



COURSE: WATER QUALITY MODELLING

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website:

Language: Italian

ECTS: 6

n. of hours: 54

Academic year: 2014/15

Campus: Potenza

Semester: First

TOPICS

The course is oriented to the description and understanding of the dynamics of transport, diffusion, and extinction of pollutants in surface water bodies, deepening the theoretical knowledge regarding the environmental modelling. The course will also provide the basis for the understanding of the operation and use of the main software for the simulation of surface water quality and for the formation of pollutant loads at the watershed scale. During the course, simulation models of water quality will be developed in Simulink (Matlab).

TEACHING METHODS (please tick one or more options)

Theoretical lessons

Tutorials in classroom

Tutorials in laboratory

Project works

Technical visits

Other activities (please specify) _____

TEXTBOOKS

Steven C. Chapra, Surface Water-Quality Modeling, McGraw-Hill, 1996.

Lecture notes and material provided by the lecturer

ON-LINE EDUCATIONAL MATERIAL

web address: The material is loaded into a folder that is shared with the students through a sharing platform (eg. Dropbox)

LEARNING OUTCOMES

The course aims to provide knowledge about the dynamics of transport, diffusion, and extinction of pollutants in surface water bodies, deepening the theoretical knowledge regarding the environmental modelling. The aim of the course is also to enable students to understand the operation and use of the main software for the simulation of surface water quality and the formation of pollutant loads at the watershed scale. Students will be able, finally, to build simulation models of water quality in the Simulink (Matlab) environment.

REQUIREMENTS

None

EVALUATION METHODS (please tick one or more options)

Intermediate verifications

Written examination

Discussion of a project work

Practical test

Oral examination

Other methods (please specify) _____

DETAILED CONTENT

Fundamental criteria for the construction and use of simulation models: purpose of the models; components involved; static and dynamic balances; classification of surface water quality models; introduction to uncertainty analysis, Monte Carlo methods and sensitivity analysis; calibration; structure of river water quality models; extended transport equations; hydrodynamic model; transport equation, sub-model of conversion. Characterization parameters and pollution phenomena of natural water: definitions and processes of self purification. Biochemical principles for the removal of pollutants from aquatic systems. Carbon cycle. Nitrogen cycle. Kinetics of reactions: reversible and irreversible reactions, homogeneous and heterogeneous reactions; order of reactions. Ideal and real reactors: model of the batch reactor, model of the continuous flow stirred tank reactor (CFSTR); model of the plug



flow reactor (PFR); general mass balance equation; analysis of the response of reactors to impulse signals and step signals; comparison between CFSTR and PFR reactors. Completely mixed systems: mass balances, steady-state and unsteady-state solutions and response times, feedforward and feedback systems of reactors. Not completely mixed systems: fundamental laws and methods of resolution. Computational tools for solving systems of differential equations: methods of Euler, Heun and Runge-Kutta. Characterization of river systems. Analysis and implementation of the main literature models. Application to some environmental phenomena: eutrophication, thermal stratification, growth and bacterial decay, degradation of carbonaceous substrate, nitrogen and phosphorus. Calibration of the parameters of environmental systems. Parametric sensitivity analysis. Construction of river water quality models, which are related to case studies, in Simulink (Matlab). Analysis and application of widespread softwares (QUAL2K), also with reference to real cases. Artificial intelligence techniques: fuzzy logic and neural networks and application to case studies.

SEMINARS BY EXTERNAL EXPERTS YES NO

FURTHER INFORMATION
