



1. GENERAL INFORMATION					
Study programme title	University graduate study programme in geological engineering Subprogramme Environmental Geology				
Course title	Environmental monitoring		Semester	II.	
Teacher	Assist. Prof. Stanko Ružičić, PhD		Course code	27259	
Course type	<input checked="" type="checkbox"/> obligatory <input type="checkbox"/> elective		ECTS	6	
Location	Faculty of Mining, Geology and Petroleum Engineering, Pierottijeva 6, Zagreb				
Language	<input type="checkbox"/> Croatian <input checked="" type="checkbox"/> English				
Class type	Weekly hours	Teaching staff	Office hours	Room	E-mail
Class	2	Assis. Prof. Stanko Ružičić, PhD	Monday 8-10 p.m.	P6 316	stanko.ruzicic@rgn.hr
Practice	2	Michaela Hruškova, PhD	Monday 10-12 p.m.	P6 303	michaela.hruskova@rgn.hr
Field lecture					
E-learning level	2		Percentage of on-line class (max. 20%)	15%	
2. COURSE DESCRIPTION					
Course aims	<p>Major goals of this course are:</p> <ul style="list-style-type: none"> - to teach students about various methods of monitoring (field sampling and laboratory analyses; data acquisition system) chemical and physical parameters of soil/sediment, water and air; - define various chemical and physical contaminants; - create model of water flow and solute transport of contaminants through unsaturated zone. 				
Requirements for applicants	No requirements.				
Programme level learning outcomes with course contribution	-				
Expected course level learning outcomes (4-10 outcomes)	<p>Students will be able to:</p> <ul style="list-style-type: none"> - calculate hydraulic parameters of unsaturated zone; - create model of water flow and solute transport in unsaturated zone; 				



	<ul style="list-style-type: none"> - point out places with higher concentrations of specific contaminants on maps with sources of contamination; - create conceptual model for water modelling and solute transport with available data; - sample soil and water for laboratory analyses on specific site.
Course contents by individual lessons	
Class	Practice
P1 – INTRODUCTION TO ENVIRONMENTAL MONITORING	V1 - Data quality in environmental monitoring
P2 - SOIL PHYSICAL PARAMETRES	V2 – Determination of soil density and texture – sieving methods
P3 - SOIL CHEMICAL PARAMETRES	V3 - Determination of soil texture- aerometer
P4 - SOIL AND UNSATURATED ZONE MONITORING	V4 – Representation of soil monitoring equipment on the field
P5 - STATISTICAL METHODS IN ENVIRONMENTAL MONITORING	V5 – Calculation methods
P6 - PHYSICAL AND CHEMICAL CONTAMINANTS	V6 – Representation of tracing experiment in laboratory
P7 - HYDRUS 1D MODEL IN ENVIRONMENT	V7 – Calculation of specific problem using Hydrus 1D
P8 - HYDRUS 1D MODEL IN ENVIRONMENT	V8 - Calculation of specific problem using Hydrus 1D
P9 –SAMPLING METHODS FOR VARIOUS ANALYSES	V9 - Representation of sample methods on the field
P10 – PRESENTATION OF CROATIAN AGENCY FOR ENVIRONMENT AND NATURE	V10 – Browsing Croatian agency for environment and nature data base
P11 - CENTRAL WASTEWATER TREATMENT PLANT ZAGREB	V11 – Visitation of Central wastewater treatment plant Zagreb
P12 - GROUNDWATER MONITORING	V12 - Visitation of well field at Zagreb aquifer system
P13 - SURFACE WATER MONITORING	V13 - Water sampling on Bundek lake
P14 - AIR MONITORING	V14 - Visitation of Croatian Meteorological and Hydrological Service laboratory for air quality
P15 - SOIL REMEDIATION	V15 – Presentation of different examples of soil remediation in the world



Students' obligations	Regular presence at the class (maximum absence 3 + 1). Laboratory exercises accepted by teacher. Model in Hydrus 1D accepted by teacher.			
Students' work track <i>(indicate share in ECTS points for each activity so that overall ECTS number corresponds to class credits score):</i>	Class attendance	2	Research	-
	Project	-	Report	-
	Colloquium	2	Seminar paper	-
	Practical work	2	Oral exam	-
	Written exam	-	(Extra)	-
Type of exam, grades and evaluation of students work during class and on final exam	Regular presence at the class (maximum absence 3 + 1). Laboratory exercises accepted by teacher. Model in Hydrus 1D accepted by teacher. 2 colloquiums (max. 60 points); Hydrus model problem (max. 10 points); laboratory exercises (max. 30 points).			
Mandatory literature (available in the Library and via other media)	Teaching materials are available on Merlin site.			
Additional literature (at the moment of study program proposition application)	<p>Books:</p> <p>Environmental Monitoring and Characterization Artiola, J.F., Pepper, I.L., Brusseau, M.L. (2004), Elsevier, 410 str.</p> <p>Environmental Geology Knödel, K., Lange, G., Voigt, H.J. (2007), Springer, 1357 str.</p> <p>Soil Physics with Hydrus-Modeling and Applications Radcliffe, D. E. and Šimunek, J. (2010), CRC Press, 373 str.</p> <p>Journals:</p> <p>Environmental Geology; Science of the Total Environment; Applied Geochemistry; Journal of Geochemical Exploration; Journal of soil and sediments</p>			
Examination terms	According to the agreement with the students.			
Other				

Course Teacher:

Assist. Prof. Stanko Ružičić, PhD