1. GENERAL INFORMATION					
Study programme title	Graduate Study of Mining Engineering				
Course title	Mineral Processing 2		**Semester**	I.	
Teacher	Full Professor Gordan Bedeković, PhD		**Course code**		
Course type	☒ obligatory ☐ elective		**ECTS**	6	
Location	Faculty of Mining, Geology and Petroleum Engineering				
Language	☐ Croatian ☒ English				

Class type	Weekly hours	Teaching staff	Office hours	Room	E-mail
Class	2	Full Prof. Gordan Bedeković, PhD	Tuesday 11-12 a.m.	V212	gordan.bedekovic@rgn.hr
Practice	2	Asist. Prof. Ivan Sobota, PhD	Tuesday 11-12 a.m.	V211	Ivan.sobota@rgn.hr
Field lecture	1	Full Prof. Gordan Bedeković, PhD Asist. Prof. Ivan Sobota, PhD			

E-learning level	1	**Percentage of on-line class (max. 20%)**	0

2. COURSE DESCRIPTION	
Course aims	The aims of the course is to introduce students with theoretical basics, apparatus and procedures used in the beneficiation of solid mineral raw materials. Students adopt theoretical knowledge of the beneficiation process, and of the apparatus and procedures used in it.
Requirements for applicants	Passed Examination of the Mineral Processing 1 course.
Programme level learning outcomes with course contribution	➢ analysis and interpretation of data collected by field and laboratory research, and determination of the quality of mineral raw materials, ➢ detailed knowledge of surface and underground exploitation of mineral resources,

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	➢ knowledge of the beneficiation technology of coal, nonmetallic mineral raw materials and metal ore, ➢ knowledge and skills that enable the harmonization of mining activities with environmental protection
Expected course level learning outcomes (4-10 outcomes)	After completing the course, students will be able to: ➢ Identify products and systematize procedures in mineral processing, ➢ Identify the mineral properties important for separation and, accordingly, propose an appropriate separation method, ➢ graphically showed the technological process of the beneficiation, ➢ calculate the technological indicators in mineral processing, ➢ evaluate beneficiation procedures based on technical indicators in mineral processing, ➢ draw, describe and explain the operating principle of devices used in concentration (separation or beneficiation) of mineral raw materials, ➢ make diagrams that result from laboratory testing of the mineral raw material concentration process, ➢ analyze the results obtained by laboratory tests of concentrations of mineral raw materials, and to interpret their meaning.

Course contents by individual lessons	
Class	Practice
C1 - Technological classification of mineral raw materials. Systematization of concentration operations. Mineral properties important for concentration. Mineral liberation.	P1 - Introduction to Laboratory Exercises. Division of students into working groups. Introduction about Laboratory. Safety measures in the laboratory.
C2 - Classification of concentration processes. Evaluation of technological efficiency of beneficiation. Gravity concentration (GC) through history. Application of GC. Principles of GC. Concentration Criteria. Device classification into GC.	P2 – Gravity concentration 1. Hartz jig.
C3 - Jigs. Stratification. Theory of concentration in jig.	P3 – Gravity Concentration 2. Concentration table Wilfley.

