BOOK OF COURSES

STUDY PROGRAM:

MINING ENGINEERING

UNDERGRADUATE STUDIES (LEVEL I OF STUDIES)

BOR, 2013.

Content – List of courses

1. MATHEMATICS I

Content

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering and Engineering Management
Level of study: Undergraduate Academic Studies
Course: MATHEMATICS I
Lecturer: Dr Darko Kocev, assistant professor
Course status: Obligatory for Mining Engineering, Metallurgical Engineering and Technological Engineering and elective for Engineering Management
ECTS: 8
Prerequisites: Secondary acquired knowledge in mathematics
Course goals: Application of acquired knowledge in the field of content items
Learning outcome: Mastering the necessary fund of knowledge for following upcoming mathematical courses as well as courses for which we need mathematical tools
Course description: *Lectures***:** Introducing of basic notions (sets, relations, algebraic structures, sets of numbers); Matrices (definitions, equality of matrices, addition and multiplication of matrices); Determinants; Matrix inverse; Rank of a matrix; Systems of linear equations (solving the system using Gaussian method of elimination, Cramer's rule and Kronecker-Capelli theorem); Real functions of a real variable (basic notions); Limits of functions; Continuity of functions; Derivative of a function; Differential of a function; Theorems about differentiation; L'Hopital's rule; Taylor's formula; Determination of intervals of monotonicity of a function and finding local extremums of a function; Intervals of convexity and concavity and inflection points; Analysis of a function and drawing the graph of a function; Functions of two variables (basic notions, definitions, partial derivatives, Taylor's formula, local extremums) . *Practice***:** Calculation practicals
Literature: *Recommended:* 1. M. Janić, Matematika (I i II), TF Bor, 2003. 2. M. Janić, Zbirka rešenih zadataka iz Matematike (I i II), TF Bor, 1996. 3. M. Uščumlić, P. Miličić, Zbirka zadataka iz više matematike I, Nauka Beograd, 1996. 4. S. Vukadinović, D. Sučević, Z. Šami, Matematika II sa zbirkom zadataka, Saobraćajni fakultet, Beograd, 2003. *Supplementary:* 1. B.P. Demidovič, Sbornik zadač i upražnenii po matematičeskomu analizu, Nauka, Moskva, 1997.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 3	Other forms of teaching:	Study research work:	

Methods of teaching:
Frontal lectures with special emphasis on the application in the main courses of study program.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	20	Written exam	40
Practicals		Oral exam	
Preliminary examination	40		
Independent work			

2. PHYSICS

Content

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: PHYSICS

Lecturer: Dr Čedomir Maluckov, associate professor

Course status: Obligatory course for Mining Engineering, Metallurgical Engineering, Technological Engineering

ECTS: 8

Prerequisites: High school knowledge in physics

Course goals:
Acquisition of basic knowledge on physical phenomena and relationships between physical quantities

Learning outcome:
Introduction to and mastering of basic physical laws

Course description:
Theory teaching: Basics of vector analysis. International system units. Dimensional analysis. MECHANICS Basic concepts of kinematics. Straight and circular motion. Newton's laws of dynamics and defining basic concepts of dynamics. Conservation Laws of momentum, Energy and angular momentum. Basic concepts of statics. Newton's law of gravity. Elastic deformations. Oscillatory motion. Mathematical pendulum. Mechanical waves (polarization, interference and wave diffraction). Mechanics of fluid. Bernoulli equation. HEAT AND TEMPERATURE. The concept of temperature and heat. Expansion the body during heating. Gas laws. First and second law of thermodynamics. Adiabatic processes. Change in aggregate state. Real gases and critical temperatures. Transferring and passing the heat. ELECTROMAGNETICS. Coulomb law, the intensity of the electric field, the electric potential and the voltage. Force in an electric field. Electrical capacitance. DC, electrical resistance, Om's law. Kirchhoff's rules. Magnetic field. Magnetic induction. Electrical oscillations and electromagnetic waves. Alternating current. OPTICS. Light sources and photometric units. Geometric optics. Dispersion of waves. Total reflection. Thin lenses. Wave optics (interference, diffraction and polarization of light). Photoelectric effect. ATOMIC AND NUCLEAR PHYSICS. Rutherford-Bohr model of atom. Rydbergs constant and the interpretation of atomic spectra. X-ray radiation. Sommerfeld theory of elliptic pathways. Bohr magneton. Spatial quantization. Spin. Quantum numbers and Paul's principle. Radioactive radiation. The law of radioactive decay. Radioactive series. Nuclear reactions. Proton-neutron hypothesis of the atomic nucleus. The dimension of the core and the binding energy of the nucleus. Nuclear forces. Elemental particles. Particles and antiparticles. Classification of elemental particles.
Practicals: Practicals, Other forms of teaching, Study research work
Computer and laboratory practicals follow lectures.

Literature:
Recommended:
1. B. Pavlović, Physics, part I, Faculty of Technology and Metallurgy, Belgrade, 2004. (in Serbain)
2. B. Pavlović, Physics, part II, Faculty of Technology and Metallurgy, Belgrade, 2000. (in Serbain)
3. B. Pavlović, S. Milojević, Practicum of calculation practicals in physics, Scientific book, Belgrade, 1983. (in Serbian)
Supplementary:
1. B. Pavlović, S. Knežević, M. Radišić, D. Vesić, Practicum of laboratory practicals in physics, Technical faculty in Bor, 1991. (in Serbian)

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	20
Practicals	10	Oral exam	20
Preliminary examination	40		
Testing	5		

3. GENERAL CHEMISTRY

Content

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: GENERAL CHEMISTRY

Lecturer: Dr Milan Antonijević, full professor

Course status: Obligatory course for Mining Engineering, Metallurgical Engineering and Technological Engineering

ECTS: 8

Prerequisites: Acquired basic knowledge in the field of chemistry.

Course goals:
The acquisition of basic knowledge about the structure of atoms and molecules, chemical bonding, chemical reactions and equilibrium. Students are mastering chemical calculations as well as practicals in which the basic chemical laws are demonstrated.

Learning outcome:
Students are enabled to successfully master the material for the future study of chemistry at senior years.

Course description:
Theoretical classes:
Chemical laws. Mol. Chemical reactions and stoichiometry. Periodic table of elements. Structure of atoms. Bohr atomic model. Wave-mechanical model of atom. Ionization energy, electron affinity and electronegativity. Chemical bonding. Covalent bonding. Complex compounds. Ionic bonding. Metallic bonding. Hybridization. Molecular orbitals. Characteristics of state of matter. Gases. Solutions. Amorphous and crystalline substances. Types of chemical reactions. Thermo-chemistry. Chemical thermodynamics. Chemical equilibrium. Chemical kinetics. Acid-base reactions. Sedimentation reactions. Redox reactions. Oxidation number. Electrode potential. Complexation reactions. Electrolytic dissociation. Ionic reactions. The main classes of inorganic compounds.
Practicals: Practicals, Other forms of classes, Study research work
Laboratory practicals.

Literature:
Recommended:
1. M. Dragojević, M. Popović, S. Stević, V. Šćepanović, Opšta hemija (I deo), Tehnološko-metalurški fakultet, Beograd, 2007.
2. M. Popović, D. Vasović, LJ. Bogunović, D. Poleti, O. Ćuković, Zbirka zadataka iz opšte hemije, Tehnološko-metalurški fakultet, Beograd, 2007.
3. S. Grujić, A. Hadži-Tonić, S. Jevtić, M. Nikolić, J. Rogan, Opšta hemija I – praktikum, Tehnološko-metalurški fakultet, Beograd, 2007.

Supplementary:
1. D. Poleti, N. Rajić, Opšta hemija I – priručnik, Tehnološko-metalurški fakultet, Beograd, 2007.
2. S. R. Arsenijević, Opšta i neorganska hemija, Partenon, Beograd, 2001.
3. LJ. Bogunović, O. Leko, M. Popovič, S.Stevič, O.Ćuković, J. Šašić, D. Poleti, Zbirka zadataka iz Opšte hemije, TMF, Beograd, 1985.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching: Classical lectures with interactive discussions, calculation and laboratory practicals, consultations with teachers and assistants, preliminary exemination.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	**60**
Practicals	10	Oral exam	
Preliminary examination	20		
Independent work			

4. INFORMATICS I

Content

Study program: Mining Engineering or Metallurgical Engineering or Technological Engineering or Engineering Management				
Level of study: Undergraduate Academic Studies				
Course: **INFORMATICS I**				
Lecturer: Dr Darko Brodić, associate professor, Dr Dragiša Stanujkić, associate professor				
Course status: Obligatory course				
ECTS: 4				
Prerequisites: The basic informatics knowledge from the high school				
Course goals: Acquiring basic computer knowledge on information technology				
Learning outcome: Introduce students to the operation of computer systems and their application for data processing, basic level				
Course description: Numeral systems and number translation: The essence of numeral system, the translation of numbers from one numeral system to another, the conversion from binary to octal and hexadecimal numeral systems, binary arithmetic, basic arithmetic operations in the system with an arbitrary basis. Representation of data in computer: BCD data, one's complement, two's complement, complement arithmetic, ASCII codes. Boolean and switching algebra: definition of Boolean algebra and basic examples, idempotence law, the law of involution operation of negation, De Morgan's theorem, the law of absorption, the simplification of logic expressions, minimization of logical expressions, Karnaugh maps, switching algebra, analysis and synthesis logic circuits. Switching and logic gates: Switching gates, AND, OR and NOT logic gates, examples of logic gates, analysis and synthesis of switching gates.				
Literature *Recommended:* Milos Ercegovac, Thomas Lang, Jaime H. Moreno, Introduction to Digital Systems, John Wiley and Sons, ISBN: 978-8-126-52251-4 *Supplementary:* Darko Brodic, Milena Jevtic, Book of Assignments in Computer Science I, translation in English				
Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching:	Study research work:	
Methods of teaching: Theoretical teaching with particular reference to the practical application of the material being taught.				

Grading system(max. number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals		Oral exam	40
Preliminary examination	40		
Seminar paper	10		

5. ENGLISH LANGUAGE I

Content

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering and Engineering Management

Level of study: Undergraduate Academic Studies

Course: ENGLISH LANGUAGE I

Lecturer: Sandra Vasković, English language teacher

Course status: Obligatory course

ECTS: 2+2

Prerequisite: Basic language user

Course goals:
Developing all language skills; the adoption of grammatical structures, vocabulary and an emphasis on functional English corresponding to the lower middle level (CEFR-A2)

Learning outcome:
Students can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). They can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. They can also describe, in simple terms, aspects of his/her background, immediate environment and matters in areas of immediate need.

Course description:
Topics:
Everyday life, Appearances, Life stories, The future, Comparison, People and places, In your life, Food and health, Possibilities, Activities, The media, Planet Earth, Time, Work .
Grammar:
Verb tenses (present simple and continuous, past simple and continuous, present and past perfect, going to vs. will), First conditional, Second conditional, Comparison of adjectives, Modals, compound nouns and adjectives, phrasal verbs.
Language functions:
making arrangements, life events, leaving messages, shopping, giving directions, ordering a meal, polite requests, telephone expressions, arranging a time, small talk.

Literature:
Recommended:
1. Tom Hutchinson, Lifelines, Pre-Intermediate, Student's Book, OUP, Oxford, 2009
Supplementary:
1. Slavica Stevanović, Elementary grammar workbook with answers, Tehnički fakultet u Boru, 2018.
2. Raymond Murphy & William R. Smalzer, Basic Grammar in Use, CUP, Cambridge, 2007

Number of classes per week				Other classes:
Lectures: 1	Practicals: 1	Other forms of teaching:	Study research work:	

Methods of teaching
eclectic

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active participation	10	Final exam	40
Attendance	10		
Midterm exam	40		
Independent work			

6. INFORMATICS II

Content

Study program: Mining Engineering or Metallurgical Engineering or Technological Engineering or Engineering Management

Level of study: Undergraduate Academic Studies

Course: **INFORMATICS II**

Lecturer: Dr Darko Brodić, associate professor, Dr Dragiša Stanujkić, associate professor

Course status: Obligatory course

ECTS: 6

Prerequisites: Acquired IT knowledge in the course on Informatics 1

Course goals:
Acquiring higher IT knowledge on information technology.

Learning outcome:
Introduction to computer systems and their application for data processing at a higher level.

Course description:
Theoretical work:
Microsoft Office: Overview of software package Microsoft Office, The advantages of using packages, basic elements of Microsoft Word, Excel and PowerPoint. Practical work: Microsoft Excel: Entering data into a worksheet, work with columns, types and cells, formatting, worksheets, absolute and relative addresses, work with graphic objects, diagrams, internal database, sorting and filtering, subtotals, IF loops, practical practicals in the Excel, applications of the Excel. Microsoft PowerPoint: Creating presentations, add text to a slide, add, delete and re-arrange slides, types of animation, adding lists, the choice of modes of presentation, presentation design changes, inserting a chart from Excel, practical practicals in Power Point. Corel: CorelDraw environment, drawing basic shapes, moving and transforming objects, forming Line-Shape tool, cutting objects with a knife, the use of erasers, coloring and filling of objects, the contours of objects, tools for organizing objects, copying, duplication and cloning objects, effects envelope and distortions, and blending contour objects, practical practicals in Corel. Computers and computer systems: Hardware: The basic organizational unit of the computer, a block diagram of a computer, input/output units of computers, central processing units of computers, other computer parts and computer systems. Software: Types of the software, intellectual property, freeware and license software, computer viruses, software protection.

Literature
Recommended:
1. John Walkenbach, Microsoft Excel 2013 Bible, John Wiley & Sons, ISBN: 978-1-118- 49036-5
2. Faithe Wempen, Microsoft Powerpoint 2013 Bible, John Wiley & Sons, ISBN: 978-1- 118-48811-9
3. Roger Young, How Computers Work: Processor And Main Memory, ISBN: 978-1-442- 11398-5
Supplementary:
Darko Brodic, Book of Assignment for Computer Science II, translation in English

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching:	Study research work:	

Methods of teaching: Theoretical teaching with particular reference to the practical application of the material being taught.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals		Oral exam	40
Preliminary examination	40		
Seminar paper	10		

7. MATHEMATICS II

Content

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering				
Level of study: Undergraduate Academic Studies				
Course: MATHEMATICS II				
Lecturer: Dr Ivana Đolović, full professor				
Course status: Obligatory course				
ECTS: 8				
Prerequisites: Fundamental knowledge in Mathematics I				
Course goals: Application of the theoretical knowledge in further studies				
Learning outcome: Students should be able to apply formal mathematical knowledge in recognizing and solving tasks in further studing process as well as real problems in engineering, sciences, business and technology fields				
Course description: Indefinite integral(definition, substitution rule, integration by parts); Integration of rational and irrational functions; Integration of trigonometric functions; definite integrals; Improper integrals; Application of definite integrals; Differential equations of first order; Separable differential equations of first order; First order homogeneous linear equation; Linear differential equation of first order; Bernoulli differential equation; Lagrange's differential equation; Clairauts' differential equation ; Exact differential equation;. Differential equations of second order; Reduction of order of differential equation; Second order linear homogeneous differential equations with constant coefficients Second order linear homogeneous differential equations with variable coefficients; Second order linear nonhomogeneous differential equations with constant coefficients; Second order linear nonhomogeneous differential equations with variable coefficients.. Lagrange's method of variation of parameters (constants)				
Literature: *Recommended:* 1. M.Janić, Matematika (I i II), TF Bor, 2003. 2. M.Janić, Zbirka rešenih zadataka iz matematike (1 i 2) TF Bor, 1996. 3. M. Uščumlić, P. Miličić, Zbirka zadataka iz više matematike I, Nauka Beograd, 1996. 4. D.Mitrinović, J.Kečkić, Matematika II, Građevinska knjiga, Beograd, 1991. 5. S. Vukadinović, D. Sučević, Z. Šami, Matematika II sa zbirkom zadataka, Saobraćajni fakultet, Beograd, 2003. *Supplementary:* 1. Б.П.Демидович, Сборник задач и упражнении по математическому анализу, Наука, Москва, 1977				
Number of classes per week				Other classes:
Lectures: 3	Practicals: 3	Other forms of teaching:	Study research work:	
Methods of teaching Frontal teaching emphasising application in the vocational courses in the coming semesters				

Grading system(max. number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation		Written exam	40
Practicals		Oral exam	
Preliminary examination	60		
Independent work			

8. ENGINEERING GRAPHICS

Content

Study program: Mining Engineering, Metallurgical Engineering and Technological Engineering

Level of study: Undergraduate Academic Studies

Course: ENGINEERING GRAPHICS

Lecturer: Dr Dejan Tanikić, associate professor

Course status: Obligatory course

ECTS: 6

Prerequisites:

Course goals:

Obtaining knowledge about the basic geometric shapes, their mutual positions and intersections and their representation in the drawings, using manual sketching and drawing, as well as computer graphics.

Learning outcome:

Students have mastered technical rules, regulations and conventions and can successfully use the most modern tools required for successful communication in the technical field.

