



1. GENERAL INFORMATION

Study programme title	Graduate Study of Mining Engineering				
Course title	Underground chambers and tunnels	Semester	III.		
Teacher	Assoc.prof. Mario Dobrilović Ph.D. / Asst.prof. Vječislav Bohanek Ph.D.		Course code		
Course type	<input checked="" type="checkbox"/> obligatory <input type="checkbox"/> elective	ECTS	5,5		
Location	Faculty of Mining, Geology and Petroleum Engineering, Pierottijeva 6, Zagreb, Croatia				
Language	<input type="checkbox"/> Croatian <input checked="" type="checkbox"/> English				
Class type	Weekly hours	Teaching staff	Office hours	Room	E-mail
Class	2	Assoc.prof. Mario Dobrilović Ph.D. / Asst.prof. Vječislav Bohanek Ph.D.	Every day from 10:00 to 14:00	228 / 223	mario.dobrilovic@rgn.hr vjecislav.bohanek@rgn.hr
Practice	2	Research Assistant Siniša Stanković	Every day from 10:00 to 14:00	P6	sinisa.stankovic@rgn.hr
Field lecture	0.5	Assoc.prof. Mario Dobrilović Ph.D. / Asst.prof. Vječislav Bohanek Ph.D.			mario.dobrilovic@rgn.hr vjecislav.bohanek@rgn.hr
E-learning level	1	Percentage of on-line class (max. 20%)			

2. COURSE DESCRIPTION

Course aims	The aim is to familiarize students with methods of making horizontal, inclined and vertical underground chambers
Requirements for applicants	Blasting 2
Programme level learning outcomes with course contribution	
Expected course level learning outcomes (4-10 outcomes)	-To know the types and features of underground chambers,

	<p>-Understand the properties of the working environment essential for the application of the construction method of underground chambers</p> <p>-To know the construction methods for certain types of underground chambers,</p> <p>-Know how to use the underground chamber excavation method</p>
Course contents by individual lessons	
Class	Practice
P1 – Introduction. Underground premises in mining and construction industry	<p>V1 – Introductory Exercises</p> <p>Familiarise yourself with the content of the subject, how you perform the exercises and how to obtain a rating.</p>
P2 – Purpose and types of underground rooms, displaying in space, hole maps	<p>V2 – SUBDIVISION OF UNDERGROUND ROOMS</p> <p>Division of underground rooms according to general purpose, form and lifetime</p>
P3 – Working environment Characteristics essential for underground room manufacturing technology	<p>V3-Marking of underground premises on a mining map.</p> <p>Reading mining maps, ways of displaying underground rooms on a mining map, various geometric shapes of rooms dimensions and forms of rooms according to norms</p>
P4 – Excavation, drilling and blasting Methods, machine-dig, TBM	<p>V4 – Preparations for preparation And application</p> <p>For Students, examples explain the principles and the way of two-dimensional and three-dimensional presentation of underground rooms</p>
P5 – Phases of work and dynamics of classical excavator,	<p>V5 – Create first Program-</p> <p>Students independently on two-dimensional and three-dimensional model depict part of the mining map</p>
P6 – Phases of work and dynamics of machine excavator	<p>V6 – SUBSTRUCTURE</p> <p>Methods of substructure, materials used for substructure. Examples of different performance of</p>

	the sub-building systems. Development of sub-building systems throughout history
P7 – Excavation of horizontal underground spaces	V7-Preparations for the preparation of the II programme Program of visits to technical museum, display of underground rooms on the situational map. The Shape, purpose and method of substructure of a single underground room.
P8 – Substructure, classical standing subcity	V8-Programming II- The Program is manufactured at the Technical Museum. The Students are visiting the mining department of the Technical Museum. Measures dimensions of different types of subgrade, shape and dimensions of the room. From the measured data, the technical drawing of a single underground room is
P9 – Substructure, anchoring	V9 – Making Underground rooms by drilling and blasting
P10 – Full-Profile excavation, machinery and operation Technology	V10 – Preparations for the development of III programmes A View of the budget excavation of underground spatial space by drilling and blasting. Calculation of the volume of excavation, the number of wells, the mass of explosive filling by a particular borehole the choice of the initiation system. Calculation of the number of workers, loading and unloading of the mined material and graphical representation of the time of the individual operation within the excavation.
P11 – Shipping and transport, machinery, technology, methods	V11 – Development of III programs The Students independently monitor the budget and work out a graphical representation of the underground room excavation by drilling and blasting.
P12-Excavation and substructure of sloping underground rooms	V12 – Mechanical excavation of underground premises

	Display machines and operating mode for underground room excavation machines			
P13 – Excavation and substructure of panes	V13 – Preparations for the preparation of the IV programme Calculation of the volume of excavations and the time of excavation, the time of substructure and the time of loading and transport			
P14 – Methods of Excavates underground premises in special conditions	V14 – Development of the III programme – Students independently with supervision perform a budget and work a graphical representation of the machine-excavation of underground premises			
P15 – Derived Projects and examples	V15 – Program Corrections Students are returned to reviewed programs to correct errors.			
Students' obligations	Compulsory attendance at lectures, exercises and on-the-spot teaching and development of three programmes			
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	1	Research	
	Project		Report	
	Colloquium		Seminar paper	1
	Practical work		Oral exam	2
	Written exam		(Extra)	1.5
Type of exam, grades and evaluation of students work during class and on final exam	Evaluation of the programme, evaluation of the seminar work and oral exam			
Mandatory literature (available in the Library and via other media)	Izrada rudničkih prostorija i tunela, Josip Krsnik, 1993, Zagreb. Support of Underground Excavations in Hard Rock, E. Hoek , P.K. Kaiser W.F. Bawden, 1997, Rotterdam Tunnelling in Weak Rocks, Volume 5, Bhawani Singh, R K Goel, 2006 London Hardrock Tunnel Boring Machines, Bernhard Maidl, Leonhard Schmid, Willy Ritz and Martin Herrenknecht, 2008, Berlin			
Additional literature (at the moment of study program proposition application)				



Examination terms	Winter (3 periods), Summer (3 times), Autumn (3 times) and additional exam period (1 Easter and 1 autumn)
Other	

