

1. GENERAL INFORMATION						
<b>Study programme title</b>	Graduate study in Engineering geology-hydrogeology and engineering geology					
<b>Course title</b>	Borehole and water well construction			<b>Semester</b>	3.	
<b>Teacher</b>	Assoc. Prof. Željko Duić, PhD			<b>Course code</b>	27220	
<b>Course type</b>	<input type="checkbox"/> obligatory <input checked="" type="checkbox"/> elective			<b>ECTS</b>	5	
<b>Location</b>	Faculty of Mining, Geology and Petroleum Engineering, Pierottijeva 6, Zagreb					
<b>Language</b>	<input type="checkbox"/> Croatian <input checked="" type="checkbox"/> English					
Class type	Weekly hours	Teaching staff	Office hours	Room	E-mail	
<b>Class</b>	2	Assoc. Prof. Željko Duić, PhD	tuesday 11-14	403	<a href="mailto:zduic@rgn.hr">zduic@rgn.hr</a>	
<b>Practice</b>	1	Assoc. Prof. Željko Duić, PhD	tuesday 11-14	403	<a href="mailto:zduic@rgn.hr">zduic@rgn.hr</a>	
<b>Field lecture</b>	1 day					
<b>E-learning level</b>	1		<b>Percentage of on-line class (max. 20%)</b>		5%	
2. COURSE DESCRIPTION						
<b>Course aims</b>	Getting acquainted with water resources and research facilities and acquiring skills in hydrogeological interpretations.					
<b>Requirements for applicants</b>	Dynamics of groundwater flow 1, Hydrogeology 1					
<b>Programme level learning outcomes with course contribution</b>	practical knowledge required for the design and execution of hydrogeological facilities used in water supply					
<b>Expected course level learning outcomes (4-10 outcomes)</b>	<p>familiarize with the basic drilling methods</p> <p>to acquire knowledge based on which it is possible to determine the design of the well and piezometer</p> <p>learn how to calculate the parameters of the well and evaluate its effectiveness</p> <p>implementing the revitalization of the well as a method for extending the life of the exploration well</p>					

Course contents by individual lessons	
Class	Practice
c1 - a history of drilling and exploration of groundwater. reasons and objectives of drilling wells in groundwater exploration and recovery processes.	p1 - the most important drills for the needs of water supply in the republic of croatia
c2 - drilling methods, impact drilling with free fall and pneumatic hammer; rotary drilling with drill bit or sampler , direct and reverse circulation drilling. role and properties of drilling fluids	p2 - schematic examples of different drilling methods
c3 - drilling machines, tools and equipment. modern rock destruction methods.	p3 - examples of different tools and equipment
c4 - record the drilling and core sampling process. determination of the core and record of the borehole profile.	p4 - analysis of data collected during core determination and recording of the well profile.
c5 - drilling tests and sampling of water. casing of observation wells	p5 - analysis of data collected during execution, testing and sampling in the piezometric well
c6 making of observation wells	p6 analysis of data collected during the making of the research-piezometric wells
c7 making of observation wells	p7 analysis of data collected during the making of the research-piezometric wells
c8 making of production wells	p8 analysis of data collected during the performance of the well
c9 making of production wells	p9 analysis of data collected during the performance of the well
c10 development of water wells	p10 analysis of data collected during the development of the well
c11 hydraulic parameters of embedded materials and problems in the design of wells. supervision of well making	p11 examples of different materials
c12 -pumping test	p12 organization of pumping test analysis of data collected during pumping test.

c13 – determination and interpretation of well parameters	p13 calculation of well parameters (example)			
c14 – well in the water supply system. corrosion, incrustation and other processes of aging of wells	p14 examples (video tapes) showing the condition of the well in the water supply system			
c15 – well rehabilitation	p15 analysis of data collected during the revitalization of the well			
<b>Students' obligations</b>	Regular presence at the class (maximum absence 3 + 1), project based on evaluation of well parameters within deadline			
<b>Students' work track</b> <i>(indicate share in ECTS points for each activity so that overall ECTS number corresponds to class credits score):</i>	Class attendance	0,2	Research	
	Project	0,3	Report	
	Colloquium	1,5	Seminar paper	
	Practical work		Oral exam	3
	Written exam		(Extra)	
<b>Type of exam, grades and evaluation of students work</b> during class and on final exam	Classes and examination Regular presence at the class (maximum absence 3 + 1), project based on evaluation of well parameters within deadline. Mark is generated from colloquium (33,3 percent) and oral examination (66,6 percent). During the oral examination student will answer the whole course content.			
<b>Mandatory literature</b> (available in the Library and via other media)	Zelenika, M.(1995): Tehnologija izrade bušotina. Geotehnički fakultet, Varaždin Driscoll, F.G. (1986): Groundwater and Wells. Johnson Screens, St.Paul, Minnesota			
<b>Additional literature</b> (at the moment of study program proposition application)	Delleur, J.W. (1998). The handbook of groundwater engineering, CRC Press			
<b>Examination terms</b>	1.7., 4.7., 11.7.,2.9.,12.9.			
<b>Other</b>				