Course description:

Theoretical teaching:

Introduction to the Engineering Graphics. Modern graphic software. The basics of the projective representation (projection methods; projection planes; orthogonal projection; single and multiple views projections; projection of the point; projection of line; projection of planes; projection of solids; intersection of a plane and a solid; intersection of solids). Drawing geometric objects in three orthogonal projections. Axonometric representation of the geometric objects. Dimensioning and surface roughness marking. Tolerances. Sketching and drawing of the geometric objects. Drawing assemblies and part's details. Using computer to draw and model geometric objects. Saving, plotting and printing drawings. Using various available software packages for drawing.

Practical teaching:

Practicals. Other forms of teaching.

Practical use of AutoCAD software package.

Literature:

Recommended:

1. R. Ljubojević, M. Stevanović, Inženjersko crtanje, TMF Beograd, 1989.
2. T. Pantelić, Tehničko crtanje, Naučna knjiga, Beograd, 1989.

Supplementary:

1. Grupa autora, Programirana zbirka zadataka iz tehničkog crtanja sa nacrtnom geometrijom, Naučna knjiga, Beograd, 1990.
2. Grupa autora, AutoCAD User's Guide, Copyright © 2001 Autodesk, Inc

Number of classes per week				Other classes:
Lectures: 2	Practicals: 1	Lectures: 1	Practicals:	

Methods of teaching

Lectures, practicals, preliminary examinations

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**	
Attendance and active participation	20	Written exam	0	60*
Activity during the practicals	10	Oral exam		
Practical work	10			
Preliminary examination	30+30=60			

* Students can pass the written exam by passing all preliminary examinations.

9. ELEVATIONAL PROJECTION

Content

Study program: Mining Engineering				
Level of study: Undergraduate Academic Studies				
Course: ELEVATIONAL PROJECTION				
Lecturer: Dr Dejan Petrović, associate professor				
Course status: Elective				
ECTS: 8				
Prerequisites: Basic knowledge on mathematics and descriptive geometry				
Course goals: Introduction to basic elements of elevational projection for engineering purposes.				
Learning outcome: The acquired knowledge should provide the necessary basis for the modern design of the mines				
Course description: *Lectures:* Elevational projection method. Scale. Point. Line. Projection of a line (interval and inclination, grading, parallel lines, perpendicular lines, true length of lines). Plane (projection of a plane, point and line in a given plane, cross section of a plane, contours, line through a plane, right size of a plane, normal to a plane, transformation of a plane). Surface through an inclined curve. Platform. Horizontal straight road. Horizontal bent road. Cut and Fill. Cut and fill intersections with terrain. Inclined bent road. Cut and fill intersections with terrain in cross sections. Complex examples of roads. Topographic surfaces. Terrain cross sections. Block diagrams. *Practicals:* Graphical assignments				
Literature: *Recommended*: 1. N. Vušović, Kotirana projekcija, Authorized lectures, Technical Faculty in Bor, 2000. 2. Lj. Gagić. Descriptive geometry. Civil Engineering book, Belgrade 1989 *Supplementary:* 1. V. Đurović. Descriptive geometry. Civil Engineering book, Belgrade 2000 2 . M. Janić, N. Vušović. D. Tanikić. Descriptive geometry. Authorized lectures, Technical Faculty in Bor, 2003.				
Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	
Methods of teaching				
Grading system(max. number of points 100)				
Pre-examination requirements		**Number of points**	**Final examination**	**Number of points**
Attendance and active participation		10	Written exam	60
Practicals		30	Oral exam	
Preliminary examination				
Independent work				

10. INORGANIC CHEMISTRY

Content

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: INORGANIC CHEMISTRY

Lecturer: Dr Snežana Milić, associate professor

Type of the course: Obligatory course for study program: Metallurgical Engineering and Technological Engineering; Elective course for study program: Mining Engineering

ECTS: 8

Prerequisites: Acquired knowledge from General Chemistry

Course goals: Students acquire basic knowledge on properties of elements, their reactions and compounds

Learning outcome: Better understanding of technological courses.

Course description:

Theoretical lectures:

General characteristics of elements. Aboundance. Reactivity. Compounds. Application.

Chemistry of hydrogen and noble gases. Chemistry of nonmetals and metaloides. Chemistry of metals. s and p elements. Transition metals (d and f elements). Chemical aspects of environment pollution.

Practical lectures:

Practicals and other types of lectures. Study research.

Laboratory practicals.

Literature:

Recommended:

1. D. Poleti, Opšta hemija – II deo – hemija elemenata, Tehnološko-metalurški fakultet, Beograd, 2000.
2. S. Grujić, A. Hadži – Tonić, S. Jevtić, M. Nikolić, J. Rogan, Opšta hemija II – praktikum,Tehnološko – metalurški fakultet, Beograd, 2008.
3. N. L. Glinka, Zadaci I vežbe iz opšte hemije, Naučna knjiga, Beograd, 1994.

Supplementary:

1. N. Rajić, Praktikum neorganske hemije, Tehnološko – metalurški fakultet, Beograd, 2004.
2. S. R. Aresenijević, Opšta i neorganska hemija, Partenon, Beograd, 2001.
3. Lj. Bogunović i saradnici, Praktikum opšte hemije, II deo, TMF, Beograd, 1989.
4. M. Jovanović, Kvalitativna analiza, Naučna knjiga, Beograd, 1989.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching

Classical lectures with interactive discussions, calculation and laboratory practicals, consultation and preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active class participation	10	Written exam	60
Practicals	10	Oral exam	
Preliminary examination	20		
Independent work			

11. MECHANICS I

Content

Study program: Mining Engineering				
Level of study: Undergraduate Academic Studies				
Course: MECHANICS I				
Lecturer: Dr Dejan Tanikić, associate professor				
Course status: Obligatory course				
ECTS: 6				
Prerequisites:				
Course goals: Enabling students to solve theoretical and practical problems of the rigid body mechanics, relevant to the static bodies.				
Learning outcome: Besides acquiring the qualification for solving specific technical problems, students obtain knowledge which is necessary for the other courses of the mechanical engineering field (Machine Elements, Materials Strenght…)				
Course description: *Theoretical teaching*: Introduction. Basic concepts. Axioms of Statics. Constraints. Concurrent forces system. Moment of a force about a point and axis. Two parallel forces. Couple. Moment of a couple. Equivalence of couples. Condition of equilibrium of force systems and couples. Internal and external forces. Forces and moments in cross-section of structures. Plane structures. Free body diagrams. Plane trusses. Friction. Real constraints. Center of gravity of a body, planar and line elements. Determination of the center of gravity. Guldin's Theorems. *Practical teaching*: Practicals. Other forms of teaching. Application of the obtained knowledge in solving specific problems of the rigid body mechanics.				
Literature: *Recommended:* 1. R. Marjanović, Mehanika I – Statika, Tehnički fakultet u Boru, 1985. 2. L. Rusov, Mehanika – Statika, Naučna knjiga, Beograd, 1988. 3. S. M. Targ, Teorijska mehanika, Građevinska knjiga, Beograd, 1975. *Supplementary:* 1. I. V. Meščerski, Zbirka zadataka iz teorijske mehanike, Građevinska knjiga, Beograd, 1984. 2. M. Kojić, D. Golubović, R. Savić, Metodička zbirka zadataka iz mehanike – Statika, Naučna knjiga, Beograd, 1982.				
Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching:	Study research work:	
Methods of teaching Lectures, practicals, graphical tasks, preliminary examinations				

Grading system(max. number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	15
Practicals	5	Oral exam	50
Graphical tasks	5		
Preliminary examination	5+5+5=15		

12. MACHINE ELEMENTS

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: MACHINE ELEMENTS

Lecturer: Dr Dejan Tanikić, associate professor

Course status: Obligatory course

ECTS: 6

Prerequisites:

Level of study: Undergraduate Academic Studies

Course goals:

Introducing students to the course of machine elements and gaining basic knowledge in constructing, calculation and verification, as well as choosing from the standard families of machine elements.

Learning outcome:

Students have become qualified for solving specific engineering problems which combine knowledge from many different courses (Engineering Graphics, Mechanics 1, Materials Strenght…)

Course description:

Theoretical teaching:

Machine Elements, as a part of the general mechanical constructions science. Standardization. Tolerances of the dimensions, shape, positions and surface roughness. Mechanical constructions materials. Stresses, deformations, strains, loads of the machines and machine elements. Friction transmission. Friction variators. Gear transmission, types. Kinematics, calculation and construction. Worm drives. Belt drives. Chain drives. Shafts, axles and pins. Types, constructions and calculations. Shaft and hub connections: friction connections, key connections, spline connections. Rolling bearings, some types of constructions, adoption and usage, calculations and sealing. Strength, carrying and operating life. Plain bearing. Characteristics, constructions and lubrication. Installation and maintenance. Clutches and breaks. Threaded connections. Thread forms. Screw connections. Standard thread, force analysis, deformation diagram. Insurance from the self-loosening. Screw constructions. Rivet connections. Welded connections. Soldered and adhesive connections. Springs. Tubes.

Practical teaching:

Practicals. Other forms of teaching.

Students must pass all preliminary examinations and finish independent project tasks to be allowed to seat the written exam.

Literature:

Recommended:

1. M. Ognjanović, Mašinski elementi, Naučna knjiga Beograd, 1999.
2. S. Veriga, Mašinski elementi I, II i III, Mašinski fakultet Beograd, 1990.
3. V. Miltenović, Mašinski elementi, Mašinski fakultet Niš 2000.

Supplementary:

1. D. Tanikić, R. Stolić, Zbirka zadataka iz Mašinskih elemenata, Tehnički fakultet u Boru, Bor, 2013.
2. N. Plavšić i dr., Mašinski elementi, zbirka rešenih zadataka, MF Beograd, 1998.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching:

Lectures, practicals, preliminary examinations

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	15	Written exam	60
Activity during practicals	10	Oral exam	
Preliminary examination	5+5+5=15		

13. BASICS OF GEOLOGY

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: BASICS OF GEOLOGY

Lecturer: Dr Mira B. Cocić, associate professor

Course status: Obligatory course

ECTS: 6

Prerequisites: Acquired physics and chemistry knowledge

Course goals:
Acquiring basic knowledge on Earth, endogen and egzogen processes and history of Earth development

Learning outcome:
Mastering the knowledge necessary for understanding other geological and professional mining courses

Course description:
Theoretical part:
Importance of geology as science. Universe, Solar system and planets, basic characteristics of Earth.
Endodinamics: Type and dynamic of geological processes occurrences, tectonic, epirogen and orogen processes (tangential and radial), main structure of Earth crusts. **Magmatism**: plutonism and volcanoism, world volcanic areas, post volcanic occurrences, magmatic processes and ore occurrences.
Seismic: Causes of trus, types of earthquakes, movements of seismic waves, elements and measuring of strength of earthquakes, regionalization and estimation of earthquakes.
Metamorphism: Causes of and types of metamorphism, contact and regional metamorphism, origin of metamorphic rocks.
Egzodinamics: Importance and characteristics of Earth atmosphere, mechanics of destruction, eolic erosion, erosion by current and standing water, ice erosion, karstification, influence of underground water, geology of accumulation basins and formation of sedimentary rocks.
Historical geology: Course of study, importance of processes of sedimentation and facies, fossil occurrence. Determination of absolute and relative age of rocks. Main phases of Earth development, especially lithosphere, flora and fauna. Geological periods and their characteristics in Europe and Serbia.

Literature:
Recommended:
1. P. Nikolić, S. Đorđević, D. Rabrenović, Basics of Geology, Nauka, Belgrade, 1997.
2. L. Pešić, Basics of Geology-Endodinamics, Belgrade, 1995.
3. L. Pešić, Basics of Geology-Egzodinamics, Belgrade, 2001.
Supplementary:
1. Ž. Milićević, Basics of Geology, Authorized lectures, Bor, 2009.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 0	Other forms of teaching:	Study research work:	

Methods of teaching
Lectures, practicals, preliminary examination

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	
Test 1	25	Oral exam	45
Test 2	25		
Preliminary examinations			

14. MINERALOGY AND PETROGRAPHY

Content

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: MINERALOGY AND PETROGRAPHY

Lecturer: Dr Mira Cocić, associate professor

Course status: Obligatory course

ECTS: 8

Prerequisites: Basic chemistry knowledge

Course goals:
Introducing students to basic knowledge on basic and special mineralogy, as well as course of petrology and rock types

Learning outcome:
Acquiring necessary knowledge for mineral deposit exploration as well knowledge necessary for other professional courses in mining, metallurgy and technology areas

Course description:
Theoretical part:
Mineralogy: Course, importance of minerals and their participation in construction of mineral raw material, classification of minerals. Basic mineralogy: crystallography, occurrence of crystal mineral shapes, crystal systems, crystallochemistry, crystallophysics, mineral genesis, methodology of mineral studies.
Special mineralogy: Silicate minerals (nesosilicates, sorosilicates, ciclosilicates, inosilicates, philosilicates and tectosilicates), non-silicate minerals (minelars Ca, Na, K, Mg, Ba, Sr, C, Cu, Au, Ag, Zn, Pb, Mo, Sb, Ni, Co, Sn, W, Bi, As, S, Te, Se, Hg, Al, Fe, Cr, Mn).
Petrography: Course and classification of rocks, basic characteristics of rocks: structure, texture, leaching, origin and genesis of rocks. Magmatic rocks: intrusive, porphyry ad effusive. Sedimentary rocks: characteristics and origin, classic rocks, organic rocks. Metamorphic rocks: origin, type of metamorphism, regional and contact metamorphic rocks.
Practical part:
Practices in mineralogical-petrographical collection: crystallography of minerals, recognition of minerals and rocks.

Literature
Recommended:
1. D. Babič, Mineralogy, Belgrade, 2003.
2. S. Janjić, Mineralogy, Naučna knjiga, Belgrade, 1995.
3. V. Đorđević, P. Đorđević, D. Milovanović, Basics of Petrology, Nauka, Belgrade, 1991.
Supplementary:
1. Ž. Milićević, Mineralogy, Authorized lectures available in electronic form, 2009.
2. Ž. Milićević, Petrography, Authorized lectures available in electronic form, 2009.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 3	Other forms of teaching:	Study research work:	

Methods of teaching
Lectures, practicals, preliminary examinations

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	
Practicals	5	Oral exam	40
Preliminary examination	25		
Preliminary examination	25		

15. ENGLISH LANGUAGE II

Content

Study programme: Mining Engineering, Metallurgical Engineering, Technological Engineering, Engineering Management

Level of study: Undergraduate Academic Studies

Course: ENGLISH LANGUAGE II

Lecturer: Mara Manzalović, teacher of English

Course status: Compulsory course

ECTS: 2+2

Prerequisites: At least A1 level of knowledge (according to CEFR)

Course goal:
Developing all language skills; acquisition of grammar structures, vocabulary and language functions as learning outcomes of A2 level (according to CEFR)

Learning outcomes:
Students use oral and written language structures and vocabulary to describe everyday topics. They understand academic texts and are able to scan and skim through the text looking for a particular piece of information.

Course description:
Grammar: Revision of basic tenses, conditionals, gerund and infinitive, relative clauses, modals, the passive voice
Topics: Human mind, the world around us, life styles, environmental issues, communication, cultural differences, free time, management (time, money, stress), famous failures
Language functions: expressing opinion, agreement/disagreement; describing people, places, events

Literature

Recommended:

1. Authorised textbook : English language 2, by Mara Manzalovic

Supplementary:

1. Raymond Murphy & William R. Smalzer, Grammar in Use - intermediate, CUP, Cambridge 2007.
2. Bilingual dictionaries

Number of classes per week				Other classes:
Lectures: 1	Practicals: 1	Other forms of teaching:	Study research work:	

Methods of teaching: direct, grammar-translation, audio-lingual, task-based

Grading (max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	**10**	Written exam	50
Practicals		Oral exam	40
Mid-term exams*	(25+25)		
Term paper (optional)	up to 20		

* Students who acquire at least 25 points at mid-term exams, do not have to take written exam, but only oral exam.

16. STRENGTH OF MATERIALS

Content

Study program: Mining Engineering

Level of study: Undergraduate academic studies

Course: STRENGTH OF MATERIALS

Lecturer: Dr Jelena M. Djoković, full professor

Course status: Obligatory course

ECTS: 8

Prerequisites: Mechanics I

Course goals:

Enabling students to solve the problems from the Strength of Materials and to apply the acquired knowledge in practice and in solving problems from other areas that are the continuance of studies.

Learning outcome:

Student is capable to independently solve problems of the structural strength, especially axial loads, torsion and bending of beams, both statically determined and undetermined, and to apply the acquired knowledge in further studies and in the engineering practice.

Course description:

Theoretical teaching:

Introduction to Strength of Materials. Stresses and strains in structures. Cross-sectional moments of inertia. Axial loads. Torsion of the circular and tubular bars. Pure and skewed bending. Buckling of columns loaded in compression. Eccentrically compressed columns. Solving statically undetermined girders. Plane stress and plane strain states. Material failure hypotheses.

