Water Resources Systems Planning and Management - Web course

COURSE OUTLINE

Introduction, System Components, Planning and management, Economics in water resources, Modeling of water resources systems, Constrained and unconstrained optimization, Linear programming with applications to reservoir sizing, reservoir operation, Dynamic programming with applications to water allocation, capacity expansion, reservoir operation;

Multi - objective optimization, Review of probability theory, Uncertainty and reliability analysis, Stochastic optimization - Chance constrained LP, Stochastic DP with applications, Surface water quality control;

Simulation - Reliability, Resiliency and Vulnerability of water resource systems, Multipurpose reservoir operation for hydropower, flood control and irrigation, Groundwater Systems, Water quality modeling, River basin Planning and management, Advanced topics.

COURSE DETAIL

Module	Sub-Module	Hours for Sub-Module	Total Hours
1. Introduction and Basic Concepts	Introduction, System Components, Planning and management	1	3
	Concept of a system, Advantages and limitations of systems approach, Modeling of Water Resources Systems	1	
	Simulation and optimization, Economics in water resources, Challenges in water sector	1	
2. Introduction to Optimization	Objective function, Maxima, minima and saddle points, convex and concave functions	1	3
	Constrained and unconstrained optimization using calculus	1	
	Lagrange multipliers, Kuhn-	1	

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Civil Engineering

Additional Reading:

1. Chaturvedi, M.C., 'Water Resources Systems Planning and Management', Tata McGraw - Hill, India, 1992.

Hyperlinks:

1. http://civil.iisc.ernet.in/~nagesh/stwree.htm

Coordinators:

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	Tucker conditions.	1	
3. Linear Programming and Applications	General form of LP, Standard and Canonical forms of LP, Elementary transformations	1	6
	Graphical method, Feasible and infeasible solutions	1	
	Simplex method, Dual and sensitivity analysis	2	
	LP problem formulation, Reservoir sizing and Reservoir operation using LP	2	
4. Dynamic Programming and Applications	Introduction, multistage decision problem, Recursive Equations, Principle of optimality, Discrete DP, Curse of Dimensionality	1	5
	Water allocation problem	2	
	Capacity expansion problem	1	
	Reservoir operation	1	
	Multipurpose reservoir operation	1	
5. Multi-objective Optimization	Introduction, Non-inferior solutions, Trade-off analysis, Pareto optimal solutions	1	3
	Multipurpose reservoir operation	1	
	Weighted and constraint methods, Other methods.	1	
6. Stochastic Optimization	Review of probability theory	1	6
	Uncertainty and reliability analysis	1	
	Chance constrained LP (CCLP), CCLP for reservoir operation	2	

	Stochastic DP with applications to reservoir operation	2	
7. Simulation	Introduction, River basin simulation	1	3
	Reservoir operation simulation	1	
	Performance evaluation - Reliability, Resiliency and Vulnerability, Some simulation models	1	
8. Water Resources Systems Modeling	River basin planning and management	1	6
	Water distribution systems	1	
	Groundwater systems	1	
	Water quality modeling	1	
	Floodplain management	1	
	Urban storm water management	1	
9. Advanced Topics	Fuzzy optimization	1	5
	Genetic algorithms	1	
	Multi criteria decision making	1	
	Decision Support Systems	1	
	Expert Systems	1	
		Total:	40

References:

1. Loucks D.P, Stedinger J.R and Haith D.A, ‘Water Resources Systems Planning and Analysis’, Prentice Hall, USA, 1981.

2. Mays L.W and Tung Y-K, ‘Hydrosystems Engineering and Management’, McGraw Hill, USA, 1992.

3. Vedula S. and Mujumdar P.P., ‘Water Resources Systems: Modelling Techniques and Analysis’, Tata-McGraw Hill, 2005.

4. Jain S.K. and Singh V.P., ‘Water Resources Systems Planning and Management’, Elsevier, The Netherlands, 2003.

5. Loucks D.P. and van Beek E., ‘Water Resources Systems Planning and Management’, UNESCO Publishing, The Netherlands, 2005.