UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Inquinamento e Bonifica delle Acque Sotterranee

2021-2-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 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 (e.g. physical barriers, reactive zones).

Prerequisites

Basic knowledge of hydrogeology

Teaching form

During the Covid emergency period lessons (4 cfu, 32 ore) and exercises (cfu, 20 ore), will take place in synchronous modality and video-recorded lessons.

The asynchronous modality will be used to fill up any misunderstanding emerged from periodic tests.

Six hours of exercise in January will be carried out in the presence modality, in alternating shift.

Textbook and teaching resource

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

https://elearning.unimib.it/course/view.php?id=30932

Suggested texts for possible personal detailed study :

Francani V., 2014. Hydrogeology. C. E. A. Publishing House Ambrosiana

Di Moffetta, Sethi, 2012. Aquifer Engineering. Springler.

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

Semester

First Semester

Assessment method

During the Covid emergency period written and oral exam lessons will take place by mean of Webex informatics platform.

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. On the e-learning platform of the course a link will be published to allow virtual audience to participate.

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

The oral exam can increase or decrease the score of the writing test up to 7/30.

Office hours

On informatic platform by appointment with the teacher by email