Practical teaching:

Numerical examples from all theoretical teaching areas. Independent work.

Literature

Recommended:

1. Printed materials for teaching
2. Rašković D.:Strength of Materials, The Civil Engineering Book, Belgrade, 1988 (in Serbian)

Supplementary:

1. Rašković D.: Solved problems in Strength of Materials, The Civil Engineering Book, Belgrade, 1988 (in Serbian)
2. Rašković D.: Tables for Strength of Materials, The Civil Engineering Book, Belgrade, 1987 (in Serbian)

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching:	Study research work:	

Methods of teaching

Theoretical and practical teaching, Independent work, Preliminary examination, Final exam

Grading system(max. number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals		Oral exam	30
Preliminary examination	30		
Independent work	30		

17. FUNDAMENTALS OF ELECTRICAL ENGINEERING

Content

Study program: Mining Engineering and Technological Engineering				
Level of study: Undergraduate Academic Studies				
Course: FUNDAMENTALS OF ELECTRICAL ENGINEERING				
Lecturer: Dr Zoran Stević, full professor				
Course status: Obligatory course				
ECTS: 8				
Prerequisites: -				
Course goals: Acquiring knowledge on basic electrical engineering laws and their application				
Learning outcome: Knowledge on electrical machines and devices, their application and protection of man				
Course description: Electrostatics. Coulomb's law. Potential. Gauss's law. Conductors. Capacitors. Dielectrics. Energy. D.C. fields and circuits. Current field. Joule's law. Electric generators. Kirchhoff's current laws. Circuit solution using Kirchhoff's laws. Mesh analysis. Electric networks with capacitors. Time constant magnetic field. Magnetic flux and induction. Amper's law. Magnetic materials. Magnetic circuit. Time-varying magnetic and electric field. Faraday's law of electromagnetic induction. Inductance. Electric circuits of alternating current. Resonance. Resolving of AC circuits. Three-phase systems. Rotating electric field. Asynchronous and synchronous electric machines. Electricity transmission. Electrical installations and protection.				
Literature *Recommended:* 1.A. Đorđević, Fundamentals of Electrical Engineering, Part 1 to 4, Academic Mind, Belgrade, 2012. 2. G. Božilović, D. Olćan, A. Đorđević, Collection of problems for Fundamentals of electrical engineering, Part 1 to 4, Academic Mind, Belgrade 2012.				
Number of classes per week				Other classes:
Lectures: 3	Practicals: 2	Other forms of teaching:	Study research work:	
Methods of teaching				

Grading system(max. number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	0 (30 without preliminary examination)
Practicals	20	Oral exam	30
Preliminary examination	30		
Independent work	10		

18. GEODESY

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: GEODESY

Lecturer: Dr Nenad Vušović, full proffesor

Course status: Elective course Study program for Mining Engineering

ECTS: 8

Prerequisites: Acquired knowledge in the course on Proposed projection

Course goals:
Acquisition of basic knowledge in the field of geodesy, geodetic instruments and methods of geodetic measurement, processing of measurement results and development of geodetic plans

Learning outcome:
Introducing students to theoretical and practical knowledge in the field of geodesy

Course description:
Definition and tasks of geodesy. Organization and division of geodetic works. Historical development of geodesy. Determining the shape and size of the Earth. Projection of the Earth to the plane. Cartographic projections. Gauss-Kriger's conformal projection. Coordinate system of Serbia. Maps and plans. Division of the trigonometric section into leaves. Basic concepts from the theory of errors. Geodetic networks (triangulation and reference networks). Measuring angles. Measurement length. Determination of height differences (geometric level). Basic geodetic calculations in trigonometric networks - triangulation. Basic geodetic calculations in polygonal networks. Basic Geodetic Calculations in Level Networks. Diameter-detailed field shooting. Labeling of objects. Marking of roads (curves). Calculation of surfaces and cubature.
Practical teaching: Theoretical instruction will be followed through practical measurement practicals and elaboration

Literature

Recommended:

1. N. Vušović, Historical Concepts of Contemporary Geodesy and Mine Surveying, Vol.1., University of Belgrade-Technical faculty at Bor, Bor 2004.
2. N. Vušović, Historical Concepts of Contemporary Geodesy and Mine Surveying, Vol.2., University of Belgrade-Technical faculty at Bor, Bor 2004
3. K. Vračarić, I. Aleksić, Practical geodesy, Geocart, Belgrade, 2007.

Supplementary:

1. G. Perovic, Precise geodetic measurements, Geocart, Belgrade, 2005.
2. K. Mihailović, K. Vračarić, Geodesy II, Scientific book, Belgrade, 1990.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching: Lectures and practicals (task preparation)

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	20
Practicals	5	Oral exam	50
Preliminary examination			
Independent work	20		

19. ANALYTICAL CHEMISTRY

Content

Study program: Mining Engineering or Metallurgical Engineering or Technological Engineering

Level of study: Undergraduate Academic Studies

Course: ANALYTICAL CHEMISTRY

Lecturer: Dr Slađana Alagić, associate professor, Dr Tanja Kalinović, assistant professor

Course status: Obligatory course for Metallurgical Engineering and Technological Engineering and Elective course for Mining Engineering

ECTS: 8

Prerequisites: Necessary knowledge on the properties of certain classes of inorganic compounds (acids, bases, salts), chemical bonding, chemical reactions and dynamic equilibrium.

Course goals:

Introducing students to theoretical basics of quantitative chemical analysis. Calculation of basic parameters essential for chemical analysis. Applying chemical dynamic equilibrium which is important for chemical analysis. Mastering theoretical and practical knowledge in regard to the identification and determination of the elements, ions and compounds in aqueous solutions - laboratory determination of acids, bases, anions and cations.

Learning outcome:

By mastering this material, students will be able to monitor and control technological processes and, also, to assess the quality of the samples of various industrial raw materials and products.

Course description:

Theoretical:

Course and tasks of analytical chemistry. Classification of methods of the chemical analysis. Chemistry of the solutions. Chemical dynamic equilibriums. Acid-base reactions. Sedimentation reactions, solubility product. Reactions of formation of complexes. Redox reactions. Gravimetric reactions, colloidal and crystalline precipitates, gravimetric calculations, gravimetric determination of individual cations and anions. Volumetric analysis: classification of volumetric methods (precipitation titrations, acid-base titration methods, complexometry and redox titrations), indicators and calculation in volumetric analysis, volumetric determination of individual cations and anions.

Practical:

Gravimetric and volumetric determination of elements. Calculation practicals.

Literature

Recommended:

1. O. Vitorović, R. Šaper, Analitička hemija-teorijske osnove, TMF, Beograd, 1989.
2. Lj.Rajaković, A.Perić-Grujić, T.Vasiljević, D.Čičkarić, Analitička hemija, kvantitativna hemijska analiza, Praktikum, TMF, Beograd, 2000.
3. Lj.Rajaković: Zbirka zadataka iz analitičke hemije, TMF, Beograd, 2005.

Supplementary:

1. J. Savić, M. Savić, Osnovi analitičke hemije, Svjetlost, Sarajevo, 1990.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching: Teaching with interactive discussions, experimental work and calculations, consultations, preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	45
Practicals	10	Oral exam	
Preliminary examination	20+20		
Independent work			

20. ROCK AND SOIL MECHANICS

Content

Study program: Mining engineering

Level of study: Undergraduate Academic Studies

Course: ROCK AND SOIL MECHANICS

Lecturer: Dr Radoje Pantović, full professor

Course status: Elective

ECTS: 6

Prerequisites: Basic knowledge on Mathematics, Physics and Materials mechanics

Course goals:
Understanding of rock and soil properties, Testing methods, processes of disintegration, changes in stress/strain state and their consequences

Learning outcome:
Acquired knowledge represents the foundation for definition of stress/strain state of rock massif and for design and stability calculations of mining facilities.

Course description:
Theory:
Rock mechanics. Structural, physical and mechanical properties of rocks. Sampling. Laboratory and field testing methods. Rock and rock mass classification. Strength and deformability of rock mass. Stresses and strains in rock mass. Primary stress state. Secondary stress state around excavations. Underground pressure. Stability of underground mining facilities. Underground pressure calculation theories. Field methods for stress/strain state testing. Protective bearing pillars. Bearing pillars calculations. NATM roof support principles. Rock bursts. Influence of underground mining operations to ground surface. Slope stability. Plain failure. Wedge failure. Soil mechanics. Probing. Physical and mechanical properties of soil. Testing methods. Soil bearing capacity. Subsidence. Soil pressure to retaining walls, pipes and tunnels. Slope stability. Circular failure.
Practice:
Laboratory testing and reporting on physical and mechanical properties of rock and soil, stress state around underground mining facilities, stability of underground facilities, slope stability.

Literature:
Recommended:
1. M. Stevic, Mehanika tla i stijena, RGF, Tuzla, 1991.
2. R. Obradović, N. Najdanović, Mehanika tla u inženjerskoj praksi, Rudarski institut, Beograd, 1999.
3. P. Jovanović, Osnovi mehanike stena u rudarstvu, RGF, Beograd, 1969.
Supplementary:
1. E. Hoek, Practical Rock Engineering, 2000.
1. 2. E. Hoek, P.K. Kaiser and W.F. Bawden, Support of Underground Excavations in Hard Rock, 1995.

Number of classes per week				Other classes
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of Teaching:
Oral lectures, laboratory and calculation practicals, discussion

Grading system(maximum number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active participation	10	Written exam	20
Practice	10	Oral exam	40
Report	20		

21. ORGANIC CHEMISTRY

Content

Study program: Technological Engineering, Mining Engineering

Level of study: Undergraduate Academic Studies

Course: ORGANIC CHEMISTRY

Lecturer: Dr Slađana Alagić, associate professor

Course status: Obligatory course for Technological Engineering and Elective course for Mining Engineering

ECTS: 6

Prerequisites: Knowledge on the atom structure, chemical bonds, chemical reactions classification, stoichiometry

Course goals:

Understanding of the structure of organic molecules, classes of organic compounds (and their reactions), nomenclature of organic compounds and the correlation of the organic compound structure with its physic and chemical characteristics. Education on basic experimental techniques in organic chemistry laboratory, characterization of organic compounds and experimental synthesis of simple organic compounds.

Learning outcome:

Better understanding of many technological courses due to the wide utilization of numerous organic compounds in technological procedures. Also, a better understanding of the ecological and toxicological problems because numerous organic compounds are serious hazardous pollutants.

Course description:

Theoretical:

Diversity and the amount of organic compounds. Covalent bonding, hybridization, intermolecular interactions, electron effects, types of reactions in organic chemistry. Methods for solid substances obtaining, their identification, and evaluation. Structural theory. Isomers. Classes of organic compounds: 1) Hydrocarbons: alkanes, alkenes, alkynes, aromatic compounds; 2) Organohalide compounds; 3) Organooxigen compounds: alcohols, ethers, phenols, aldehydes and ketones, carboxylic acids and their derivates; 4) Organonitrogen and organosulfur compounds – aliphatic and aromatic (5 or 6 membered heterocyclic compounds); 5) Organic compounds – bio-molecules: lipids, carbohydrates, proteins; 6) Polymers.

Practical:

Experiments in the laboratory – determination of some physic characteristics, characterization and basic elemental analysis of organic compounds with calculations; identification of functional groups; preparative organic chemistry – synthesis of simple organic compounds.

Literature

Recommended:

1. R. Palić, N. Simić, Organska hemija, I izdanje, Univerzitet u Nišu, PMF, Niš, 2007.
2. G. A. Taylor, Organska hemija, III izdanje, Naučna knjiga, Beograd, 1995.

Supplementary:

1. J. Rikovski, Organska hemija, Građevinska knjiga, Beograd, 1979.
2. S. Arsenijević, Organska hemija, Naučna knjiga, Beograd, 1990.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching: Teaching with interactive discussions, experimental work and calculations, consultations, preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	45
Practicals	10	Oral exam	
Preliminary examination	20+20		
Independent work			

22. TECHNOLOGY AND SUSTAINABLE DEVELOPMENT

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: TECHNOLOGY AND SUSTAINABLE DEVELOPMENT

Lecturer: Dr Jovica M. Sokolović, associate professor

Course status: Obligatory course

ECTS: 6

Prerequisites: Required knowledge in Mathematics.

Course goals:

The aim of the course is to point out the need for parallel learning of technologies as economically justified and environmentally friendly processes, as well as the role and significance of science in sustainable survival and community development from a local to a global level.

Learning outcome:

Theoretical and practical training for work in scientific, educational and economic organizations dealing with this issue, as well as promoting the concept of sustainable development as a challenge for the 21st and future centuries.

Course description:

Theory:

The concept and significance of sustainable development. Economic and environmental aspect of technology relations and sustainable development. Standards and legal regulations in the field of environmental protection and sustainable development. Mining, metallurgy, inorganic and organic technologies and sustainable development. Recycling technologies in the function of sustainable development. Strategy for development of new and improvement of existing technologies in the function of environmental protection and sustainable development. Morality and ethics in sustainable development. Scientific basics of environmental control. The concept of implementing a sustainable development strategy.

Practical:

Practicals, other forms of teaching, independent work.

Literature

Recommended:

1. R. Stanojlović, Technologies and sustainable development (in Serbian), Authorized lectures, 2007.
2. M. Djukanović, Environment and sustainable development (in Serbian), Elit, Belgrade, 1996.
3. H. Staletović, Environmental development planning - a way to sustainable development (in Serbian), Bor, 2006.
4. M. Kostović, Sustainable development and preparation of mineral raw materials (in Serbian), Monograph, Belgrade, 2007.

Supplementary:

1. S. Milutinović, Local Agenda 21 (in Serbian), Belgrade, 2004.
2. Sustainable development strategy of the Republic of Serbia (in Serbian), Belgrade, September 2007.
3. A. Kostić, Environmental Engineering (in Serbian), Belgrade, 2007.
4. M. Miljković, Sustainable development of the closed mines area (in Serbian), CD, Bor, 2000.
5. M. Miljković, Effect of surface exploitation of metal ores on environmental factors of the environment (in Serbian), Monograph, Bor, 1998.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 1	Other forms of teaching: 1	Study research work:	

Methods of teaching: Lectures, practicals organized on an interactive principle, which, in addition to classical lectures and presentations, includes discussions, active participation of students in all aspects of teaching and preparation for independent work.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	20	Oral exam	30
Preliminary examination	20		
Independent work	20		

23. ENGLISH LANGUAGE III

Content

Study programme: Engineering Management, Mining Engineering, Metallurgical Engineering and Technological Engineering

Level of study: Undergraduate Academic Studies

Course: ENGLISH LANGUAGE III

Lecturer: Enisa Nikolić, teacher of English

Course status: Compulsory

ECTS: 2+2

Prerequisite: At least A2 level of the Common European Frame of Reference (CEFR)

Course Goals:

Developing all language skills in a professional context in order to enable students to use professional literature and communicate in English (both in oral and written form) for the purpose of studying and further professional development.

Learning outcomes:

Upon successful fulfillment of pre-exam and exam requirements students should be able to: a) use professional terminology and grammatical structures characteristic of the field-specific scientific discourse b) understand a professional text at an intermediate or upper- intermediate level as well as take part in discussions on different scientific and engineering topics c) express themselves in writing (short essays, compositions, reports, summaries, abstracts, CVs...)

Course description:

Grammar points:

Tenses of the verb (Present Simple/ Continuous, Past Simple/ Continuous, Present Perfect Simple/ Continuous, Past Perfect Simple/ Continuous, Future Simple/ Continuous), The Passive Voice (revision of passive structures, impersonal constructions in the passive, passive questions), Conditionals (zero, first, second and third type), Participles (used adjectivally and to shorten relative clauses), Verbs followed by infinitive or -ing, Modal Verbs (present, future and past), Phrasal Verbs, Extended Nominal Groups, Compounds, Foreign Plurals, Numerals, Linking words, Word formation (common prefixes and suffixes).

Themes:

Why English Matters, Science and Engineering, Our Technological World, Environmental Matters, Sustainability Issues, Management Functions, Management Levels in an Organization, Quality Management, Making Decisions, Solving Problems, Plant Operation, Secrets of Successful Presentations, Attending Conferences.

Literature:

Recommended:

1. E.Nikolić, English Language III (a collection of texts with lexical practicals)
2. Mark Powell, In Company (second edition), intermediate student's book, Macmillan, Oxford, 2009.
3. John Eastwood, Oxford Practice Grammar- Intermediate, Oxford University Press, Oxford, 2006.

Supplementary:

1. Michael Vince, Intermediate Language Practice, Macmillan, Oxford 2003.
2. Macmillan English Dictionary for Advanced Learners, Macmillan Education, 2002.
2. Oxford English-Serbian Student's Dictionary, Oxford University Press, Oxford 2006

Number of classes per week				Other classes:
Lectures: 1	Practicals: 1	Other forms of teaching:	Study research work:	

Methods of teaching

Eclectic approach combining the principles and techniques of various methods with a special emphasis on communicative approach.

