20-GI03 Course description	
Name of the course	***Mathematical modelling of contaminant transport in groundwater systems (5 ECTS)*** ***- teachers: Posavec, K.; Nakić, Z.***
Main goals	- present transport processes of contaminants in nature, - present characteristics of advective-dispersive transport and transport with geochemical reactions with emphasis on linear and nonlinear sorption processes, - process parameters of advection-dispersion equation including geochemical reactions, - define mathematical models i.e. governing transport equations with initial and boundary conditions, - define analytical and/or numerical methods for mathematical models solution, - present model calibration, verification and sensitivity analysis.
Expected learning outcomes (level 8.2)	Upon completion of the learning process the doctoral candidate will be able to: (5 ECTS) - formulate processes of contaminant transport in nature *(1 ECTS)* – Z. Nakić, - connect transport processes with parameters of advection-dispersion equation including geochemical reactions *(1 ECTS)* – Z. Nakić, - form mathematical models with initial and boundary conditions for specific hydrogeological problems *(1 ECTS)* – Z. Nakić i K. Posavec, - suggest analytical or numerical methods for solution of mathematical models *(1 ECTS)* – K. Posavec, - design transport models *(1 ECTS)* – K. Posavec.
Outlines /module content	A framework for application of groundwater contaminant transport models. Theoretical foundations of contaminant transport processes. Goals of contaminant transport modelling. Conceptual models. Examples of application of stratigraphic modelling and 2D and 3D geostatistical methods in building conceptual models. Advective-dispersive transport in groundwater. Geochemical reactions in groundwater. Model input parameters: flow parameters, transport parameters, chemical parameters. Mathematical models of contaminant transport in groundwater: governing equations, initial and boundary conditions. Analytical and numerical solutions of mathematical models. Spatial and temporal discretization in contaminant transport models. Calibration, verification and validation of contaminant transport models. Sensitivity analysis. Types and sources of uncertainty in contaminant transport simulations.
Teaching methods	Teaching will be conducted through lectures (2 ECTS), computer exercises (1 ECTS) and student project (2 ECTS)
Evaluation procedure	1. Student project: Development of conceptual and mathematical contaminant transport model for specific example and presentation of solution with application of analytical and/or numerical methods. 2. Oral exam