

# UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA

### **COURSE SYLLABUS**

## **Fundamentals of Hydrogeology**

2324-1-F7401Q094

#### Aims

Provide skills about: the characteristics of soils and rocks that control subsurface water storage and circulation; estimation of groundwater reserves and renewable water resource; surface and deep water relationships; data acquisition and monitoring techniques; groundwater hydrochemistry; characterization and analysis of the source regime; construction of intake and catchment works; characterization of aquifers with flow tests for the determination of aquifer hydraulic parameters. Ensure learning with exercises for the purpose of applying analytical and/or numerical solutions for the analysis of tests and estimation of parameters of porous media, including for complex boundary conditions.

#### **Contents**

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

Hydrogeologic Concepts:

Groundwater flow principles
Aquifer characterization and classification

Darcy's Law and groundwater flow equations
Transient and steady-state flow
Groundwater recharge and discharge
Groundwater-surface water interactions
Aquifer Testing and Analysis:

Pumping tests (e.g., slug tests, constant-rate tests)
Analysis of aquifer properties (e.g., hydraulic conductivity, specific yield)
Aquifer test design and interpretation
Well hydraulics and well efficiency

#### **Detailed program**

Fundamentals of hydrogeology

Basic Hydrogeologic concepts:

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.

Aquifer testing 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.

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.

#### **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**