Faculty of Engineering and Technology
Bachelor of Technology (Semester VI / Third Year)
In Effect from Academic Year 2023-24

Branch Name:	Mechanical Engineering
Program Code:	ET101
Course Name:	Operation Research
Course Code:	2ET1000602T
Pre-requisite Course:	Zeal to learn the subject

Course Objectives:

1. To give students an elementary idea about applications of Operations Research concepts.
2. To develop analytical abilities for evaluating the working of Operations Research.
3. To understand the benefits and limitations of Operations Research techniques.
4. To formulate linear programming problems

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
					SEE		CCA		SEE		CCA		
	L	T	P	Total	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	**Operations Research:** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.	03	06
2	**Linear Programming Problem:** Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Primal and Dual Problems	08	18
3	**Transportation and Assignment:** Transportation Problems definition, Linear form, Solution methods: North west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution method, Unbalanced problems and profit maximization problems, Transshipment Problems, Assignment Problems and Travelling sales man Problem.	08	18
4	**Project Management:** Introduction to PERT and CPM, Critical Path calculation, Float calculation and its importance, Cost reduction by Crashing of activity.	07	16

5	**Game Theory:** Introduction, Characteristics of Game Theory, Two Person Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2, mx2, 2xn), Algebraic and graphical methods.	04	12
6	**Replacement theory:** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy.	04	10
7	**Queuing Theory:** Basis of Queuing theory, Elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models, Preliminary examples of M/M/1:∞/FCFA	04	10
8	**Inventory Control:** Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis.	04	10

List of Reference Books:

1. Taha, Hamdy A. Operations research: an introduction. Pearson Education India, 2013.
2. A M Natarajan, P Balasubramani, A Tamilarasi "Operations Research" , Pearson Education Inc.,2012
3. J K Sharma , "Operations Research" , S Chand.,2010
4. P Mariappan, "Operations Research", Pearson.,2010
5. H N wagner, "Operations Research", Prentice hall.,2015
6. Ronald Rardin, "Optimization in Operations Research", Pearson Education Inc.,2014
7. R. Paneerselvam, "Operations Research", Prentice Hall of India Pvt. Ltd.,2013
8. N D Vohra, "Quantitative Techniques in Management", Tata McGraw-Hill.,2010

List of Tutorial:

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

E-Resources:

1. https://nptel.ac.in/courses/112106134/
2. https://ocw.mit.edu/courses/sloan-school-of-management/15-053-optimization-methods-in-management-science-spring-2013/tutorials/

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain the fundamentals, scope, and methodology of Operations Research.	2 Understanding
CLO2	Formulate and solve Linear Programming Problems using graphical and analytical methods.	3 Applying
CLO3	Apply methods to solve transportation, assignment, and transshipment problems.	3 Applying
CLO4	Use PERT/CPM techniques to analyze and optimize project schedules.	3 Applying 4 Analyze
CLO5	Solve strategic decision problems using Game Theory techniques.	4 Analyze
CLO6	Apply models for inventory control, queuing, and equipment replacement decisions.	3 Applying

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	M	L	L			L	H				M			
CLO2			M	L	L	L							L	
CLO3		L	M		H			L		M			L	M
CLO4	M		M		M			L	M	L			M	
CLO5		L		M	L		L							M
CLO6	L							M		M		L		M

H: High, M: Medium, L: Low