

1. GENERAL INFORMATION						
<b>Study programme title</b>	Graduate study of Mining Engineering					
<b>Course title</b>	Demolition of structures			<b>Semester</b>	Winter	
<b>Teacher</b>	Assoc.Prof. Mario Dobrilović, PhD			<b>Course code</b>	27333	
<b>Course type</b>	<input type="checkbox"/> obligatory <input checked="" type="checkbox"/> elective			<b>ECTS</b>	3,5	
<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. Mario Dobrilović, PhD	Every working day (10 a.m. – 2 p.m.).	V 228	<a href="mailto:vinko.skrlec@rgn.hr">vinko.skrlec@rgn.hr</a>	
<b>Practice</b>	1	Asst. Prof. Vinko Škrlec, PhD	Every working day (10 a.m. – 2 p.m.).	V 223	<a href="mailto:vinko.skrlec@rgn.hr">vinko.skrlec@rgn.hr</a>	
<b>Field lecture</b>						
<b>learning level</b>	1		<b>Percentage of on-line class (max. 20%)</b>		0	
2. COURSE DESCRIPTION						
<b>Course aims</b>	The objective of the course is to acquaint students with methods of demolition of structures that are no longer functional. Classical demolition methods, excavators, special tools and techniques are being introduced. It is also explained how to dispose of construction waste. The emphasis of the course is on the demolition of construction facilities using explosives.					
<b>Requirements for applicants</b>	Blasting 1. Pass. Blasting 2. Pass.					

<p><b>Programme level learning outcomes with course contribution</b></p>	<p>After successfully finishing the course, the students will:</p> <ul style="list-style-type: none"> <li>-Know the methods of construction facilities demolition</li> <li>-Know how to treat construction waste, disposal and separation</li> <li>-Learn methods of demolition by explosive.</li> </ul>
<p><b>Expected course level learning outcomes (4-10 outcomes)</b></p>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>-Describe the needs to demolition of structures (level 1)</li> <li>-Define methods of demolition of structures (Level 1)</li> <li>-Explain the mechanics of different types of demolition of structures by blasting (Level 2)</li> <li>-Choose and calculate parameters for the demolition of structures (Level 3)</li> <li>-Recommend the method of demolition of structures considering the design properties of the structure and environment (Level 5)</li> <li>-Plan and organize demolition work (Level 5)</li> <li>-Propose measures to protect the environment during demolition works (level 5)</li> </ul>
<p>Course contents by individual lessons</p>	
<p>Class</p>	<p>Practice</p>
<p>P1 – INTRODUCTION-The basics of decommissioning and demolition of buildings, documentation on demolition, disposal of waste building materials.</p>	<p>V1 – INTRODUCTION- familiarize of students with the program, objectives of the course, introduction of required literature, method of assessment and verification of knowledge.</p>
<p>P2 – DEMOLITION METHODS WITHOUT USE of EXPLOSIVES-mechanical demolition using excavators with long boom, mechanical demolition using manual tools, hydraulic pins, cutting elements of the construction using diamond tools, methods with melting of media that collapses, Intrafix method, methods with chemical expansion materials, the method of breaking concrete under high water pressure, breaking the concrete under high pressure of CO<sub>2</sub>.</p>	<p>V2 – BASICS of the STRUCTURE STATICS-the barycenter of the structure and the use of the structure's own mass, the supporting elements of the structure, the removal of constructive elements of the structure, the role of the undercutting.</p>
<p>P3 – METHODS of DEMOLITION WITHOUT USE of EXPLOSIVES-Methods of braking concrete with pyrotechnic and powder filings.</p>	<p>V3 – DEMOLITION METHODS WITHOUT The USE of EXPLOSIVES-examples from the different projects.</p>

