4IT54 : MODELING SIMULATION AND OPERATION RESEARCH
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To provide knowledge of different operational research and modeling methods to optimize engineering problems' solutions.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** OR Methodology, Definition of OR, Application of OR to Engineering and Managerial problems, Features of OR models, Limitations of OR.	2
2	**Linear Programming:** Definition, Mathematical formulation, Standard form, Solution space, Types of solution – Feasible, Basic feasible, Degenerate, Solution through Graphical Method, Simplex Method, Artificial Variable Method, Two Phase Method, Big-M Method, Applications, Duality, Dual Simplex Method, Introduction to sensitivity analysis.	6
3	**Transportation Problem:** Mathematical Formulation of Transportation Model, Basic Feasible Solution using North-West corner, Least Cost, Vogel's Approximation Method, Optimality Methods: MODI Method, Stepping Stone Method, Unbalanced Transportation Problem, Degeneracy in Transportation Problems, Variants in Transportation Problems.	6
4	**Assignment Problem:** Formulation of the Assignment problem, solution method of assignment problem-Hungarian Method, Variants in assignment problem.	5
5	**Network Analysis:** Network Definition, Minimal spanning tree problem, Shortest route problem, Maximal flow problem concepts and solution algorithm as applied to problems. Project planning and control by CPM network, Probability assessment in PERT network.	6

Unit No.	Topics	Teaching Hours
6	**Queuing Models:** Concepts relating to queuing systems, Types of queuing system: Use of six character code, Basic elements of Queuing Model, Role of Poisson & Exponential Distribution, Concepts of Birth and Death process, Steady state measures of performance, M/M/1 model with and without limitation of q-size M/G/1, single channel with poisson arrival rate and general service time.	8
7	**Computer Modeling & Simulation:** Distribution functions, Random number generation, Selection of input probability distribution, Design of simulation models experimental design, Output analysis variance reduction techniques, Introduction to simulation languages programming tools for developing simulation models.	7
8	**Replacement And Maintenance Models:** Introduction, Types of failure, Replacement of items whose efficiency deteriorates with time, Replacement of items that completely fail, Other replacement problems.	5
	Total	**45**

List of References:

1. J. K. Sharma, *"Operations Research: Theory and Application",* 5thEdition, Macmillan Publishers.
2. Hamdy A Taha, *"Operations Research: An Introduction",* 8th Edition, Pearson Publications.
3. N. D. Vora, *"Quantitative Techniques in management",* 3rdEdition, Tata McGraw Hill.
4. H. M. Wagner, *"Principles of Operations Research: With Applications to Management Decisions",* Prentice-Hall of India, New Delhi, 1982.
5. Hillier, F.S. and Lieberman, G.J., *"Operations Research",* Holden Day Inc., San Francisco, 1974.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Identify and apply different operational research methods for engineering problems.
2. Understand the characteristics of the operational research methods to correctly interpret the results.
3. Design solution for linear programming problems.
4. Evaluate transportation, assignment and network problem for solving industrial and social applications.
5. Identify queuing problem and design the model of the system using simulation.
6. Resolve replacement problem with resource smoothing.