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C4 - Cycle in jig. Jig classification. Mechanical jigs: Harz, Denver.	P4 – Gravity Concentration 3. Humphreys spiral.
C5 - Ragging. Baum jig, Batac jig, Wemco-Remer jig. Pneumatic jigs. Centrufugal jigs.	P5 – Silk float analysis.
C6 - Concentration table. Concentration in a thin layer. Concentration in the flow layer. Additional concentration mechanisms.	P6 – Magnetic separation 1. Dry high-intensity magnetic drum separator.
C7 - Types of concentration tables. Sluices. Sluice concentration. Rheo sluice. The Cannon circular Concentrator. Spiral concentrator.	P7 – Magnetic separation 2. Wet, low-intensity magnetic separator.
C8 – Heavy medium concentration (HMC). Principles of HMC. Classification of suspensions and medium solids. HMC-concentration phases. Regeneration.	P8 – Electrostatic separation. Corona separator.
C9 - Tromp Deep Bath. MS Separator. Wemco Deep Cone. The Drewboy separator. Wemco Drum separator with 2 and 3 products. Dyna Whirlpool separator. Heavy media cyclones.	P9 – Froth Flotation of nonmetal raw material. Wemco Fagergren cell.
C10 - Principles of Magnetic Separation. Classification of matter with regard to magnetism. Magnetic permeability and susceptibility. Forces in magnetic separator. Classification of minerals with regard to magnetic susceptibility.	P10 – Froth Flotation of metallic raw material. Flotation cell MS.
C11 - Types of magnets. Types of magnetic separators. Low-intensity magnetic separators, drum, belt, dry and wet. High-intensity magnetic separators: induction dry, Jones-wet, Carpco-Amax carousel magnetic separator.	P11 – Froth Flotation of coal. Flotation column.
C12 - Principles and phases of Electrostatic Concentration. Electrostatic separators: with roller, Corona separators.	P12 – Dewatering.
C13 – Froth Flotation Principles. Flotation reagents. Flotation pulp. Solid phase properties and types of matter connections.	P13 – Practice in the field

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Polarity of matter. Mineral surface and collector adsorption.	
C14 - Structure and characteristics of water. Gas phase. Phenomenom at the phase boundaries. Contact angle. Electric double layer. Collectors, regulators, regulators. Bubble mineralization.	P14 – Practice in the field.
P15 - Working phases of flotation. Mechanical Flotation Cells: Denver Sub-A, Wemco-Fagergreen, Agitair. Pneumatic flotation cells: Callow, Forrester, FPS, flotation column. Flotation regime and flotation process circuits.	P15 – The flowsheets of mineral processing.

Students' obligations	The obligation of the student is to complete all the exercises and field lecture, and to attend 80% of the lectures. Exercises are required to pass preliminary exam (colloquium), which, along with the prescribed attendance, performs duly performed duties and can be accessed by a final (written and oral) exam.			
Students' work track *(indicate share in ECTS points for each activity so that overall ECTS number corresponds to class credits score):*	Class attendance	75 h	Research	
	Project		Report	
	Colloquium	20 h	Seminar paper	
	Practical work		Oral exam	40 h
	Written exam	40 h	(Extra)	
Type of exam, grades and evaluation of students work during class and on final exam	Knowledge is evaluated on the basis of the (practice) colloquium, and during the semester through two colloquium. Both colloquiums must be written for a pass grade and the student can get a final grade based on the total number of points obtained through two colloquium. If a student is not satisfied with a grade or a colloquium (one or both) was negative, student knowledge is checked by a final (written and oral) exam.			
Mandatory literature (available in the Library and via other media)	1. Halbe, D.N., Barratt, D.J., Mular, L.A.: Mineral Processing Plant Design, Practice, and Control Volumes 1 and 2. Society of Mining Engineers, 2002. 2. Wills, B.A.: Mineral Processing Technology. Pergamon Press, Oxford 1992. 3. Weiss, N.L.: Mineral Processing Handbook, Volume 1-2. Society of Mining Engineers, New York, 1985. 4. Schubert, H.: Aufbereitung fester mineralischer Rohstoffe II. Leipzig, 1967.			

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Aditional literature (at the moment of study program proposition application)	1. King, R.P.: Modeling & Simulation of Mineral Processing Systems.Butterworth Heinemann, Boston, 2001. 2. Croizer, R.D.: Flotation – Theory, Reagents and Ore Testing. Pergamon Press, Oxford, 1992. 3. Jain, S.K.: Ore Processing. A.A. Balkema, Rotterdam, 1987. 4. Burt, R.O.: Gravity Concentration Technology. Elsevier, Amsterdam, 1984. 5. Journal "International Journal of Mineral Processing". Elsevier, Amsterdam. 6. Journal "Minerals Engineering". Elsevier, Amsterdam. 7. Journal "Aufbereitung Technik". Bauverlag BV GmbH, Gütersloh.
Examination terms	Two times per exam period (winter, summer, autumn).
Other	

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