UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Groundwater Pollution and Remediation

2122-2-F7501Q086

Aims

- achieve the knowledge of chemical and physical characteristics of the contaminants, such as of miscible and non-miscible contaminants, to comprehend contaminants behavior in groundwater;

- ability to distinguish between anthropogenic pollution and natural contamination;

- capability in solving simple problems related to the transport of contaminants, including advection, dispersion, delay and degradation;

- achieve the knowledge of the main investigations techniques to acquire hydrogeological and hydrochemical parameters;

- agility in reading a conceptual model from the collected data

- achieve the knowledge of the main groundwater remediation techniques and of their implementation in different sityations.

Contents

Contaminants and their propagation in groundwater;

Survey methods to define the polluted area characterization;

Techniques to cleaning up aquifers ad to evaluate the results of the remediation,

Resolution of groundwater pollution cases.

Detailed program

Anthropogenic pollution and natural contamination;

Pollutants and sources of pollution: characteristics, frequency, and distribution;

Chemical physical characteristics of contaminants;

Transport phenomena: advection, dispersion, adsorption, delay, degradation;

Mass conservation principle and transport equation;

Analytical transport solution of the transport equation, simple case of a continuous source;

Movement of NAPL (non-aqueous liquid phase), light and heavy (LNAPL and DNAPL); basic concepts of capillarity and wettability, permeability and relative permeability

Site characterization, investigations, and construction of a conceptual model;

Legislation: theoretical outline related with groundwater remediation and risk analysis;

Main remediation techniques, influencing physicochemical factors, feasibility, remediation time prediction, monitoring, data interpretation, achievement of the remediation objectives (hydraulic barrier, air sparging and soil venting, permeable reactive barrier, LNAPL and DNAPL removal, short references to other techniques).

Prerequisites

Basic knowledge of hydrogeology

Teaching form

Lessons

Textbook and teaching resource

The teaching (slides, exercises, schematics), which will published on the e-learning site:

Suggested texts for detailed study :

https://elearning.unimib.it/enrol/index.php?id=37830

Francani V., 2014. Idrogeologia. C.E.A. Casa Editrice Ambrosiana

Di Moffetta, Sethi, 2012. Ingegneria degli Acquiferi. Springler.

Fetter C.W., 1993. Contaminant Hydrogeology, New York, Macmillan.

Semester

First Semester

Assessment method

A written and an oral examination are planned.

The written examination consists of: 1) a question, in order to evaluate the comprehension of the principle theoretical concepts. 2) a problem to solve through an ordered sequence of exercises and to discuss, in order to evaluate the skill in solving a contamination problem.

The oral exam consists of: - a discussion on topics concerning site characterization and remediation techniques, in order to evaluate personal knowledge and application of the methods of investigation and remediation.

The written test provides a total score of 25/30.

The oral exam give the possibility to increase the score of the writing test up to 7/30.

Office hours

On informatic platform by appointment with the teacher by email