Dr. Ravi Kant and Akshay A. Pujara, Books India Publications.

9. Reference Books

1) Operation Research by Girish G. Phatak, Tech Knowledge Publication.
2) Introduction to Operations Research by Hillier, F. S., & Lieberman, G. J., Tata McGraw Hill Publication.
3) Operations Research by Hamdy A. Taha, Prentice Hall Publication.
4) Operations Research by Dr. R K Gupta, Krishna Prakashan Media (P) Ltd.
5) Operations Research, A Practical Introduction by Michael W. Carter, Camille C. Price, Ghaith Rabadi, CRC Press.

10. Open Sources (Website, Video, Movie)

1) https://www.youtube.com/watch?v=4X9v4jMXiE0
2) https://www.youtube.com/watch?v=dx0TQ2tOc8w
3) https://www.youtube.com/watch?v=hW8rZr_Dr7M
4) https://www.youtube.com/watch?v=6ZQ32oVcL6E
5) https://www.youtube.com/watch?v=vy5qJ33Xp7I
6) https://www.youtube.com/watch?v=3DhOdTAmTt0
7) https://www.youtube.com/watch?v=5lj6UavFgCA
8) https://www.youtube.com/watch?v=NSVmOC_5zrE
9) https://www.youtube.com/watch?v=4U2eDJnwz_s
10) https://www.youtube.com/watch?v=2u0XIOJ1O2k
11) https://www.youtube.com/watch?v=9H5F5XdLYSM
12) https://www.youtube.com/watch?v=btRJyxsRd_w