

**Subject Code: 01ME0604**

**Subject Name: Operation Research**

**B.Tech. III Year – (Sem-6) Mechanical Engineering**

**Type of course:** Core

**Prerequisite:** Nil

**Rationale:** Understanding Operation research and to apply problem solving techniques to organization activities such as transportation, assignment, queuing, Project management and Inventory control.

**Teaching and Examination Scheme:**

Teaching Scheme (Hours)			Credits	Evaluation Scheme					Total Marks
Theory	Tutorial	Practical		Theory Marks			Practical Marks		
				ESE(E)	IA	CSE	Viva(V)	Term Work (TW)	
3	2	0	4	50	30	20	25	25	150

## **COURSE OUTCOME**

After learning the course the students should be able to:

- Describe Characteristics and applications of Operation Research.
- Formulate real world problems as a mathematical programming model and solve Linear Programming problems.
- Formulate and solve transportation and work/job assignments problems.
- Understand policies for the replacement of machines/components in the industry.
- Solve problems related to CPM and PERT for project management techniques.
- Solve Queuing and Inventory problems related to practical applications.

Sr. No.	Content	Total Hrs	Weightage
<b>1</b>	<b>Introduction:</b> Introduction to operation research, History of Operation Research, Methodology and characteristics, Different phases, Limitations & Applications of Operation research.	02	5 %
<b>2</b>	<b>Linear Programming Problems:</b> Introduction to linear programming, Basic assumptions of Linear Programming, General Mathematical form, Formulation of Linear Programming Graphical solution technique for Linear Programming, Limitations of Linear Programming.	04	10 %
<b>3</b>	<b>Analytical Methods for LPP:</b> Concept of slack and surplus variables, Solution of LP using Simplex method, Two phase method, Big M method, Primal and Dual problems.	08	15 %
<b>4</b>	<b>Transportation Problem:</b> Introduction to Transportation Problems, Mathematical Model for Transportation Problem, Unbalanced Problems, Methods for initial basic feasible solution: Northwest corner method, Least cost method, Vogel's approximation method. Degeneracy in transportation, Optimal solution using Modified Distribution method, Special cases - Unbalanced problems and profit maximization problems. Transshipment Problems.	06	15 %
<b>5</b>	<b>Assignment Problem:</b> Introduction to Assignment Problems, Mathematical formulation of the problem, Hungarian method to solve Assignment problem, Travelling salesman Problem.	04	10 %
<b>6</b>	<b>Queuing Theory:</b> Basics of queuing theory, Operating Characteristics of queuing, Components of queuing system, Kendall's Notation, Classification of Queuing Models, Preliminary examples of M/M/1 : $\infty$ / FCFS.	04	10 %

<b>7</b>	<b>Replacement Theory:</b> Introduction to Replacement Models, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group replacement policy, Individual replacement policy.	05	10 %
<b>8</b>	<b>Project Management:</b> Introduction to Introduction to Project Management, Network diagram components and Rules of Network Construction, Fulkerson's Rules, critical Path calculation, float calculation and its importance, PERT method, Cost reduction by Crashing of activity.	06	15 %
<b>9</b>	<b>Inventory Control :</b> Introduction to Inventory Control, Inventory Classification, Types of Inventories, Different cost associated to Inventory, Economic order quantity, Inventory model with deterministic demand (Constant rate of demand, No shortage allowed & instantaneous replenishment), ABC analysis.	04	10 %

**Distribution of Theory Marks**

<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>N Level</b>	<b>E Level</b>	<b>C Level</b>
<b>10</b>	<b>20</b>	<b>25</b>	<b>25</b>	<b>15</b>	<b>5</b>

**Legends: R:** Remembrance; **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate and **C:** Create

*Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.*

**Reference Books:**

1. Operations Research: An Introduction by Hamdy Taha, Pearson.
2. Operations Research by D.S. Hira and Premkumar Gupta
3. Operations Research by H N wagner, Prentice hall.
4. Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.
5. Quantitative Techniques in Management by N D Vohra, Tata McGraw-Hill

**List of Tutorials:**

1. Exercise on formulation of linear programming problems.
2. Exercise on Graphical solution of linear programming problems
3. Exercise and case problems on Transportation problems
4. Exercise and case problems on Assignment Problems
5. Exercise and case problems on Simplex, Big M and Two phase LP Problems
6. Exercise and case problems on Dual and Primal LP Problems
7. Exercise and case problems on Queuing theory.
8. Exercise on Inventory model
9. Exercise on Replacement theory
10. Exercise and case problems on PERT/CPM

**List of Open ended Tutorials:**

1. Solve LP problems using Microsoft Excel.
2. Solve LP problems using Lindo.

**List of Open Source Software/learning website**

1. <http://nptel.ac.in/>
2. <http://ocw.mit.edu/>