Grading system (max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation (lectures and practicals)	10	Written exam	Taken only by the students who have not taken or passed the tests.
Tests	25+25	Oral exam	30
Presentations	10		

24. MACHINERY AND EQUIPMENT Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: MACHINERY AND EQUIPMENT

Lecturer: Dr Miodrag Zikić, associate professor

Course status: Elective course for the Mining Engineering study program

ECTS: 9

Prerequisite: Acquired knowledge on Mechanical Elements

Course goals:
Introducing students to the basic structure of machinery and equipment and their characteristics in general, especially those used in mining

Learning outcome:
The ability of a student to be qualified to decide on the selection of machinery and equipment used in mining

Course description:
Lectures:
Introductory remarks. Historical development, significance, current condition and trends in the development of machinery and equipment. Basic terms. Basic machine structure. Capacity. Maintenance. Availability. Drilling and blasting machinery and equipment. Excavation and loading machinery and equipment. Haulage machinery and equipment. Waste disposal machinery and equipment. Stationary machinery and equipment. Auxiliary machinery and equipment. Protection measures when operating machinery and equipment.
Practicals:
Visiting mining operations where machinery and equipment are being used, as well as workshops for their maintenance.
Practicals:
Solving math calculation tasks regarding the capacity of machinery and equipment for drilling and blasting, excavation and loading, haulage and disposal. Writing a term paper on the characteristics of individual machinery and equipment.
Other forms of coursework:
Study research

Literature
Recommended:
1. V. Jevtić, Građevinske i rudarske mašine (prvi i drugi deo), Univerzitet u Nišu, Mašinski fakultet, Niš, 1995.
2. V. Popović, Tehnologija površinske eksploatacije, Univerzitet u Beogradu, RGF, Beograd, 1992.
Supplementary:
1. B. Trbojević, Građevinske mašine, Građevinska knjiga, Beograd, 1964.
2. M. Oljača, D. Raičević, Mehanizacija u melioracijama zemljišta, Poljoprivredni fakultet, Beograd, 1999.
3. Prospect materials.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching
Lectures, practicals, term paper writing.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active participation	10	Written exam	
Term paper	40	Oral exam	50

25. PHYSICAL CHEMISTRY Content

Study programs: Technological Engineering, Metallurgical Engineering, Mining Engineering

Level of study: Undergraduate Academic Studies

Course: PHYSICAL CHEMISTRY

Lecturer: Dr Marija B. Petrović Mihajlović, associate professor

Course status: Obligatory course for Technological Engineering, Metallurgical Engineering; and elective course for Mining Engineering

ECTS: 9

Prerequisites: Acquired knowledge on General chemistry

Course goals:
Introducing students to physicochemical concepts, laws and principles. Theoretical foundation for studying structure and states of matter, physical processes and phase equilibrium in material systems, as well as chemical reactions and chemical equilibrium. Study fundamentals of chemical thermodynamics and kinetics, as well as electrochemistry.

Learning outcome:
Mastering and adopting fundamental physicochemical terms and principles. Identifying and understanding physicochemical processes associated with technological, metallurgical and mining processes. Acquiring knowledge on experimental physicochemical methods, measurements and data processing.

Course description:
Theoretical instruction:
1. Structure of the atom; Chemical bonding (ionic, covalent, metallic bonds, hybridization of atomic orbitals, delocalized molecular orbitals, chemical bonding in complex compounds, Van der Waals and hydrogen bonding); Aggregate states of matter; 2. Introduction to chemical thermodynamics; Thermodynamic properties of a multicomponent homogeneous system; Conditions of the phase equilibrium and phase transformations; Equilibrium in solutions; The heat of chemical reaction; Chemical affinity; Chemical equilibrium; Surface phenomena; Transport phenomena; Chemical kinetics; 3. Properties of electrolyte solutions; Electrochemical thermodynamics; Irreversible processes on electrodes; Fundamentals of electrochemical kinetics.
Practical instruction:
Practicals, Other forms of teaching, Study research work
Experiments in the field of gaseous state of matter, chemical thermodynamics, chemical equilibrium, solutions, phase equilibrium, adsorption, kinetics and electrochemistry. Calculation practicals.
1st cycle: Determination of partial pressure; Determination of vapour pressure of liquids; Determination of viscosity; 2nd cycle: Structural analysis; Adsorption; Determination of reaction order and the rate constant; 3rd cycle: Determination of electrical conductivity; Electromotive forces; Corrosion of metals.

Literature
Recommended:
1. S. Đ. Đorđević, V. J. Dražić, Fizička hemija, TMF, Beograd, 2005.
2. D. Minić, A. Antić-Jovanović, Fizička hemija, FFH, BF, Beograd, 2005.
Supplementary:
1. D. Ovcin, D. Jovanović, V. Dražić, M. Maksimović, N. Jakovljević-Halai, Lj. Vračar, S. Jovanović, K. Jeremić, D.Šepa, M. Vojnović, Fizička hemija - zbirka zadataka, TMF, Beograd, 2004.
2. Z. Stanković, M. Rajčić-Vujasinović, Eksperimenti u fizičkoj hemiji, TF, Bor, 2006.
3. Lj. Vračar, A. Despić, V. Dražić, S. Zečević, K. Jeremić, D. Jovanović, S. Jovanović, M. Maksimović, B. Nikolić, D. Ovcin, D. Šepa, Eksperimentalna fizička hemija, TMF, Beograd, 2004.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching: Lecturing with interactive discussions, calculation and laboratory practicals, consultations and preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	30
Practicals	5	Oral exam	40
Preliminary examination	20		
Independent work			

26. MINERAL DEPOSITS

Content

Study program: Mining Engineering				
Level of study: Undergraduate Academic Studies				
Course: MINERAL DEPOSITS				
Lecturer: Dr Miodrag Banješević, assistant professor				
Course status: Obligatory course				
ECTS: 7				
Prerequisites: Knowledge acquired in the courses on Basic Geology, Mineralogy and Petrology				
Course goals: Introduction to the basic types and characteristics, genesis and conditions of the mineral deposits				
Learning outcome: The acquired knowledge is the basis for studying the course on Exploration of mineral deposits				
Course description: Basic terms and basic characteristics of the mineral deposits. Mineral and chemical composition of ore. Metallogenetic reionization. Superposition relationships. Structural and morphological framework. Genetic classification. Endogenous mineral deposits. Exogenous mineral deposits. Metamorphogenic mineral deposits. Metallic, non-metallic and kaustobiolitic mineral deposits				
Literature *Recommended:* 1. Č. Mudrinić. Ležišta mineralnih sirovina, RGF, Beograd, 1997. *Supplementary:* 1. M. Banješević. Ležišta mineralnih sirovina, praktikum, TF, Bor, 2017. 2. S. Gajić. Ležišta mineralnih sirovina, skripta, TF, Bor, 1981.				
Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching:	Study research work:	
Methods of teaching: Lectures, practical lessons - practicals, tests, preliminary examinations				

Grading system(max. number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	
Practicals	5	Oral exam	60
Preliminary examination	30		
Independent work			

27. MINE SURVEYING

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: MINE SURVEYING

Lecturer: Dr Nenad Vušović, full proffesor

Course status: Obligatory course for Mining Engineering study program

ECTS: 6

Prerequisites: Acquired knowledge in the course on Geodesy

Course goals:
Acquiring knowledge on Mine surveying as a scientific discipline and measurements of basic geometric elements in mines with surface and underground exploitation

Learning outcome:
Getting to know basic tasks from Mine surveying on mines with surface and underground exploitation

Course description:
Historical development of Mine surveying. Definition and tasks of Mine surveyings and connections with other scientific disciplines. Design and stabilization of the above ground and underground geodetic bases (cavernous polygonal and leveling trains). Measuring angles in the cave. Measuring the length in the cave. Determination of height differences in cave rooms. Connection of basic cave polygon trains with geometric basis on the surface of the terrain. Breaks. Measurement works for the observation of mine facilities. Mine maps and plans. Measurement works on surface mining. Geometric bases on surface mines. Detailed recordings on surface mines. Calculating the surface and cubature of the excavated masses. Observation of slope stability on surface mines and landfills. Geometrically-congruent control of excavators. Modern ways of monitoring the state of mining works.
Practical teaching:
Theoretical instruction will be followed through practical measurement practicals and elaboration

Literature
Recommended:

1. N. Vušović, Historical Concepts of Contemporary Geodesy and Mine Surveying, Vol. 1. Том 1, University of Belgrade, Technical faculty at Bor, 2004.
2. N. Vušović, Historical Concepts of Contemporary Geodesy and Mine Surveying, Vol. 2. Том 1, University of Belgrade, Technical faculty at Bor, 2004.
3. N. Vušović, Mine surveying – selected chapters, University of Belgrade - Technical faculty at Bor, 1997.
4. N. Vušović, Mine surveying – Practice for practicals, University of Belgrade - Technical faculty at Bor, 1997.

Supplementary:

1. M. Patarić, Mine surveying part 1., , Belgrade, 1990. Faculty of Mining And Geology
2. Borshch-Komponiets V., Mine Surveying, Mir Publishers, Moscow, 1989.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching: 0	Study research work:	

Methods of teaching: Lectures and practicals (task preparation)

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	20
Practicals	5	Oral exam	50
Preliminary examination			
Independent work	20		

28. COMMINUTION AND CLASSIFICATION OF MATERIALS

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: COMMINUTION AND CLASSIFICATION OF MATERIALS

Lecturer: Dr Milan Trumić, full professor

Course status: Obligatory course

ECTS: 7

Prerequisites: Basic knowledge on mathematics and physics

Course goals:
Acquiring knowledge on theoretical and practical principles on which processes of comminution and classification of materials are based

Learning outcome:
Students are able to follow courses that rely on a processed program and to effectively apply acquired knowledge in practice

Course description:
Theoretical teaching:
Introduction. Characteristics of materials size: coarseness of the individual grain, grain size distribution, average diameter and specific surface area of the grain mixture. Theoretical basics of comminution: structure of solids, comminution laws, comminution methods, comminution rate. Crushing: jaw, cone, impact, roller crusher and shedder; construction and principle of operation, technological indicators of crushers operation. Grinding: rod mill, ball mill, semi-autogenic and autogenic mills, vertical mill, vibratory mill, planetary mill and other mills; construction and principle of operation, batch grinding kinetics, batch types and batch and lining wear, grinding kinetics, technological indicators of mills operation. Screening: theoretical basis of screening, grids and sieves, construction and principle of operation, technological indicators of screening operation. Classification: theoretical basis of classification, sedimentation and hydraulic classifiers, spiral and rake classifiers, hydrocyclones, construction and principle of operation, technological indicators of classification operation. Comminution and classification technological schemes.
Practicals:
Laboratory and calculation practicals based on theoretical instruction.

Literature
Recommended:
1. N. Magdalinović, Usitnjavanje i klasiranje, Nauka, Beograd, 1999.
2. N. Magdalinović, Usitnjavanje i klasiranje mineralnih sirovina-praktikum, Tehnički fakultet, Bor, 1985.
Supplementary:
1. N. Magdalinović, Meljivost mineralnih sirovina, Nauka, Beograd, 1997.
2. N. Magdalinović, I. Budić, N. Ćalić, R. Tomanec, Kinetika mlevenja, Tehnički fakultet, Bor, 1994.
3. Mineral Processing Handbook 7/07, Telsmith, Inc., USA, 2007.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 2	Other forms of teaching: 1	Study research work:	

Methods of teaching: Lectures with interactive work with students, practical work through laboratory and calculation practicals. Pre-examination of knowledge through two preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	20
Practicals	20	Oral exam	20
Preliminary examination I	15		
Preliminary examination II	15		

29. TESTING MINERAL AND SECONDARY RAW MATERIALS Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: TESTING MINERAL AND SECONDARY RAW MATERIALS

Lecturer: Dr Zoran Štirbanović, assistant professor

Course status: Obligatory course for modules MP and RTSD

ECTS: 6

Prerequisites:

Course goals:
Introducing students to theoretical and practical principles on which methods of testing mineral and other raw materials are based.

Learning outcome:
Acquiring the necessary knowledge from the methods of testing mineral and secondary raw materials, for engineering activities in teaching, scientific and production organizations and institutions.

Course description:
Theoretical lectures:
INTRODUCTION (Significance and objective of testing mineral and other raw materials); SAMPLING (sampling theory, sampling models, statistical processing of samples and sampling errors); CHARACTERIZATION OF RAW MATERIALS (determination of physical, chemical and physico-chemical properties, from the aspect of their treatment in mineral and recycling technologies); MICROSCOPIC EXAMINATIONS (form and appearance of mineral grains, scaling and size of mineral grains, forms and phenomena in secondary raw materials, binocular, petrographic and ore microscopes); ORE MICROSCOPY (qualitative and quantitative methods for the determination of mineral, granulometric and chemical composition in ore samples and in concentrate samples); INSTRUMENTAL METHODS (the methods most commonly used in the examination of mineral and secondary raw materials, X-Ray, UV-Vis, FTIR, SIMS, RAMAN, DTA, TGA, AAS, SEM, XPS).
Practical lectures:
Practical lectures are being performed as laboratory and calculation and follow the program of theoretical lectures. Sampling and processing of samples, statistical data processing. Characterization, determination of chemical and physical properties of raw materials. Microscopic examination, qualitative and quantitative analysis. Practical introduction to devices and instruments for spectral and other advanced methods of testing raw materials.

Literature:
Recommended:
1. R. A Tomanec, Metode ispitivanja mineralnih sirovina u PMS, RGF, Beograd, 2007.
2. R. Milosavljević, Metode ispitivanja mineralnih sirovina u PMS, RGF, Beograd, 1974.
3. A. Cisarc, Uputstvo za upotrebu rudnog mikroskopa, IŠP, Beograd, 1950.
4. M. Tomljanović, Instrumentalne kemijske metode, Prvi dio, Zenica, 2000, ISBN 9958-716-03-8.
Supplementary:
1. J.W. Merks, Sampling and weighing of bulk solids, Trans Tech Publication, 1985.
2. J.R.Craig and D.J. Vaughan, Ore microscopy and ore petrography, Moscow, Mir, 1983.
3. E.N.Cameron, Ore microscopy, John Wiley&Son, New York, 1961.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching:	Study research work:	

Methods of teaching: Lectures with interactive work with students, practical work through laboratory and calculation practicals. Pre-examination of knowledge through one preliminary examination.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	25	Written exam	
Practicals	25	Oral exam	40
Preliminary examination	10		

30. HAULAGE

Content

Study program: Mining engineering
Level of study: Undergraduate Academic studies
Course: HAULAGE
Lecturer: Dr Saša Stojadinović, assistant professor
Course status: Obligatory
ECTS: 6
Prerequisites: Basic knowledge on Mechanical engineering
Course goals: Understanding of haulage types and haulage capacity calculations especially in mining.
Learning outcome: Ability to independently select appropriate haulage system and equipment.
Course description: *Theory:* Introductory remarks. Mine haulage development through history. Types of loading and hauling. Railroad haulage. Truck haulage. Chain conveyors. Belt conveyors. Hydraulic transport. Aerial tramways. Hoisting. Other types of haulage. *Practice: Mine visits* *Practicals:* Capacity calculations for different haulage system types. Written report: Selection of appropriate haulage system and capacity definition.
Literature: *Recommended:* 1. V. Čokorilo, Mašine za utovar i transport u podzemnoj eksploataciji, RGF, Beograd, 2000. 2. M. Grujić, Transport i izvoz u rudnicima, RGF, Beograd, 1999. 3. D. Knežević, Transport u pripremi mineralnih sirovina, RGF, Beograd, 2000. *Supplementary:* Not specified

Number of classes per weak				Other classes:
Lectures: 3	Practicals: 2	Other forms of teaching:	Study research work:	

Methods of Teaching: Oral lectures, practicals, field work, discussion

Grading system(maximum number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active participation	10	Written exam	-
Practice	20	Oral exam	30
Preliminary examination	40		

31. PROFESSIONAL PRACTICE

Content

Study program: Mining Engineering	
Level of study: Undergraduate Academic Studies	
Course: PROFESSIONAL PRACTICE	
Lecturer: All lecturers on study program	
Course status: Obligatory course	
ECTS: 4 in VI semester; 3 in VIII semester	
Prerequisites: Enrolled VI semester (third year) and VIII semester (fourth year)	
Course goals: The aim of the professional practice is to instantly introduce students to industrial technological processes, process stages and integral, industrial process equipment, process control and regulation, as well as the organization of work safety and environmental protection. The professional practice of undergraduate academic studies as the first direct contact of students of the Mining Engineering study program with industrial production is of particular importance for understanding mining production, as a complex industrial activity, and ambient conditions of operation in its plants.	
Learning outcome: Training students to recognize previously acquired theoretical knowledge and apply it in real industrial production processes. By subliming the theoretical knowledge acquired in teaching activities and practical knowledge achieved by the realization of professional practice, students gain new quality and competences for better understanding, more efficient studying and independent preparation of final work.	
Course description: The content of professional practice is defined in agreement with the management of the company in which it is performed. All students of the Mining Engineering Study Program are visiting all phases of the technological process of production. In accordance with the election module, (M1: exploitation of deposits of mineral resources, M2: mineral processing or M3: recycling technologies and sustainable development), special contents of the professional practice for groups of students-individual modules, created by teachers-coordinators of professional practice, are formed in consultations with other teachers of the elective module.	
Number of classes per week	Other classes: 4
Methods of teaching: The professional practice of undergraduate academic studies is done in the sixth and eighth semester, every Friday in the week in industrial plants. The obligation of students on professional practice is to visit all stages of the production process, to collect all relevant technical and technological data and parameters of technological processes, to acquaint themselves with the technological process scheme, as well as to constantly consult with experts from the company in which the professional practice is realized, and the lecturer, the coordinator of professional practice. Upon completion of the professional practice, the student submits to the lecturer-coordinator a journal of professional practice describing all the activities in the technological process in the company where he was practicing. The lecturer-coordinator of the professional practice examines the journal of the professional practice by checking all the data in it and with his signature in the Student assessment booklet confirms that the student has successfully completed professional practice, which is a prerequisitesfor the certification of the sixth and eighth semesters.	
Grading system(max. number of points 100)	
	Number of points
Presence on professional practice:	50
Defense of professional practice:	50

32. TECHNOLOGY OF DRILLING AND BLASTING

Content

Study program: Mining engineering

Level of study: Undergraduate accademic studies

Course: TECHNOLOGY OF DRILLING AND BLASTING

Lecturer: Dr Radoje Pantović, full professor

Course status: Obligatory

ECTS: 6

Prerequisites: Basic knowledge on Mathematics, Physics and Materials mechanics

Course goals:
Understanding of drilling principles and blasting means, procedures for definition of drilling and blasting parameters, efficiency and safety measures.

