Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course number: CE 7XX

2. Course title: Water resources systems analysis

3. Per week: Lectures – 3(L), Tutorial – 0(T), Laboratory – 0(P), Additional hours: 0(A)

Credits: 3-0-0-0 (9)

Duration of course: Full semester

4. Proposing department/IDP: Civil Engineering

Other Departments/IDPs which may be interested in the proposed course: Earth Sciences, School of Sustainability

Other faculty members interested in teaching the proposed course: Shivam Tripathi

5. Proposing instructor: Tushar Apurv

6. Course description: PG course/department elective

A. Objectives

The course introduces optimization and simulation techniques that are used in planning and management of water resources systems. The course will include application of these techniques to problems such as reservoir design and operations, river basin management, water allocation to multiple sectors, decision making under uncertainty and multi-criteria decision making.

B. Contents

S. No.	Broad title	Topics	No. of lectures
1.	Introduction	Overview of water resources systems analysis and its applications	1
2.	Optimization	Optimization techniques in problems of Hydrology and Water Resources	15
3.	Simulation	Stochastic streamflow generation models, simulation-based optimization using genetic and evolutionary algorithms	9
4.	Reservoir design and operation	Reservoir capacity design, rule curves, optimization of reservoir release, hedging rules	5
5.	River basin management models	Setting up a river basin model: representation of river networks, surface and groundwater storages, water users, specification of objective functions and constraints	5
6.	Decision making under uncertainty	Scenario generation for climate change impact assessment, performance metrics for water resources systems, multi-criteria decision analysis	5
Total			**40**

C. Pre-requisites: (CE361 and CE262) or (CE610 and CE611)

D. Short summary for including in the Courses of Study Booklet: Linear programming, non-linear optimization, constrained optimization, stochastic optimization, dynamic optimization, multi-objective optimization, genetic and evolutionary algorithms, stochastic streamflow generation, reservoir design and operation, river basin management models, decision making under uncertainty, scenario generation for climate change impact assessment.

7. Recommended books:

Reference books:

Loucks, D. P., & Van Beek, E. (2017). Water resource systems planning and management: An introduction to methods, models, and applications. Springer.

Deb, K. (2012). Optimization for engineering design: Algorithms and examples. PHI Learning Pvt. Ltd.

8. Any other remarks: none

Proposer: Tushar Apurv
Dated: 05-04-2024

DPGC convener:
Dated:

The course is approved/not approved.
Chairperson, SPGC
Dated: