Course Code:	Subject Title: Operations Research
	Year and Semester: IV Year I Semester

COURSE OBJECTIVES:
1. To understand the basics of linear programming, transportation, queueing, sequencing of jobs, replacement, inventory and simulation problems.
2. To apply linear programming, transportation and assignment models to solve real life problems.
3. To apply Sequencing, queueing, Game and Replacement theories to solve problems.
4. Apply knowledge of inventory control and simulation to solve practical industrial problems.

COURSE OUTCOMES: Students will be able to:

SN	OUTCOME	Cognitive Levels as per Bloom's Taxonomy	Weightage (%)
CO1	The understand the basics of linear programming, transportation, queueing, sequencing of jobs, replacement, inventory, and simulation problems **{Understand level, KL2}**	L1, L2	20
CO2	To apply linear programming, transportation, and assignment models to solve real life problems. **{Apply level, KL3}**	L1, L2, L3	20
CO3	To apply queuing and sequencing theories to solve real life problems. **{Apply level, KL3}**	L1, L2, L3	20
CO4	To Recognize and solve queuing and game theory problems. **{Apply level, KL3}**	L1, L2, L3	20
CO5	The Model the project management problems through CPM and PERT. **{Apply level, KL3}**	L1, L2, L3,	20

WEIGHTAGE OF BLOOM'S LEGENDS & PERCENTAGEOF QUESTIONS IN EXAMINATIONS:
L1 (Remembering) = 30- 40%, L2 (Understanding)= 30 - 40%, L3 (Applying) = 10- 20 %, L4 (Analysing) = 10 - 20%, Easy (%) = 15%-20%, Average (%)= 60% - 70%, Difficult (%)= 15% - 20% TOTAL = L1 + L2 + L3 + L4 = 100%(on an average about 2minutes per mark)
Note: This specification weightage in above shall be treated as a general guideline for students, teachers and paper setters. The actual distribution of marks in the question paper may vary slightly.

DETAILED SYLLABUS:
UNIT-1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education
INTRODUCTION TO OPERATIONS RESEARCH: History, definition, operations research models, phases of implementing operations research in practice, applications.
LINEAR PROGRAMMING: Introduction, formulation, graphical solution, simplex method, Big M and two-phase methods, duality principle.

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself!
TRANSPORTATION: Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method.
ASSIGNMENT: One to one assignment problem, optimal solutions, unbalanced assignment matrix, travelling salesman problem, maximization in A.P.

UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human Relationship
QUEUING THEORY: Introduction, Kendall's notation, classification of queuing models, single server and multi-server models, Poisson arrival, exponential service, infinite population.
SEQUENCING: Introduction, assumptions, processing n-jobs through two machines, n-jobs through three machines, and graphic solution for processing 2 jobs through n machines with different order of sequence.

UNIT-IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
GAME THEORY: Introduction, game with pure strategies, game with mixed strategies, dominance principle, graphical method for 2xn and mx2 games. **REPLACEMENT THEORY:** Introduction, replacement of items that deteriorate with time - value of money unchanging and changing, simple probabilistic model for replacement of items that fail completely.

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics
NETWORK ANALYSIS: Project planning, scheduling, and controlling – tools for project management – critical path method – Programme evaluation and review technique (PERT) – cost analysis and crashing – resource levelling – updating.

TEXTBOOKS:

1.Operations Research, by S.D. Sharma, Kedarnath & Ramnath publications (15th edition),2013.

2.Introduction to Operations Research, by Taha, Pearson Education, New Delhi, (8th edition), 2008.

REFERENCEBOOKS:

1. Operations Research, (4th edition) by A.M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education, New Delhi, 2009.
2. Operations Research, (2nd edition) by R. Panner Selvam, 2009, PHI Publications, Noida.
3. Operations Research, (2nd edition) by Wagner, 2007, PHI Publications, Noida
4. Operation Research, (4th edition) by J.K. Sharma, 2009, Macmillan publishers, India Ltd. New Delhi.

MICRO-SYLLABUS:

Unit	Module	Micro content
1	**Introduction to**	History and Definition.
		operations research models
		phases of implementing operations research in

Unit	Module	Microcontent
	Operations Research	practice
		Applications of Operations research
	Linear Programming	Introduction, formulation
		graphical solution
		simplex method,
		Big M
		two-phase methods
		duality principle
		Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
		Programs to ensure Sanyam and Health.

Unit	Module	Microcontent
2	**Transportation**	Introduction to the problem
		LP formulation of a transportation problem.
		Basic feasible solution by north-west corner method
		Basic feasible solution by Vogel's approximation method
		Basic feasible solution by least cost method.
	Assignment	One to one assignment problem,
		optimal solutions
		unbalanced assignment matrix
		travelling salesman problem
		maximization in A.P.

Unit	Module	Microcontent
3	**Queuing Theory**	Introduction
		Kendall's notation
		classification of queuing models
		single server and multi-server models
		Poisson arrival
		exponential service
		infinite population
	Sequencing	Introduction, assumptions
		Processing n-jobs through two machines
		Processing n-jobs through three machines
		graphic solution for processing 2 jobs through n machines with different order of sequence

Unit	Module	Microcontent
4	**Game Theory**	Introduction
		game with pure strategies
		game with mixed strategies
		dominance principle
		graphical method for 2xn games
		graphical method for mx2 games
	Replacement Theory	Introduction
		replacement of items that deteriorate with time - value of money unchanging

Unit	Module	Microcontent
		replacement of items that deteriorate with time - value of money changing
		simple probabilistic model for replacement of items that fail completely
Unit	**Module**	**Microcontent**
5	**Network Analysis**	Project planning
		scheduling and controlling
		tools for project management
		critical path method
		Programme evaluation and review technique (PERT)
		cost analysis and crashing
		resource leveling and updating