Course Name:
Applied Ground-Water Flow Modelling

Course Number:
-

Credit:
3

Course Content (outline):

- Introduction
    - The purpose of modelling
    - The proper use of models
    - Constructing a Numerical Model
    - Numerical methods for groundwater models
- Governing Equations
    - Darcy's Eq.
    - General GW continuity Eq.
    - Transport Eq.
- The Finite Difference Method
    - Approximation of the derivative
    - Solution of the Flow Eq.
    - Transient Flow
    - The Alternating direction technique
    - Block-Centered finite differences
    - Stability
- The Finite Element Method
    - Basic Principles
    - Galerkin Method
    - Solution of the Flow Eq.
    - Anisotropy and Heterogeneity
    - Comparison with finite difference method
    - Confined/Unconfined aquifers
- Solution of the transport Eq.
    - Advection processes
    - Diffusion and dispersion processes
    - Mass transport equation,
    - FDM and FEM for Solution of the transport Eq.
    - Numerical dispersion
    - Particle tracking methods
- Model Applications
    - Model application process
    - Defining Goals
    - Building a flow and contaminant transport model
    - Model input parameters

- Model Calibration and Sensitivity Analysis
    - Basic concepts of model calibration
    - Assessment of model calibration
    - Calibration by trial and error
    - Automated calibration
    - Sensitivity analysis
- Dealing with uncertainty
    - Types and sources of uncertainty
    - Methods of evaluating uncertainty
    - Managing uncertainty
- Case studies

References:

- "Applied Groundwater Modeling: Simulation of Flow and Advective Transport", M. Anderson et al., 2nd Ed., 2015.
- "Groundwater Contamination", P.B. Bedient et al., 1999.
- "Applied Hydrogeology", C.W. Fetter, 1988.
- "Contaminant Hydrogeology", C.W. Fetter, 1993.
- "Modeling Groundwater Flow and Contaminant Transport", J. Bear & H. D. Ch. Alexander, 2010.
- "Groundwater hydrology", D.K. Todd, 1980.