Learning outcome:
Acquired knowledge represents the foundation for design and conduct of mining operations.

Course description:
Theory:
Purpose of drilling. Blasthole parameters. Percussive drilling. Rotary drilling and tricone bits. Drilling efficiency indicators. Mechanization and automation of drilling. Precision. Drill productivity. Drilling costs. Explosives. Dynamites. ANFO and Slurry explosives. Emulsion explosives. Explosive selection. Initiation systems. Explosive detonation and rock breakage. Theories of detonation. Theories of rock breakage. Energy balance of explosion. Surface mine blasting. Geometry of bench blasting. Explosive charge construction. Blasting results prediction. Blasting at tunneling. Purpose and types of cuts. Smooth blasting. Blasting parameters in underground mining. Blasting in methane conditions. Secondary blasting. Blasting safety. Ground vibrations, airblast, flyrock and toxic fumes
Practice:
Hammer - principles of operation. Drill capacity calculation. Blasting parameters calculations, timing analysis and blasting patterns. Practical practicals - explosives handling.

Literature:
Recommended:
1. Р. Пантовић, Технологија бушења, Технички факултет, Бор, 2004.
2. М. Савић, Минирање на површинским коповима, Институт за бакар, Бор, 2000.
Supplementary:
1. G. Berta, Exsplosives - an engineering tools, Italesplosivi, Milano, 1990.
2. S. Olofsson, Applied exsplosives technology for construction and mining, Arla, Sweden, 1988.

Number of classes per weak				Other classes:
Lectures: 3	Practicals: 2	Other forms of teaching:	Study research work:	

Methods of Teaching: Oral lectures, practicals, field work, discussion

Grading system(maximum number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active participation	10	Written exam	20
Practice	10	Oral exam	40
Written report	20		

33. TECHNOLOGY OF UNDERGROUND FACILITIES CONSTRUCTION

Content

Study program: Mining engineering

Level of study: Undergraduate Academic studies

Course: TECHNOLOGY OF UNDERGROUND FACILITIES CONSTRUCTION

Lecturer: Dr Dejan Petrović, assistant professor

Course status: Obligatory

ECTS: 6

Prerequisites: Completed course on Rock and soil mechanics

Course goals:
Understanding of the basic principles of tunneling, individual tunneling phases, working environment and its properties.

Learning outcome:
Necessary competences for independent underground facilities construction.

Course description:
Theory:
Introduction. Classification of underground facilities. Technological phases of construction: drilling, blasting, loading, hauling. Profile selection and sizing. Work environment - properties and classification of rock mass. Horizontal facilities - drives and tunnels. Drill and blast. Roadheaders. Inclined facilities - declines and inclines. Vertical facilities - shafts. Underground chambers. Scheduling and planning.
Practice:
Calculation and assignments which follow the lectures.

Literature:
Recommended:
1. P. Jovanović, Dimenzionisanje jamskih prostorija, radne operacije i definisanje radne sredine, Nauka i društvo, Beograd, 1983.
2. P. Jovanović, Izrada jamskih prostorija, Knjiga 1, Definicije i rudarske operacije, Rudarsko-geološki fakultet, Beograd, 1990.
3. P. Jovanović, Projektovanje i proračun podgrade horizontalnih podzemnih prostorija, Knjiga 1, Oblik, dimenzije, podgradni materijali, uslovi izgradnje i injektiranje, Rudarsko-geološki fakultet, Beograd, 1994.
4. P. Jovanović, Projektovanje i proračun podgrade horizontalnih podzemnih prostorija, Knjiga 2, Naponsko stanje u stenskom masivu i opterećenje na podgradu, Rudarsko-geološki fakultet, Beograd, 1994.
5. P. Jovanović, Projektovanje i proračun podgrade horizontalnih podzemnih prostorija, Knjiga 3, Konstruktivni oblici i proračun podgrade, Rudarsko-geološki fakultet, Beograd, 1995.

Supplementary:
1. V. Milić, Ž. Milićević, Osnovi eksploatacije ležišta mineralnih sirovina, Tehnički fakultet, Bor, 2005.

Number of classes per weak				Other classes:
Lectures: 3	Practicals: 2	Other forms of teaching:	Study research work:	

Methods of Teaching: Oral lectures, practicals, field work, discussion

Grading system(maximum number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active participation	10	Written exam	
Practice	25	Oral exam	65

34. EXPLORATION OF MINREAL DEPOSITS

Content

Study program: Mining Engineering				
Level of study: Undergraduate Academic Studies				
Course: EXPLORATION OF MINREAL DEPOSITS				
Lecturer: Dr Mira Cocić, associate professor				
Course status: Elective course				
ECTS: 6				
Prerequisites: Acquired knowledge in course on Mineral deposits				
Course goals: Introducing students to methods and resources for exploration of mineral deposits, methods of sampling and reserve calculation				
Learning outcome: Acquired knowledge presents groundwork for exploration deposits projecting, calculation of mineral reserves and modeling of deposits necessary for mining projecting				
Course description: *Theoretical part:* Basic research problems. Basic deposit types and their characteristics. Systematic and methodology of execution of exploration works. Geochemical and geophysical methods of exploration. Mining methods of exploration. Explorative drilling. Combined explorative works. Determination of quality of mineral deposits. Calculation of mineral reserves. Determination of parameters for calculation of reserves. Methods of calculation of mineral reserves. Classification and categorization of ore reserves. *Practical part*: Making of elaborate: Geological cross-section of deposits, geological interpretation of deposits based on drill-hole data, calculation of reserves.				
Literature: *Recommended:* 1. M. Cocić, Ž. Milićević, S. Cocić, Exploration of mineral deposits, University of Belgrade, Technical Faculty in Bor, Bor, 2016. 2. S. Gajić, Exploration of mineral deposits, Technical faculty, Bor, 1981.				
Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching:	Study research work:	
Methods of teaching: Lectures, practices, practical lectures, preliminary examinations				
Grading system(max. number of points 100)				
Pre-examination requirements		**Number of points**	**Final examination**	**Number of points**
Attendance and active participation		5	Written exam	
Practicals		5	Oral exam	45
Elaborate		15		
Preliminary examination		15		
Preliminary examination		15		

35. UNDERMINED GROUND MOVEMENT AND STRUCTURAL OBJECTS PROTECTION Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: UNDERMINED GROUND MOVEMENT AND STRUCTURAL OBJECTS PROTECTION

Lecturer: Dr Nenad Vušović, full proffesor

Course status: Elective course for Mining Engineering Study program

ECTS: 6

Prerequisites: Acquired knowledge in the courses on Geodesy and Mine Surveying

Course goals:
Introducing students to the problems of undermined ground movement process and protecting the structural objects from the impact of mining works, deformations that occur on the surface of the terrain and on objects in the zone of influence of mining works and the construction of protective pillars for natural and technical objects

Learning outcome:
Acquired knowledge in the field of the problem of undermined ground movement process and protection of structural objects from the influence of mining works, the geometric characteristics of the shift process, methods for forecasting the calculation of the displacement and deformation of the underground terrain, surveying of subsidence and deformations on structural objects

Course description:
A historical overview of the problem of undermined ground movement process. Terms, definitions and labels. Geometric characteristics of the ground movement process. Mining as a cause of subsidence. Overview the undermined ground movement process in the massif. Classification of methods for the estimation of displacement and deformation of the underground terrain. Stochastic calculation method. Estimations for mines with an unknown subsidence. Parameters of the greatest displacement and deformation. Angle parameters of the ground movement process. Survey of subsidence of undermined ground surface. Protective pillars. Criteria of protection and permitted deformation for certain categories of structural objects. Specificity of subsidence in metal mines.
Practicals:
Theoretical instruction will be followed through practical practicals of design of survey networks, survey data analysis, calculation of maximal values of subsidence and displacement, calculations of maximal subsidence, boundary angles and maximal subsidence angle, construction of protective pillars for shafts, civil engineering objects and roads.

Literature
Recommended:

3. N. Vušović, D. Đorđević, Methods for the estimation of undermined ground movement process, University of Belgrade- Faculty of Mining and Geology, Belgrade 2014.
4. M. Patarić, Undermined ground movement process and protection of structural objects, University of Belgrade Faculty of Mining and Geology, Belgrade, 1994.

Supplementary:

1. R. Obradović, Z. Milanović, Survey of deformations at mining facilities, Mining Institute, Belgrade, 1995.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching: 0	Study research work:	

Methods of teaching Lectures and practicals (task preparation)

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	20
Practicals	5	Oral exam	50
Preliminary examination			
Independent work	20		

36. PHYSICAL METHODS OF CONCENTRATION

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: PHYSICAL METHODS OF CONCENTRATION

Lecturer: Dr Jovica M. Sokolović, associate professor

Course status: Obligatory course for MP and RTSD modules

ECTS: 6

Prerequisites: Required knowledge on Mathematics I and Physics

Course goals:
Introducing students to theoretical and practical principles of physical methods of concentration.

Learning outcome:
Theoretical and practical training for work in scientific, educational, and economic organizations dealing with this issue.

Course description:
Theory:
Introduction. Methods of concentration. Choice of concentration method. Possibility of application and importance of physical concentration methods. The basic principles on which they are based, the state and tendencies of the development of physical concentration methods. Gravitational concentration. Characteristics of raw materials (mineral, technical, secondary and waste) that are important for the application of the gravity concentration process. Methodology of research and presentation of results. Industrial application of gravity concentration. Characteristics and properties of dense fluids. Regeneration of suspensions and organic liquids. Gravity concentration of raw materials in dense fluids, water and air. Technological processes and devices in processes of gravity concentration. Principles of creation of technological processes. Selection of machines and devices for process of gravity concentration. Control of gravity concentration process. Parameters and indicators of gravity concentration process. Measurement and regulation of individual parameters and devices for measurement and regulation.
Practical:
Laboratory and calculation practicals and other forms of teaching.

Literature
Recommended:
1. R. Ignjatović, Physical methods of concentration (in Serbian), Bor, 1983.
2. R. Ignjatović, Theory of gravity concentration (in Serbian), 1980.
3. N. Ćalić, Theoretical basis for the preparation of mineral raw materials (in Serbian), Belgrade, 1990.
Auxiliary:
1. M. Ignjatović, R. Ignjatović, M. Trumić, Principles of separator work with suspensions (in Serbian), Belgrade, 1999.
2. R. Ignjatović, M. Ignjatović, R. Stanojlović, Theoretical principles of the operation of static devices with electromagnetic valve in the gravity concentration of mineral raw materials (in Serbian), Bor, 1992.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching:
Theoretical classes are conducted with lectures and interactive consultations with the help of video equipment. Practicals are conducted in the laboratory in the form of calculation and laboratory practicals.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Поена**
Attendance and active participation	10	Written exam	
Practicals	20	Oral exam	30
Preliminary examination	2 x 20 = 40		
Independent work			

37. FLOTATION

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: FLOTATION

Lecturer: Dr Maja Trumić, assistant professor

Course status: Obligatory course

ECTS: 6

Prerequisites: Basic knowledge on mineralogy, petrography and physical chemistry

Course goals:
Acquiring knowledge on theoretical and practical principles on which processes of flotation of materials are based

Learning outcome:
Acquiring the necessary knowledge on the flotation of materials necessary for engineering activities in teaching, scientific and production organizations and institutions

Course description:
Theoretical teaching:
INTRODUCTION (history of flotation development, concept of phases in the flotation system, stages in the flotation process); FLOTATION SYSTEMS (phases-solid, liquid and gaseous, phenomena on border surfaces.); FLOTATION REAGENTS (functions of flotation reagents, classification of flotation reagents); ASSESSMENT OF FLOTATION PROCESSES (technological parameters - mass and technological recovery, concentration rate, flotation kinetics); FLOTATION MACHINES AND AUXILIARY EQUIPMENT (definitions of terms, type of flotation machines, hydrodynamics, energy efficiency, principles of increasing the flotation machines capacity based on the theory of similarity and dimensional analysis, contact vessels-conditioners, factors for sizing and equipment selection - flotation machines, conditioners, reagents and measurement devices; FLOTATING SCHEMES (basic and extended flotation, flotation purification, material balance).
Practicals-practicals:
Laboratory and calculation practicals according to the course of theoretical teaching.

Literature
Recommended:
1. S. Milošević, Flotacijska koncentracija, Bor 1994.
2. Z.S. Marković, Zbirka zadataka iz flotacije, Bor, 2003.
3. Z.S. Marković, Flotacione mašine i uređaji, Autorizovana predavanja (u elektronskom obliku)
Supplementary:
1. Lynch, G. Harbort and M. Nelson, History of Flotation, (AusIMM), Brisbane, 2010, ISBN1921522259.
2. S. Bulatovic, Handbook of Flotation Reagents, Elsevier, 2007. ISBN 0444530290.
3. Cytec, Mining Chemical Handbook, 2010, Cytec Industries, Inc. ISBN 978-0-615-33190-4.
4. J.A.Finch and G.S.Dobby, Column Flotation, Pergamon Press, 1983. ISBN 0-08-040186-4.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 2	Other forms of teaching: 1	Study research work:	

Methods of teaching: Lectures with interactive work with students, practical work through laboratory and calculation practicals. Pre-examination of knowledge through two preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	20	Written exam	20
Practicals	20	Oral exam	20
Preliminary examination 1	10		
Preliminary examination 2	10		

38. BASICS OF MINING ENGINEERING

Content

Study program: Mining Engineering
Level of study: Undergraduate Academic Studies
Course: BASICS OF MINING ENGINEERING
Lecturer: Dr Dejan Petrović, assistant professor
Course status: Elective
ECTS: 6
Prerequisites: Completed second year courses
Course goals: Understanding of basic concepts and processes mining engineering
Learning outcome: Acquiring the necessary knowledge on the basics of mining engineering technologies.
Course description: Mineral deposits: types of deposits according to basic characteristics (thickness, inclination, ore grade). Exploration: prospection, exploration and validation. Calculation, classification and categorization ore reserves. Productivity. Technological phases of mining: drilling and blasting, loading and hauling, roof supporting, ventilation and dewatering of mine. Drifting: horizontal and inclined drifts, vertical shafts. Classification of drifts according to functionality, profile, support type, location. Drifting using drilling and blasting method. Drifting by TBM and roadheaders. Underground mining. Surface mining.
Literature: *Recommended:* 1 V. Milić, Ž. Milićević. Basic of exploitation of mineral deposits. Technical Faculty in Bor,2005. *Supplementary:* 1. B. Gluščević. Otvaranje i metode podzemnog otkopavanja rudnih ležišta, Minerva Belgrade 1974 2. B. Genčić Tehnološki postupci podzemne eksploatacije slojevitih ležišta, Bureau for textbooks and teaching aids of Serbia, Belgrade, 1971.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 0	Other forms of teaching:	Study research work:	
Methods of teaching				

Grading system(max. number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	30	Written exam	
Practicals		Oral exam	70
Preliminary examination			
Independent work			

39. FUNDAMENTALS OF THE EXTRACTIVE METALLURGY

Content

Study program: Metallurgical Engineering, Mining Engineering

Level of study: Undergraduate Academic Studies

Course: FUNDAMENTALS OF THE EXTRACTIVE METALLURGY

Lecturer: Dr. Nada Štrbac, full professor

Course status: Elective course for study program Metallurgical Engineering and Obligatory course for study program Mining Engineering

ECTS: 6

Prerequisites: Knowledge on Physical chemistry and Mineralogy and petrography is required

Course goals:
The objective of the course is to transfer basic knowledge in the field of metal production from primary and secondary raw materials of ferrous and non-ferrous metallurgy to the students

Learning outcome:
After completing the course, students have the necessary knowledge of the basics of extractive metallurgy of iron and steel, non-ferrous and rare metals.

