UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Fundamentals of Hydrogeology

2526-1-F7402Q005-F7402Q00501

Aims

To provide advanced knowledge and modelling techniques for: the identification and characterization of aquifers in consolidated and unconsolidated materials, the laws that govern groundwater flow, the relationships between superficial water and groundwater, the design and construction of water wells and spring water collection, characterization of water wells and aquifers by pumping tests in steady and transient conditions. The second part of the course will provide knowledge to solve problems of well and spring protection, contaminant migration and solute transport; natural attenuation, design of sampling campaigns, groundwater remediation.

Contents

Students will learn basic knowledge on hydrogeology, applied and contaminant hydrogeology, treatment of contaminated sites

Detailed program

Fundamentals of hydrogeology

Hydrologic cycle and water circulation in different geological systems. Hydrogeological balance: rainfall, temperature, real and potential evapotraspiration. Porosity definitions and use. Fluid flow in saturated and unsaturated soil, porous rocks or jointed rocks. Reconstruction and interpretation of piezometric surfaces and flow nets. Classification and analysis of springs, spring discharge regime, evaluation of spring discharge dynamics using recession curves, Hydrochemistry: physical chemical properties of groundwaters, TDS, dissolved elements their origin and their effects, data representation, plotting and analysis. . Well design and installation, drilling and construction techniques, purging, maintenance, materials. Monitoring and interpretation of well hydraulic testing

and pumping tests under steady state and transient conditions. Well sampling techniques and problmes, methods and materials, sampling campaigns. Applying site characterization to model development.

Applied hydrogeology

Solute transport and contaminant migration in saturated and unsaturated soils. Tracer tests and characterization of dipersivity. Multi-fluid processes. NAPLs, physical chemical characteristics and transport in the vadose and saturated zones. Primary or direct and secondary contamination processes. Interaction between soil matrix and solutes. Transformation, attenuation and decay processes of solutes. Biodegradation: theory, in situ estimation, and modelling. Organic and inorganic compounds in subsurface water. Treatments at contaminated sites and groundwater remediation methods and techniques.

Risk analysis for soil and water contamination. Reference legislation: regional, national and european laws for superficial and subsurface water.

Lab exercises: Flow net construction, simple solution of water flow in porous media, interpretation of well tests.

Design of a reclamation scheme for different contaminated sites.

Prerequisites

A base-level knowledge in engineering geology, site investigation, physics and mathematics is required

Teaching form

- Lessons

- Laboratory experiences and problem solving

Textbook and teaching resource

All the lectures are downloadable form the elearning website

Semester

1st and second semenster

Assessment method

Oral

Office hours

Sustainable Development Goals

CLEAN WATER AND SANITATION | RESPONSIBLE CONSUMPTION AND PRODUCTION | CLIMATE ACTION | LIFE ON LAND