

Year & Sem	Course Code: CE4511	Course Name: <b>Water Resource Systems</b>	No. of Credits: 4	L	T&PS	P
				2	2	0

Unit-I: **Introduction and Basic Concepts** : Introduction, System Components, Planning and management ,Concept of a system, Advantages and limitations of systems approach, Modeling of Water Resources Systems , Simulation and optimization, Economics in water resources, Challenges in water sector

Unit-II: **Introduction to Optimization** : Objective function, Maxima, minima and saddle points, convex and concave functions, Constrained and unconstrained optimization using calculus, Lagrange multipliers, Kuhn-Tucker conditions

Unit-III:**Linear Programming and Applications** : General form of LP, Standard and Canonical forms of LP, Elementary transformations, Graphical method, Feasible and infeasible solutions, Simplex method, Dual and sensitivity analysis, LP problem formulation, Reservoir sizing and Reservoir operation using LP

Unit-IV:**Dynamic Programming and Applications** : Introduction, multistage decision problem, Recursive Equations, Principle of optimality, Discrete DP, Curse of Dimensionality, Water allocation problem , Capacity expansion problem, Reservoir operation, Multipurpose reservoir operation.

Unit-V:**Multi-objective Optimization** :Introduction, Non-inferior solutions, Trade-off analysis, Pareto optimal solutions , Multipurpose reservoir operation , Weighted and constraint methods, Other methods.

Unit-VI:**Stochastic Optimization: Review** of probability theory, Uncertainty and reliability analysis, Chance constrained LP (CCLP), CCLP for reservoir operation, Stochastic DP with applications to reservoir operation.

Unit-VII :**Simulation** : Introduction, River basin simulation, Reservoir operation simulation, Performance evaluation - Reliability, Resiliency and Vulnerability, Some simulation models.

Unit-VIII:**Water Resources Systems Modeling**: River basin planning and management, Water distribution systems, Groundwater systems, Water quality modeling, Floodplain management, Urban storm water management.

**References/Text Books:** Loucks D.P, Stedinger J.R and Haith D.A, 'Water Resources Systems Planning and Analysis', Prentice Hall, USA, 1981.

1. Mays L.W and Tung Y-K, 'Hydrosystems Engineering and Management', McGraw Hill, USA, 1992.
2. Vedula S. and Mujumdar P.P., 'Water Resources Systems: Modelling Techniques and Analysis', Tata-McGraw Hill, 2005.
3. Jain S.K. and Singh V.P., 'Water Resources Systems Planning and Management', Elsevier, The Netherlands, 2003.
4. Loucks D.P. and van Beek E., 'Water Resources Systems Planning and Management', UNESCO Publishing, The Netherlands, 2005.

**Lecture Plan:** Unit-I & Unit-II & Unit-III syllabus for MID-I, Unit-IV & Unit-V and Unit-VI syllabus for MID-II and Unit-VI & Unit-VII syllabus for MID-III examinations.