Course description:
Lectures:
The concept and division of metallurgy. Metal properties. Basic characteristics of pyrometallurgical, hydrometallurgical and electrometallurgical processes. Metallurgical slags. Refractory materials. Metallurgical fuels. General concepts of technical iron. Classification of iron. Classification of the iron production processes. Raw materials for the production of iron and their preparation. Production of iron in a blast furnace. Manufacturing of iron by other methods. General terms about steel. Classification of steel. Classification of the steel production processes. Raw materials and materials for the steel production. An overview of the processes for the steel production.
Basics of extractive metallurgy of non-ferrous and rare metals (copper, nickel, aluminum, lead, zinc, vanadium, molybdenum, uranium and titanium). Classification of non-ferrous and rare metals. Basic raw materials. Review of the technological procedures for obtaining each metal separately.
Metallurgy of secondary raw materials. Processing of secondary raw materials, collection, sorting, cleaning, melting, refining. Metals and alloys obtained from secondary raw materials.
Environmental protection in extractive metallurgy. Problems of purification of gases, wastewaters and treatment of metallic slags.

Literature
Recommended:
1. N. Štrbac, D. Živković, Osnovi ekstraktivne metalurgije, Autorizovana predavanja, TF Bor, 2012. *(in Serbian)*
2. F. Habashi, Principles of extractive metallurgy, Laval University, Quebec, Canada, 2008.
Supplementary:
1. R.Vračar, Teorija i praksa dobijanja obojenih metala, SIMS, Beograd, 2010. *(in Serbian)*
2. V. Trujić, N. Mitevska, Metalurgija gvožđa, Institut za bakar Bor, 2007. *(in Serbian)*
3. M. Gojić, Metalurgija čelika, Denona, Zagreb, 2005. *(in Serbian)*
4. B. Đurković, D. Đurković, Metalurgija retkih metala, Tehnološko-metalurški fakultet, Beograd, 1991. *(in Serbian)*
5. Ž. Kamberović, D. Sinadinović, M. Korać, Metalurgija zlata i srebra, SIMS, Beograd, 2007. *(in Serbian)*
6. T.Volkov Husović, Vatrostalni materijali, svojstva i primena, SIMS, Beograd, 2007. *(in Serbian)*
7. T.Volkov Husović, K. Raić, Goriva i sagorevanje, SIMS, Beograd 2008. *(in Serbian)*

Number of classes per week				Other classes:
Lectures: 2	Practicals:	Other forms of teaching:	Study research work:	

Methods of teaching: Lectures are organized on an interactive basis, with the development of practical examples through group and individual work.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals		Oral exam	60
Preliminary examination	10		
Independent work	20		

40. MANAGEMENT AND TREATMENT OF WASTE

Content

Study program: Mining engineering

Level of study: Undergraduate Academic Studies

Course: MANAGEMENT AND TREATMENT OF WASTE

Lecturer: Dr Milan Ž. Trumić, full professor, Dr Ljubiša D. Andrić, full professor

Course status: Obligatory for module RTOR

ECTS: 6

Prerequisites: None

Course goals:

Theoretical and practical training of students with a system of integrated waste management and methods for waste treatment.

Learning outcome:

Students are able to master the course on Recycling Technology, as well as to apply the acquired knowledge in the preparation and implementation of an integrated waste management plan

Course description:

Theory teaching:

Introduction. Review of legislation. Overview of solid waste management strategies and plans. Municipal waste: Waste generation, Waste classification, Waste collection, Waste transportation, Waste treatment methods, Waste disposal. Industrial waste: Preservation of natural resources, Treatment Hazardous waste treatment, Disposal of hazardous waste. Mining waste: types and origin of mining waste, Possibilities for utilization of mining waste. Radioactive waste: The formation of radioactive waste, Recycling of radioactive waste, Deposit of radioactive waste.

Practical teaching:

Getting to know the content of the waste management plan and budget and analyzing the necessary data for making it.

Literature:

Recommended:

1. M. Ristic and M. Vuković, Solid Waste Management, Solid Waste Processing Technology, TF, Bor, 2006. 2.National
2. Strategy for Integrated Solid Waste Management, Ministry of Natural Resources and Environmental Protection, Belgrade, 2003.
3..Regional Waste Management Plan, REC, Belgrade, 2004.
4.Municipal Waste Management Plan, REC, Belgrade, 2003.

Supplementary:

1.M.Ilic , S. Miletic, Solid Waste Management Basis, Institute for Material Testing, Belgrade, 1998.
2.Енглеско-српски речник терминологије у области управљања отпадом, ОЕБС, Београд, 2004
English-Serbian Dictionary of Waste Management Terminology, OSCE, Belgrade, 2004.

Number of active classes				Other classes:
Lectures: 3	Activities: 3	Other forms of teaching	Study research	

Methods of teachng

Theoretical lectures are conducted in lectures and practical in the form of elaborate studies according to the interactive principle with the active participation of students..

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final exam**	**Number of points**
Attendance and active participation	10	Written exam	
Activity during the practicals	10	Oral exam	40
Practical work	20		
Preliminary examination	20		

41. OCCUPATIONAL SAFETY

Content

Study program: Mining engineering				
Level of study: Undergraduate Academic Studies				
Course: OCCUPATIONAL SAFETY				
Lecturer: Dr Saša Stojadinović, assistant professor				
Course status: Obligatory				
ECTS: 4				
Prerequisites: Acquired knowledge and basic understanding of mining operations				
Course goals: Acquiring theoretical and practical knowledge on occupational safety and health in mining and mineral processing.				
Learning outcome: Danger identification and assessment. Injuries and occupational diseases reporting and analysis. Hazardous gasses concentration measurement and protective and preventive measures planning. Personal breathing protection. Principles of technical safety organization and management.				
Course description: *Theory:* Regulations in the field of occupational safety in mining. Ergonomics and work safety in mining. Occupational injuries and diseases. Sources of professional diseases and prevention. Gasses. Dust. Mine fires. Mine explosions. Flooding. Other sources of danger. Technical protective measures. Personal protective equipment. Rescue and first aid service and rescue plans. Environmental impacts. Remediation and reclamation of degraded areas. *Practice:* Laboratory practicals, mine visits and personal assignments.				
Literature: *Recommended:* 1. V. Jovičić, M. Miljković, J. Nuić, H. Uljić, Sigurnost i tehnička zaštita u rudnicima, Tuzla, 1987. 2. Mining act. 3. Legal and sublegal safety and health acts. *Supplementary:* 1. M. Miljković, Rudarske katastrofe, Monografija, Institut za bakar, Bor, 2003. 2. M. Miljković, Rudarska ergonomija, TF, Bor, 2002.				
Number of classes per weak				Other classes:
Lectures: 3	Practicals: 2	Other forms of teaching:	Study research work:	
Methods of Teaching: Oral lectures, practicals, field work, discussion				

Grading system(maximum number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active participation	10	Written exam	
Practice	20	Oral exam	40
Preliminary examination	30		

42. MINE VENTILATION

Content

Study program: Mining engineering				
Level of study: Undergraduate Academic Studies				
Course: MINE VENTILATION				
Lecturer: Dr Vitomir Milić, full professor				
Course status: Elective				
ECTS: 8				
Prerequisites: Completed courses on the third year of the studies.				
Course goals: Theoretical fundaments and systems of mine ventilation.				
Learning outcome: Individual competences for mine ventilation management.				
Course description: *Theory:* Composition of mine air. Basic – permanent components of mine air. Impurities in mine air. Methane. Mine dust. Properties of mine air. Pressure, temperature, humidity, density and enthalpy. Fundamentals of mine ventilation. Basic laws of aerostatics and aerodynamics. Aerodynamic resistance of mine drives. Mine ventilation networks. Air quantity calculations. Properties of mine and mine drives. Air motion laws in mines ventilation networks. Analytic and graphic calculation methods. Natural depression – compression. Artificial depression – compression. Fans. Fan properties and selection. Air regulation in mines. Ventilation equipment. Auxiliary ventilation systems. Compressed air supply. Open pit mine ventilation. *Practice:* Assignments and calculation practicals.				
Literature: *Recommended:* 1. V. Jovičić, Ventilacija rudnika, Novi dani, Beograd, 1973. 2. M. Miljković, D. Bogdanović, Ventilacija rudnika, Institut za rudarstvo i metalurgiju, Bor, 2002. *Supplementary:* 1. K. Đinović, A. Cvjetić, Eksploatacija rudničkih ventilatora, Beograd				
Number of classes per weak				Other classes:
Lectures: 3	Practicals: 2	Other forms of teaching:	Study research work:	
Methods of Teaching: Oral lectures, practicals, field work, discussion				
Grading system(maximum number of points 100)				
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**	
Active participation	10	Written exam		
Practice	30	Oral exam	60	
Preliminary examination				

43. ENVIRONMENTAL PROTECTION

Content

Study programs: Technological Engineering, Mining Engineering

Level of study: Undergraduate Academic Studies

Course: ENVIRONMENTAL PROTECTION

Lecturer: Dr Maja Nujkić, assistant professor

Course status: Elective course for Technological Engineering and Mining Engineering

ECTS: 8

Prerequisites: Acquired fundamental knowledge on General chemistry

Course goals:

Acquiring fundamentals knowledge on sources which affect the relationship between different parts of the environment due to anthropogenic impacts and consideration of possibilities to improve the quality of the environment.

Learning outcome:

Learning fundamentals about new measures, in regard to technology, to recover damaged ecosystems, and improve the state of basic abiotic ecological factors.

Course description:

Theoretical instruction:

Fundamental terms: pojmovi (or principles) of the environment and ecology. Genesis and evolution of the environment and life on earth. Anthropogenic factor – the driving force in the environment. Changes in environmental factors (pollution) and their impact on ecology and humans. Sustainable development and protection of environmental factors. Environmental importance of air and its composition air. Sources and classification of air pollutants. Protection of air and climate. Drinking and wastewaters. Water quality and improvement of water purification technologies. Water protection. The importance and composition of the soil. Pollution sources and categories of soil contamination. Remediation technology for contaminated soil. Influence of accident and natural disasters on environmental factors. Cycling of polluted materials in nature and their degradation.

Practical instruction:

Practicals, Other forms of teaching, Study research work

Calculation examples and experiments related to monitoring and determination of the air, water, and soil pollution, and their purification.

Literature

Recommended:

1. M. Vuković, Osnovi ekologije, Grafomed-trade, Bor, 2005.

Supplementary

1. J. Hodolič, M. Badida, M. Majernik, D. Šebo, Mašinstvo u inženjerstvu zaštite životne sredine, Fakultet tehničkih nauka, Novi Sad, 2005.
2. B. Škrbić, Polihlorovani bifenili, Tehnološki fakultet, Novi Sad, 2003.

Number of classes per week				Other classes:
Lectures: 3	Practicals:	Other forms of teaching: 2	Study research work:	

Methods of teaching (or Teaching methods)

Lecturing with interactive discussions, calculation and laboratory practicals, consultations and preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	10	Oral exam	50
Preliminary examination			
Independent work	30		

44. SURFACE MINING TECHNOLOGY

Content

Study program: Mining engineering

Level of study: Undergraduate Academic Studies

Course: SURFACE MINING TECHNOLOGY

Lecturer: Dr Miodrag Žikić, full professor

Course status: Obligatory

ECTS: 6

Prerequisites: Completed Mining Equipment and Machinery course.

Course goals:
Acquiring knowledge on surface mining technologies.

Learning outcome:
Individual competences for surface mining technology selection and parameters calculation.

Course description:
Theory: Introductory remarks. Historic development. Significance. Present state and trends in surface mining. Application conditions. Terminology. Technology of surface mining in horizontal and sub-horizontal deposits. Surface mining of steep deposits. Quarrying. Overburden disposal technology. Pit and dump slope stability. Surface mining systems – classification and properties. Environmental aspects of surface mining. Remediation and reclamation of degraded land.
Practice:
Mine visits.
Practicals:
Assignment – surface mine design for given ore deposit. Definition of geometric parameters, necessary g equipment selection and productivity calculation in accordance to mine design regulations.

Literature:
Recommended:
1. . V. Popović, Tehnologija površinske eksploatacije, RGF, Beograd, 1992.
2. V. Pavlović, Sistemi povšinske eksploatacije, RGF, Beograd, 1998.
3. A. Lazić, Projektovanje površinskih kopova, RGF, Beograd, 1998.

Supplementary:
1. N. Popović, Naučne osnove projektovanja površinskih kopova, NIRO, Zajednica, Oslobođenje, Sarajevo, 1984.
2. V. Pavlović, Rekultivacija povšinskih kopova i odlagališta, RGF, Beograd, 2000.

Number of classes per weak				Other classes:
Lectures: 3	Practicals: 3	Other forms of teaching:	Study research work:	

Methods of Teaching:
Oral lectures, practicals, field work, discussion

Grading system(maximum number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Active participation	10	Written exam	
Assignment	40	Oral exam	45
Practice	5		

45. UNDERGROUND MINING TECHNOLOGY

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: UNDERGROUND MINING TECHNOLOGY

Lecturer: Dr Vitomir Milić, full proffesor

Course status: Obligatory

ECTS: 6

Prerequisites: Acquired knowledge in the occupational courses on undergraduate studies

Course goals:
Introduction to basic technological processes of underground mining: opening, development and extraction

Learning outcome:
Individual competences for work in an underground mine, underground mine design and mine management.

Course description:
Lectures:
Introduction. Underground mining in Serbia. Importance, types and characteristics of mineral resources from the aspect underground mining. Classification of deposits from the aspect of mining method selection. Technological phases of underground mining: opening, development, drifting and crosscutting and excavation. Mine opening. Location of openings. Development of horizontal, slightly inclined and steep coalseams. Development of ore deposits. Development by horizons. Development optimization, the width of the excavation panels and the height of the horizons. Preparation for excavation. Undercutting and trenching. Excavation. Coal mining. Hard rock mining. Drilling and blasting. Ventilation. Loading and hauling. Support. Backfill. Indicators of mining methods: productivity, capacity, advance, development factor, excavation effects, norms, ore recovery, ore loss and ore dilution. Operating costs. Flow theory in sublevel and block caving methods.
Practicals:
Personal assignments and specific cases of mine opening, development and operation design.

Literature:
Recommended:
1. Milićević Ž., Milić V. Underground mining technology of mineral deposits. Bor 2013
2. B. Gluščević. Mine development and underground mining methods for ore deposits (in Serbian: Orvaranje i metode podzemnog otkopavanja rudnih ležišta) Minerva Belgrade 1974
3. B. Genčić Technological processes of underground mining of stratified deposits(in Serbian: Tehnološki postupci podzemne eksploatacije slojevitih ležišta), Bureau for textbooks and teaching aids of Serbia, Belgrade, 1971.
Supplementary:
1. Ž. Milićević, Underground mining methods. Bureau for textbooks and teaching aids of Serbia, Belgrade, 1998.
2 Ž. Milićević, Sublevel and block caving methods. Monography- electronic only. 2010.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 3	Other forms of teaching:	Study research work:	

Methods of teaching

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	30
Practicals	25	Oral exam	40
Preliminary examination			
Independent work			

46. GEOINFORMATION TECHNOLOGIES

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: GEOINFORMATION TECHNOLOGIES

Lecturer: Dr Nenad Vušović, full proffesor

Course status: Elective course for Mining Engineering Study program

ECTS: 6

Prerequisites: Acquired knowledge in the course on Geodesy and Mine Surveying

Course goals:
Acquiring basic theoretical and practical knowledge in the field of geoinformation technologies

Learning outcome:
Introducing students to geoinformation technologies, measurement methods, processing of measurement results for the needs of geoinformatics, geobase and GIS

Course description:
Presentation of Earth's shape. Geodetic dates. Date transformation. Geographic coordinate systems. Reference systems: Spatial reference system. Horizontal reference system. Vertical reference system. Gravimetric reference system. Astronomical reference system. Coordinate systems of Serbia. Cartographic projections. Gauss-Kriger's projection. Merkaton projection. UTM projection. Global Navigation Satellite System-GNSS: Development of Navigation and Satellite Systems. Radio navigation systems. Inertial and radar navigation systems. Development of satellite navigation systems. Global Positioning System-GPS. GPS segments. Standards of accuracy. Gathering GPS data. Application of GPS technology in geodetic works and mining. Photogrammetry: Theoretical basics and principles of photogrammetry. Types of photogrammetry. Acquisition of images and data. Recording resolution. Accuracy of photogrammetry. Coordinate systems and transformations. Orientation elements stereopar. Photogrammetric recording. Terestical photogrammetry. Terrestrial measuring cameras. Aerofotogrametry. Platforms and digital cameras for aerial recording. Measurement of control and binding points. Digital terrain model (DTM). Orthophoto plan. Photogrammetric scanners. Application of photogrammetry in mining. Remote detection: Basic principles of remote detection. Platforms in remote sensing. Methods of remote detection. Sensors for remote sensing. Simultaneous Multispectral Platform. Satellite platforms of medium and low resolution. High-resolution satellite platforms. Overview of satellite systems. Receiving data from satellites. Processing and image analysis. Laser scanning. Laser scanning technology. Terrestrial laser scanning. Aerial laser scanning. Laser scanner. Application of LIDAR. Field analysis. Laser scanning of terrains and objects. 3D laser scanners-HDS. Application of 3D laser scanners in mining.
Practicals:
Theoretical instruction will be demonstrated during practicals

Literature:
Recommended:

5. N. Vušović, Geoinformation technologies - Authorized lectures, University at Belgrade-Technical facultu in Bor, 2012.
6. S. Vujić, Mining multifunctional GPS, Faculty of Mining and Geology, Belgrade, 2008.