<p>P4 – METHODS of DEMOLITION using EXPLOSIVES-the calculation of required quantities of explosive for demolition of certain materials (wood, concrete and reinforced concrete).</p>	<p>V4 – MATERIALS-Calculation of explosive loading for concrete and reinforced concrete, examples from the different projects.</p>
<p>P5 – METHODS of DEMOLITION using EXPLOSIVES-the calculation of the required quantities of explosive for demolition of concrete and reinforced concrete, forms for the calculation of the required quantities of explosive, the parameters of blast holes for blasting of foundations, the parameters of blast holes for blasting of concrete walls, parameters of blast holes for blasting of concrete pillars, construction of explosive loading for blasting concrete pillars.</p>	<p>V5 – MATERIALS-Calculation of explosive loading for stone and for brick, examples from different projects.</p>
<p>P6 – METHODS of DEMOLITION using EXPLOSIVES-bricks, stone, steel and cast iron, blasting of steel and cast iron with contact explosive, blasting of steel and cast iron with linear cumulative cutters.</p>	<p>V6 – MATERIALS-Calculation of explosive loading for wood and for steel, examples from different projects.</p>
<p>P7 – EXAMPLES of DEMOLITION of STRUCTURES by BLASTING-a partial demolition of structures, the method of demolition of complete structures, the rotation of the structure, collapsing into existing foundations (ground plan), combined method of demolition.</p>	<p>V7 – METHODS of DEMOLITION of STRUCTURES-demolition method by rotation of the structure, basic calculations.</p>
<p>P8 – EXAMPLES of DEMOLITION of STRUCTURES by BLASTING-statics of the structure and movements during demolition, preparation of structures for demolition, initiation and connecting of explosive charge, detonating cord, electrical system for initiation, non-electric initiation system, combined initiation system.</p>	<p>V8 – METHODS of DEMOLITION of CIVIL OBJECTS- demolition method by collapsing of the structure, basic calculations.</p>
<p>P9 – EXAMPLES of DEMOLITION of STRUCTURES by BLASTING – environmental protection measures during blasting works, general safety measures, special safety measures, measures against flyrock, measures against air shock wave, measures against seismic effects of blasting, performance of trial</p>	<p>V9 – METHODS of DEMOLITION of CIVIL ENGINEERING STRUCTURES-combined method of demolition of structures, basic calculations.</p>

<p>blasting and measurement of seismic effects, constant seismic monitoring, protection of people and surrounding structures during blasting.</p>				
<p>P10 – Elaborated EXAMPLES of DEMOLITION of STRUCTURES using EXPLOSIVES-wooden structures, an elaborate example of demolition of sawmill in the factory "Tvin" Virovitica, buildings made of concrete and reinforced concrete.</p>		<p>V10 – METHODS of DEMOLITION of CIVIL ENGINEERING STRUCTURES -examples from different projects for certain methods, video materials.</p>		
<p>P11 – Elaborated EXAMPLES of DEMOLITION of STRUCTURES using EXPLOSIVES-bridges and viaducts.</p>		<p>V11 – METHODS of DEMOLITION of CIVIL ENGINEERING STRUCTURES -class assignment.</p>		
<p>P12 – Elaborated EXAMPLES of DEMOLITION of STRUCTURES using EXPLOSIVES— demolition of special structures.</p>		<p>V12 – DEMOLITION OF BRIDGES - basic calculations, examples from different projects, video materials.</p>		
<p>P13 – Elaborated EXAMPLES of DEMOLITION of STRUCTURES using EXPLOSIVES – unerwater demolition of bridges.</p>		<p>V13 – DEMOLITION of CHIMNEYS-basic calculations, examples from different projects, video materials.</p>		
<p>P14 – Elaborated EXAMPLES of DEMOLITION of STRUCTURES using EXPLOSIVES - Breaking of clinker and cement in silos.</p>		<p>V14 – DEMOLITION OF THE FOUNDATIONS - basic calculations, examples from different projects, video materials.</p>		
<p>P15 – Elaborated EXAMPLES of DEMOLITION of STRUCTURES using EXPLOSIVES - other.</p>		<p>V15 – DAMAGING EFFECT of BLASTING IN DEMOLITION of STRUCTURES and PROTECTION-seismic effects of blasting, protection against flyrock, air shock wave, examples from different projects.</p>		
<p><b>Students' obligations</b></p>	<p>Regularly attending lectures and exercises. Independent assignment solving and submission in the given terms.</p>			
<p><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></p>	Class attendance	1	Research	
	Project		Report	
	Colloquium		Seminar paper	
	Practical work		Oral exam	1,5
	Written exam	1	(Extra)	
<p><b>Type of exam, grades and evaluation of</b></p>	<p>The Knowledge is evaluated based on the exercise preliminary exam and the final (written and oral) exam.</p>			



<b>students work</b> during class and on final exam	
<b>Mandatory literature</b> (available in the Library and via other media)	<ol style="list-style-type: none"><li>1. Ester: Miniranje I, eksplozivne tvari, svojstva i metode ispitivanja, RGNF 2005.</li><li>2. Lectures – Rušenje objekata</li><li>3. Krsnik: Miniranje, RGNF, 1989.</li></ol>
<b>Additional literature</b> (at the moment of study program proposition application)	<ol style="list-style-type: none"><li>1. Structure demolition designs - arhiva Laboratorija za ispitivanje eksplozivnih tvari</li></ol>
<b>Examination terms</b>	Every Wednesday within exam-terms (at 10 a.m.).

