# ENVIRONMENTAL MODELING AND SIMULATION

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IIT Roorkee

**PRE-REQUISITES :** Basic UG 1st year mathematics course covering calculus

**INTENDED AUDIENCE :** Final year UG students, first year PG students, and first year doctoral students in the Department of Civil Engineering and Department of Chemical Engineering

**INDUSTRY SUPPORT :** Envitrans; Enviro Care and Systems; Delta T Devices Ltd.; Itasca International Inc.; Aquatic Informatics Inc.; International Environmental Modeling and Software Society; CivilGeo Inc..

## COURSE OUTLINE :

Environmental Modeling and Simulation covers a variety of traditional models used by environmental engineers and scientists and then builds a foundation in nonlinear modeling to build new models and improve existing environmental models. Simulation methodologies including Monte Carlo simulation would be demonstrated on MATLAB and Octave.

## ABOUT INSTRUCTOR :

Prof. Gargi Singh is currently working at the interface of microbiology and environmental engineering at IIT Roorkee to address environmental challenges of pathogen ingress in water distribution network and environmental proliferation of antibiotic resistance. In her doctoral research, she applied molecular biology tools including quantitative polymerase chain reaction, isolation, selection, high-throughput sequencing on pyrosequencing and Illumina based platforms, and metagenomics to investigate biodegradation of petroleum and nanocellulose, and sequestration of heavy metals. She is also faculty member of Centre of Nanotechnology at IIT Roorkee, where she is currently teaching environmental statistics and environmental implications of nanotechnology.

## COURSE PLAN :

1. Introduction to modeling and simulation, develqpment process and applications;
2. Model classification and evaluation; Basics of EnvironmentalSystem Desion;
3. Introduct on to Software Packages
4. Lumped and distributed parameter models, solution methods using MATLAB;
5. Simulation methodologies, continuous, discrete.Monte - Garlo,agent-based models
6. Game theory,system dynamics
7. Design of experiments. Reactor Modeling, kinetics,parameter estimation,RTO studies and flow reaimes
8. ID models. geometrical approach, Introduct on to nonlinear dvnamics
9. 2D models, bifurcations, sensitivity analysis. Lotka Volterra Models,outbreak models
10. Microbial dynamics.mixinginlakes, river self- purification.dynamics of DO,BOD and nutrients
11. Modeling transport phenomena. atmospheric and porous media transport and transformation of oollutants
12. Environmentalrisk management,health r sk assessment, Uncertaintv
13. Cluster analysis. ecological modeling, classification of ecolog ical data. stability of complex ecosvstems