Supplementary:

7. B. Božić, Global Positioning System, Higher Geodetic School, Belgrade, 2010.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching: 0	Study research work:	

Methods of teaching: Lectures and practicals (task preparation)

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	
Practicals	5	Oral exam	70
Preliminary examination			
Independent work	20		

47. MINERAL PROCESSING

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: MINERAL PROCESSING

Lecturer: Dr Jovica M. Sokolović, associate professor

Course status: Elective course for ELMS module

ECTS: 6

Prerequisites: Previously acquired knowledge in the study program

Course goals:

Introducing mining students, the ELMS module, to basic characteristics of mineral raw materials and basic technologies for preparing them (crushing, grinding, gravity, magnetic and electrostatic concentration, flotation and chemical methods of concentration.

Learning outcome:

Additional training of mining engineers, ELMS module, for work in the field, plants for the preparation of mineral resources and for better understanding and professional communication with the engineers of preparation of mineral raw materials, as a complementary professional module in the mining scientific and professional field.

Course description:

Theory:

Introduction. Mineral raw materials. Division, chemical composition, mineral composition, physical and physical-chemical properties of mineral raw materials. Preparation of raw materials, crushing and grinding, screening and grading of raw materials and products of concentration. Methods of concentration of mineral raw materials. Theory and practice of gravity concentration, magnetic and electrostatic concentrations, flotation and chemical concentration methods. Technological indicators of the concentration process: exploitation and product quality. Drainage of concentrate products and repository housing. Auxiliary operations in mineral processing. Industrial application of mineral processing

Practical:

Laboratory and calculation practicals and other forms of teaching.

Literature

Recommended:

1. D. Knežević, Mineral processing (in Serbian), RGF, Belgrade, 2001.
2. N. Ćalić, Theoretical basis for the preparation of mineral raw materials (in Serbian), Belgrade, 1990.
3. Đ. Lešić, S. Marković, Mineral processing (in Serbian), Belgrade, 1968.

Auxiliary:

1. N. Magdalinović, Comminution and classification (in Serbian), Belgrade, 1999.
2. N. Magdalinović, Comminution and classification of mineral raw materials – Practicum (in Serbian), Bor, 1985.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching:	Study research work:	

Methods of teaching: Theoretical lectures (module ELMS) about processes of characterization of raw materials and mineral processing processes, as a phase of mining activity. Practical teaching refers to laboratory practicals and experiments in the same scientific field.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	20	Oral exam	30
Preliminary examination	20		
Independent work	20		

48. SPECIAL METHODS OF CONCENTRATION

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: SPECIAL METHODS OF CONCENTRATION

Lecturer: Dr Jovica M. Sokolovic, associate professor

Course status: Obligatory course for MP and RTSD modules

ECTS: 6

Prerequisites: Required knowledge in the course on Physics and Physical methods of concentration.

Course goals:
Study of principes and special properties of mineral and secondary raw materials of special concentration methods.

Learning outcome:
Training and preparing students for work in all plants, where there is a need to apply special methods of concentration.

Course description:
Theory:
Introduction. Types and division of special concentration methods. Possibility of application and importance of special methods in the concentration of mineral and secondary raw materials. Magnetic concentration. Magnetic properties. Magnetic field. Magnetic force of attraction. Magnetic systems. Devices for magnetic concentration. Behavior of the grain of the magnetic and non-magnetic fractions in the magnetic field of the separator. Application of magnetic concentration. Electrical methods of concentration. Electrical properties. Electric field. Electrostatic force and electromotive force. Effect of electric field on conductor, semiconductor and non-conductive particles. Grain electrification. Electrostatic concentration, corona and corona-electrostatic pyroelectrostatic, triboelectrostatic and dielectric concentration. Devices in the processes of electrical methods of concentration. Application of electrical method of concentration. Optical methods of concentration. The principles of optical method of concentration. Devices for optical concentration. Control and regulation. X-ray and radiometric methods of concentration. Concentration by disintegration and decrypitation. Other special concentration methods. Devices and industrial applications.
Practical:
Laboratory and calculation practicals and other forms of teaching.

Literature
Recommended:
1. R. Ignjatović, Physical methods of concentration (in Serbian), Bor, 1983.
2. N. Ćalić, Theoretical basis for the preparation of mineral raw materials (in Serbian), Belgrade, 1990.
3. M. Ignjatović, Magnetic separation, new trends in the preparation of mineral resources (in Serbian), Belgrade, 1997.
Auxiliary:
1. J. Svoboda, Magnetic techniques for the treatment of materials, Springer, 2004.
2. J. Drzymala, Mineral Processing. Foundations of theory and practice of minerallurgy, Wroclaw, 2007.
3. O. Ralston, Electrostatic separation of mixed granular solids, Elsevier, Amsterdam, 1961.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 1	Study research work:	

Methods of teaching: Theoretical classes are conducted with lectures and interactive consultations. Practicals are conducted in the laboratory in the form of calculation and laboratory practicals.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	20	Oral exam	30
Preliminary examination	2 x 20 = 40		
Independent work			

49. WASTE WATERS

Content

Study program: Mining Engineering and Technological Engineering

Level of study: Undergraduate Academic Studies

Course: WASTE WATERS

Lecturer: Dr Grozdanka D. Bogdanović, full professor

Course status: Obligatory course

ECTS: 6

Prerequisites: Required knowledge on Chemistry and Physical Chemistry

Course goals:
The aim of the course is to introduce students to the classification of wastewater, waste water treatment and industrial methods for their purification and further treatment.

Learning outcome:
Obtaining the necessary engineering knowledge on modern technologies of processing industrial and municipal wastewater.

Course description:
Theoretical instruction:
Introductory part: classification of wastewater - by species, by composition, by way of formation; requirements for the degree of wastewater treatment - legal regulations, treatment options. Industrial methods for wastewater treatment: chemical methods (neutralization, precipitation, destructive methods), physico-chemical methods (adsorption, hemisorption - ion exchange), flotation processes, solvent extraction, membrane processes, electrochemical processes (reduction of metal ion, anode oxidation of organic compounds, electrodialysis), biochemical methods, combined processes. Basic and auxiliary wastewater treatment operations: separation of suspensions (thickening, clarification, filtration, drying). Sludge treatment.
Practical instruction:
Practicals, Other forms of teaching, Study research work, Laboratory practicals and seminar paper.

Literature
Recommended:
1. D. Ljubisavljević, A. Đukić, B. Babić, Prečišćavanje otpadnih voda, Građevinski fakultet, Univerzitet u Beogradu, Beograd, 2004.
2. V. Stanković, Fenomeni prenosa i operacije u metalurgiji 1 i 2, Univerzitet u Beogradu, Tehnički fakultet u Boru, Bor, 1998.
3. Zakon o vodama, Sl. List, Uredba o MDK u vodama i druga legislativna dokumentacija.

Supplementary:
1. F. Habashi, A Textbook of Hydrometallurgy, Metallurgie Extpactive Quebec, Enr., 1992
2. N.P. Cheremisinoff, Handbook of Water and Wastewaters Treatment Technologies, N&P Ltd Butterworth and Heinemann, Boston, USA, 2002
3. Ch. Comninelis, Technologie Chimique et Biologie de L'environement, SB, EPFL, Swiss, 2004

Number of classes per week				Other classes:
Lectures: 2	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching:
Classical lectures with interactive discussions, laboratory practicals and independent work.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	10	Oral exam	40
Preliminary examination			
Independent work	40		

50. DEWATERING AND TAILING

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: DEWATERING AND TAILING

Lecturer: Dr Grozdanka Bogdanović, full professor, Dr Milan Trumić, full professor

Course status: Elective course

ECTS: 6

Prerequisites: Previously acquired knowledge from relevant courses

Course goals:
Introducing students to methods for dewatering and disposing of products formed by the mineral processing and concentration.

Learning outcome:
Theoretical and practical training of students for work in scientific, educational, state and economic organizations in the field of dewatering and disposal of products formed by the mineral processing and concentration.

Course description:
Theory teaching:
Dewatering: Introduction. Drenering. Thickening: general principles and devices, modeling the thickener, the effect of the reagent on thickening. Centrifugation: general terms and theoretical basis of the process, devices and calculation of centrifuges. Filtering: general terms about the process, *basic filtering laws,* filtering devices, technological indicators of filtering process and influencing factors. Drying: general terms about the process, calculation of drying plants, drying devices. Tailing: General terms and definitions. Criteria for selecting locations for tailings. Types of tailings. Locating the tailings. Material for tailing construction and formation. Tailing observation. Tailing and environment. Waste water for mineral process plant.
Practical teaching:
Practicals: Sedimentation curve, Specific surface thickening and filtering, Technological indicators of thickening and filtering process. Show practicals with analysis of the construction process and exploitation of the tailings.
Other forms of teaching: Sedimentation in the censuses, Laboratory testing of the filtration process, Examples of the dewatering process in mineral processing.

Literature
Recommended:
1. P.Aћић, N.Magdalinović, M.Trumić, Lj.Šutulović, Odvodnjavanje i jalovišta, Nauka, Beograd, 2001.

Supplementary:
1. Ladislav Svarovsky, Solid-Liquid Separation, Fourth Edition, Butterworth-Heinemann, 2000.
2. Projects and studies.

Number of classes per week				Other classes:
Lectures: 1	Practicals: 1	Other forms of teaching: 1	Study research work:	

Methods of teaching: Theoretical teaching is conducted with lectures, practical in the form of calculating, laboratory and demonstration practicals according to the interactive principle with the active participation of students.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	20	Oral exam	40
Preliminary examination	30		
Independent work			

51. REAGENTS IN MINERAL PROCESSING

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: REAGENTS IN MINERAL PROCESSING

Lecturer: Dr Zoran Štirbanović, assistant professor

Course status: Elective course for module MP

ECTS: 6

Prerequisites: Acquired knowledge in the course on Organic Chemistry

Course goals:
Introducing students to theoretical and practical procedures for the handling of chemicals (reagents) used in mineral processing.

Learning outcome:
Theoretical and practical training of students for work and proper handling of chemicals (reagents) in laboratories and mineral processing facilities.

Course description:
Theoretical lectures: Introduction. Inorganic and organic chemical compounds used in mineral processing, classifications and divisions. IUPAC titles. CAS No. and MSDS (methods of describing types of chemicals and instructions for handling and personal protection). Classification of chemical compounds by function of application in particular technological operations in mineral processing laboratories and plants, (in classification, flotation, gravity separation, leaching and dewatering).
Practical lectures: Laboratory practicals according to the program of theoretical lectures are based on testing, preparation and application of reagents in the relevant technological operation in the mineral processing.

Literature
Recommended:
1. Z. S. Marković, Reagensi u PMS, Skripta autorizovanih predavanja u elektronskom obliku.
2. D. Salatić, Flotacijski reagensi, Beograd, 1987.
3. S. Alagić, Toksikologija, TF, Bor, 2012.
Supplementary:
1. Workplace Hazardous Materials Information System (WHMIS): A Guide to the Legislation. Queen's Printer for Ontario, 2008. ISBN 978-1-4249-6997-5 (PDF), ISBN 978-1-4249-6995-1, (Print).
2. WHMIS Handbook, Dalhousie Univ., Issued by the Environmental Health & Safety Office, 2001.
3. OHSAH MSDS Database User Guide, Occupational Helth & safety Agency for Healthcare in BC, Canada, 2010.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 1	Other forms of teaching: 1	Study research work:	

Methods of teaching: Lectures with interactive work with students, practical work through laboratory and calculation practicals. Pre-examination of knowledge through two preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	25	Written exam	
Practicals	25	Oral exam	40
Preliminary examination	10		
Independent work			

52. TECHNOGENIC WASTE MATERIALS PROCESSING

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: TECHNOGENIC WASTE MATERIALS PROCESSING

Lecturer: Dr Grozdanka Bogdanović, full professor

Course status: Elective course

ECTS: 6

Prerequisites: Required knowledge in the Mineral processing and Environmental protection

Course goals:
Introducing students to technogenic waste materials and modern technologies for recycling and neutralization

Learning outcome:
Theoretical and practical training for solving the problem of recycling of technogenic and hazardous waste materials

Course description:
Theoretical instruction:
Introductory part: mining, metallurgy and thermal power plants as technogenic waste materials producers. Mining technogenic waste from exploitation and mineral processing. Mining dumps, mining tailings, flotation tailings, mining wastewaters. Characteristics of mining technogenic waste; technologies and processing. Process control, economic and environmental effects of processing. Metallurgical technogenic waste; slag and dust. Characteristics of metallurgical technogenic waste; technologies and processing. Process control, economic and environmental effects of processing. Thermo-energy technogenic waste, slag, ash, dust, wastewater. Characteristics of waste of thermal power plants; technologies and processing; process control, economic and environmental effects. Techno-economic sustainability and ecological acceptability of the proposed technologies for technogenic waste materials processing.
Practical instruction:
Study and interpretation of technologies and technological schemes for technogenic waste materials processing. Interactive analysis of existing schemes and creation of new technologies of technogenic waste materials processing to the given conditions. Defining technological, economic and environmental indicators.

Literature
Recommended:
1.M. Ristić, M. Vuković, Upravljanje čvrstim otpadom – tehnologije prerade i odlaganja čvrstog otpada, Bor, 2006.
2.B. Branković, Postupci i uređaji za recikliranje otpadnog materijala, Beograd, 2002.
Supplementary:
1.Frank Woodard, Industrial waste treatment handbook, Butterworth-Heinemann, 1st edition, ISBN 0-7506-7317-6, Hardcover, 2001.
2.M. Ilić, Osnovi upravljanja čvrstim otpadom, Beograd, 1998.
3.F. Barbič, Recikliranje otpadnog materijala i sekundarnih sirovina u funkciji zaštite životne sredine, Beograd, 1995.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 1	Other forms of teaching: 1	Study research work:	

Methods of teaching: Lectures and practicals organized on an interactive principle.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	20	Oral exam	30
Preliminary examination	20		
Independent work	20		

53. ALTERNATIVE AND RENEWABLE ENERGY SOURCES

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: ALTERNATIVE AND RENEWABLE ENERGY SOURCES

Lecturer: Dr Zoran Štirbanović, assistant professor

Course status: Elective course for module RTSD

ECTS: 6

Prerequisites: Acquired knowledge in the course on General Chemistry

Course goals:
Introducing students to theoretical and practical principles on which alternative and renewable energy sources are based.

Learning outcome:
Theoretical and practical training for work in scientific, educational and industrial organizations dealing with this issue.

Course description:
Theoretical lectures:
The notion of alternative and renewable energy sources. First and second law of thermodynamics. Conversion of energy from one form to another and losses, storage and energy transfer. Types of alternative and renewable energy sources: biomass, biogas, biodiesel, bioethanol, solar energy, wind energy, sea-wave energy, tidal energy, geothermal energy, fission and cold fusion energy, fuel cells, mini-hydroelectric power plants. Industrial and municipal waste as alternative energy sources (gasification, classical combustion, fluid bed combustion, PEPS technology, liquefaction technology and the production of liquid fuels and generator gas).
Practical lectures:
Practical lectures are conducted in laboratories in the form of experimental and calculation practicals, according to the program of theoretical instruction.

Literature:
Recommended:
1. Z. S. Marković, Alternativni i obnovljivi izvori energije, Skripta autorizovanih predavanja u elektronskom obliku.
2. N. Đajić, Energija za održivi svet, Rudarsko-geološki fakultet, Beograd.
3.Lj. Majdandžić, Obnovljivi izvori energije, Graphis-Zagreb, ISBN 978-953-279-004-7.

Supplementary:
1. M. Radaković, Geotermalna energija, AGM, knjiga, Beograd, 2011.
2. M. Radaković, Biodizel, biogas, biomasa, AGM, knjiga, Beograd, 2009.
3. M. Radaković, Obnovljivi izvori energije i njihova ekonomska ocena, AGM, knjiga, Beograd, 2010.
4. T. Markvart, Solar Cells, Elsevier, 2005.
5. J.Martin, Wind Power, Academic Press, 2002.
6. B. Sorensen, Renewable energy, Elsevier, 2004.
7. C.Beggs, Energy management, supply and consevatioin, Butterworth and Heinemann, 2002.
8. J.R. Fanchi, Energy tecnology and directions for future, Elsevier, 2004.
9. N. Bassam, Integrated renewable energy for rural communites, Elsevier, 2004.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching:	Study research work:	

Methods of teaching: Lectures with interactive work with students, practical work through laboratory and calculation practicals. Pre-examination of knowledge through two preliminary examinations.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	25	Written exam	
Practicals	25	Oral exam	40
Preliminary examination	10		
Independent work			

54. ECONOMICS AND ORGANIZATION OF BUSINESS

Content

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: ECONOMICS AND ORGANIZATION OF BUSINESS

Lecturer: dr. Dejan Riznić, full proffesor

Course status: Obligatory course

ECTS: 6

Prerequisites: Knowledge from general technical and technological disciplines and functioning of the business system

Course goals:

The aim of the course is to gain necessary knowledge on the current state of economy and businesses organization, the economy of capital and labor, investments in reproduction, operating expenses, financial result and basic economic principles. Course is conceived with aim to provide student's acquisition fundamental theoretical and practical knowledge and skill from area of organizations enterprises. Fundamentals of organization will prepare future managers for the challenges of today's business world.

Learning outcome:

Fundamentals of business economics and organization is a microeconomic scientific discipline that ensures gaining the basic knowledge about the operation of enterprises. Getting acquainted with basic economic laws and organization of business.fundamentals of organization will prepare future managers for the challenges of today's business world. Students will discover the most progressive thinking about organizations in real world. Mastering the basic ones economic principles of modern business.

Course description:

Introduction - the course, objective of studying economics and business organization as an economic discipline.Methods of studying economics and business organization as an economic discipline.

Organization of business economy - forms of organization of economic entities. Classification and termination of business entities. Business functions -vertical and horizontal. Economics of funds of business entities - basic and working capital, investments in reproduction, sources of business assets.

Liquidity of business entities.Investments. Economics of Labor. Operating costs - price and division, natural costs, cost of reproduction dynamics. Cost dynamics and revenues, cost accounting.

Determination and distribution of business results. Basic economic principles. Final Test

Literature

Recommended:

1. Gregory Mankiw (2017): "Principles of Microeconomics", Harvard University,
2. Milgrom, Paul and John Roberts (1992): "Economics, Organization and Management", Published by Prentice Hall,
3. Wilson, D. C., & Rosenfeld, R. H. (1990): "Managing organizations": Text, readings, and cases. McGraw-Hill

Supplementary:

1. Richard L Daft (2010): "Organization theory and design", Mason, Ohio : South-Western Cengage Learning
2. Begg David and Ward Damian(2006): "Economics for Business", Published by McGraw-Hill Higher Education
3. Edwin Mansfield (2005): "Managerial Economics 6th ", Publisher: W. W. Norton & Company

Number of classes per week				Other classes:
Lectures: 3	Practicals:	Other forms of teaching:	Study research work:	

Methods of teaching: Theoretical teaching with practical applications within the group, individual and combined teaching methods.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	20	Written exam	15
Practicals		Oral exam	35
Preliminary examination	30		
Independent work			

55. DESIGN OF MINES

Content

Study program: Mining Engineering
Level of study: Undergraduate Academic Studies
Course: DESIGN OF MINES
Lecturer: Dr Vitomir Milić, full proffesor
Course status: Elective
ECTS: 6
Prerequisites: Completed courses from previous years
Course goals: Understanding of the mine design process.
Learning outcome: Individual competences to participate in mine design teams.
Course description: *Lectures:* Introduction. Design task and basic definitions. Types of mine designs, legislation, design phases (exploration, ore reserves validation, scope of work, pre feasibility study, design, design review, short and long term scheduling, annual plans Optimization methods: mathematical, operational research, application of computers in design. Underground mine design. Surface mine design. Economic assessment. *Practicals:* Personal assignment for underground mine and surface mine designs.
Literature *Recommended:* 1. Ž. Milićević, R. Nikolić. Basic of mine design. Technical faculty in Bor. 2003. 2. Ž. Milićević, Mines design- design of underground mines. Technical faculty in Bor. 2007 3. N. Popović. Scientific basic of design of surface mines. Veselin Masleša. Sarajevo. 1975. *Supplementary:* 1. Lj. Redžić. Basic of design of underground mines. RMF, Kosovska Mitrovica, 1997. 2 . V. Simeunović. Design of underground mines. Faculty of Mining and Geology, Belgrade.1995.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 3	Other forms of teaching:	Study research work:	

Methods of teaching: Lectures, practicals - project design.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	35	Oral exam	55
Preliminary examination			
Independent work			

56. PROCESS MEASUREMENT TECHNIQUES

Content

Study program: Mining Engineering				
Level of study: Undergraduate Academic Studies				
Course: PROCESS MEASUREMENT TECHNIQUES				
Lecturer: Dr Vladimir Despotović, assistant professor				
Course status: Elective course				
ECTS: 6				
Prerequisites: Fundamentals of Electrical Engineering				
Course goals: The course prepares students to have a broad understanding of modern measurement devices, measurement methods and control systems.				
Learning outcome: Learning physical principles of measurements in industrial processes and understanding modern measurement techniques.				
Course description: *Lectures*: Fundamentals of metrology. Measurement error. Measurement region. Sensitivity. Accuracy and precision. Electrical measurements of non-electrical quantities. Sensors and Transducers. Resistive, inductive and capacitive sensors. Magnetoelastic, piezoelectric and optoelectronic sensors. Thermocouples. Non-contact temperature measurement. Digital sensors. Actuators. Electromagnetic actuators (DC and AC motors, step motors and electromagnets). Fluid power actuators (hydraulic and pneumatic). Piezoelectric actuators. Relays. Contactors. Transducers. Analog to digital and digital to analog conversion. Programable logic controler (PLC). Typical input/output modules of PLCs. Wireless sensor networks. Virtual instrumentation and virtual laboratories. *Practical teaching*: Application of modern hardware and software tools for solving practical process control problems in mineral and recycling technologies.				
Literature *Recommended:* 1. D. Stanković, Physical and technical measurements – sensors (in Serbian: Fizičko tehnička merenja – senzori), University of Belgrade, Belgrade, 1997. 2. M. Popović, Sensors and Measurements (in Serbian: Senzori i merenja), School of Electrical Engineering of Applied Studies, Belgrade, 2000. *Supplementary:* 1. I. R. Sinclair, Sensors and transducers, Newnes, Oxford, 2001.				
Number of classes per week				Other classes:
Lectures: 3	Practicals: 3	Other forms of teaching:	Study research work:	
Methods of teaching Lectures and laboratory practicals				

Grading system(max. number of points 100)			
Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	40
Practicals	20	Oral exam	30
Preliminary examination			
Independent work			

57. MINES DEWATERING

Content

Study program: Mining Engineering				
Level of study: Undergraduate Academic Studies				
Course: MINES DEWATERING				
Lecturer: Dr Miodrag Žikić, associate professor				
Course status: Obligatory				
ECTS: 6				
Prerequisites: Completed course on Mining equipment and machinery				
Course goals: Introduction to basic concepts of hydraulics, dewatering systems, equipment and methods for water protection in underground and surface mines.				
Learning outcome: Competences for inflow definitions and dewatering systems selection and design.				
Course description: *Lectures:* Introductory remarks. Development, significance,state and trends of mine dewatering. Basic hydrology terminology. Water table in deposits and mining facilities. Mine dewatering. Uwerburden dumps dewatering. Dewatering equipment. *Practice:* Mine visits. *Practicals:* Personal assignment – Surface and underground mine dewatering design.				
Literature *Recommended:* 1. Ljubić Z., Stojković Z. Odvodnjavanje rudnika Technical Faculty in Bor. *Supplementary:* 1. Ignjatović M., Miljković M. Rudarska hidrotehnika Mining and Metallurgy Institute Bor. 2. Avakumović D. Odvodnjavanje. Faculty of Civil Engineering Belgrade, 2005.				
Number of classes per week				Other classes:
Lectures: 2	Practicals: 3	Other forms of teaching:	Study research work:	
Methods of teaching				
Grading system(max. number of points 100)				
Pre-examination requirements		**Number of points**	**Final examination**	**Number of points**
Attendance and active participation		10	Written exam	/
Practicals		5	Oral exam	45
Preliminary examination		/		
Independent work		40		

58. METHODS OF EXCAVATION Content

Study program: Mining Engineering
Level of study: Undergraduate Academic Studies
Course: METHODS OF EXCAVATION
Lecturer: Dr Vitomir Milić, full proffesor
Course status: Obligatory
ECTS: 6
Prerequisites: Completed third year of undergraduate mining studies
Course goals: Introduction to underground mining methods.
Learning outcome: Personal competences for mine method selection, application and design in coal and hardrock mining.
Course description: *Theoretical classes:* Introduction. Basic properties of ore deposits. Application conditions for underground mining. Factors influencing mining methods selection. Coal mining methods. Classification of coal mining methods. Shortwall mining methods. Longwall mining methods. Combined methods. Thin seam mining methods. Wire saw coal mining. Hydraulic coal mining. Ore mining. Classification of mining methods. Open stoping mining methods. Room and pillar methods. Shrinkage stoping methods. Backfill stoping methods. Sublevel and block caving methods. Combined methods *Practicals:* Personal assignment – Method selection and parameters calculation for design purposes.
Literature: *Recommended:* 1. Ž. Milićević, Metode podzemnog otkopavanja ležišta mineralnih sirovina Bor, 2011. 2. B. Gluščević. Otvaranje i metode podzemnog otkopavanja rudnih ležišta Minerva Belgrade 1974 3. B. Genčić Tehnološki postupci podzemne eksploatacije slojevitih ležišta), Bureau for textbooks and teaching aids of Serbia, Belgrade, 1971. *Supplementary:* 1. Ž. Milićević, Underground mining methods. Bureau for textbooks and teaching aids of Serbia, Belgrade, 1998. 2. Ž. Milićević, Sublevel and block caving methods. Monography- electronic only. 2010.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 3	Other forms of teaching:	Study research work:	

Methods of teaching

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	5	Written exam	30
Practicals	25	Oral exam	40
Preliminary examination			
Independent work			

59. LEACHING AND SOLUTIONS PROCESSING

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: LEACHING AND SOLUTIONS PROCESSING

Lecturer: Dr Grozdanka Bogdanović , full professor

Course status: Obligatory course

ECTS: 6

Prerequisites: Acquired knowledge on Physical Chemistry

Course goals:

Acquiring knowledge about the basic laws of leaching metals, minerals and waste raw materials; treatment of leach solutions and methods for separating metals and metal compounds from the solution.

Learning outcome:

Theoretical and practical training of students for work in scientific, educational, state and economic organizations in dealing with this issue.

Course description:

Theoretical instruction:

Introduction to leaching. Physico-chemical basis of the leaching processes. Leaching agents. Metals leaching. Leaching of primary raw materials (oxide, carbonate, silicate and sulphide minerals). Leaching of secondary raw materials (mining tailings, flotation tailings, dusts and sludges). Leaching of solid waste and ash of incinerators. The role of microorganisms in the process of leaching. Methods of leaching and equipment. Heap, dump and in-situ leaching.

Treatment of leach solutions. Concentration and purification of metal ions from the solution: Ion Exchange and Adsorption. Solvent extraction. Membrane processes. Separation of metal compounds from solution: Crystallization and precipitation processes. Separation of the metal from the solution: Cementation and chemical reduction. Electrochemical separation of metals.

Practical instruction:

Calculation practicals and solutions in the field of thermodynamics and kinetics of the leaching process. Experimental practicals related to the determination of the kinetics of the leaching process; purification and concentration metals and metal compounds from solutions.

Literature

Recommended:

1. N. Pacović, Hidrometalurgija, ŠRIF, Bor, 1980.
2. G. Hovanec, Hemijske metode koncentracije ruda zlata, srebra i bakra, Rudarski institut Beograd, 1986.
3. V.Stanković, Fenomeni prenosa i operacije u metalurgiji, Knjiga 2, Prenos toplote i mase, Tehnički fakultet Bor, 1998 (odabrana poglavlja).

Supplementary:

1. G.D.Bogdanović, M.M.Antonijević, Ponašanje i oksidacija halkopirita u vodenoj sredini, Tehnički fakultet Bor, 2011.
2. F. Habashi, A Textbook of Hydrometallurgy, Metallurgie Extective Quebec, Enr., 1992.
3. P.Fečko, M.Kušnierova, V.Čablik, I. Pečtova, Environmental Biotechnology, VŠB-Technical University of Ostrava, Ostrava, 2006.

Number of classes per week				Other classes:
Lectures: 3	Practicals: 1	Other forms of teaching: 2	Study research work:	

Methods of teaching: Oral presentations with interactive discussions; Lab practicals; Consultations

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	
Practicals	20	Oral exam	50
Preliminary examination	20		
Independent work			

60. MINERAL PROCESSING TECHNOLOGIES

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: MINERAL PROCESSING TECHNOLOGIES

Lecturer: Dr Zoran Štirbanović, assistant professor

Course status: Obligatory course for module MP

ECTS: 6

Prerequisites: The necessary knowledge from the narrow professional courses of this module (comminution and classification, physical concentration methods, flotation, leaching and solution processing).

Course goals:
Introducing students with technological processes for the preparation and concentration of metallic, non-metallic and energy mineral raw materials.

Learning outcome:
Acquiring knowledge and experience in creating technological processes of preparation and concentration of various mineral raw materials, as a prerequisite for work in this field.

Course description:
Theoretical lectures:
Introduction. Classification of industrial processes for the preparation and concentration of mineral raw materials. Characteristics of raw materials and technological procedures for the processing of non-ferrous metals: copper, lead, zinc, nickel, antimony, tin, and ferrous metals: iron, chromium and manganese. Technological processes for processing light and rare metals. Ores of precious metals: gold, silver and platinum. Characteristics and technological processes of preparation and concentration of non-metallic mineral raw materials: abrasive, asbestos, barite, feldspar, phosphate, graphite, limestone, mica and magnesite. Coal. Industrial processes of coal purification (concentration). Product quality standards and market requirements. Economic and environmental sustainability of technological processes in mineral processing.
Practical lectures:
Technological operations in the preparation of mineral raw materials. Technological schemes. Creation of technological schemes based on the given characteristics of mineral raw material. Material balance of technological schemes. Calculation practicals: Determination of the material balance of technological schemes. Technological procedures and processing schemes for colored, black, light, rare and precious metals, coal and non-metallic mineral raw materials. Technological indicators and control of industrial processes.

Literature
Recommended:
1. D. Draškić, Industrijska primena pipreme mineralnih sirovina, I knjiga, Izdavačko-informativni centar studenata, Beograd, 1975.
2. D. Draškić, Industrijska primena pripreme mineralnih sirovina, II knjiga Rudarsko-Geološki Fakultet, Beograd, 1986.
3. J. Pavlica, D. Draškić, Priprema nemetaličnih mineralnih sirovina, Rudarsko-Geološki Fakultet, Beograd, 1997.

Supplementary:
1. Grupa autora, Domaće nemetalične mineralne sirovine za pripremu u privredi, ITNMS, Beograd, 1998.
2. B. A. Wills, Mineral Processing Technology, Pergamon Press, Oxford, Fourth Edition, 1988.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 2	Other forms of teaching: 2	Study research work:	

Methods of teaching: Lectures, practicals and practical work, organized on an interactive principle, which besides lectures and presentations includes discussions and active participation of students in all aspects of lectures, preliminary examination, written and oral exam.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	15
Practicals	30	Oral exam	15
Preliminary examination	30		
Independent work			

61. RECYCLING TECHNOLOGY

Content

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: RECYCLING TECHNOLOGY

Lecturer: Dr Maja Trumić, assistant professor

Course status: Obligatory course

ECTS: 6

Prerequisites: The necessary knowledge in the field of waste management and treatment, process of comminution and classification of materials, process of flotation and physical methods of concentration

Course goals:
Theoretical and practical training of students for adopting optimal recycling solutions of certain types of secondary raw materials.

Learning outcome:
Students are able to follow courses that rely on a processed program and to effectively apply acquired knowledge in practice

Course description:
Theoretical teaching:
Introduction. Waste paper: History, Paper waste management. Waste paper characterization. Technologies and treatment for waste paper recycling. Waste Glass: History, Glass waste management. Waste glass characterization. Technologies and treatment for waste glass recycling. Waste plastic: History, Plastic waste management. Waste plastics characterization. Technologies and treatment for waste plastics recycling. Waste metal: History, Metal waste management. Scrap metal characterization. Technologies and treatment for waste metal recycling. Waste tires: History, Tires waste management. Waste tires characterization. Technologies and treatment for waste tires recycling. Electrical and electronic waste: History, Electrical and electronic waste management. Characterization of electrical and electronic waste. Technologies and treatment for electrical and electronic waste recycling. Waste batteries and accumulators: History, Batteries and accumulators waste management. Characterization of waste batteries and accumulators. Technologies and treatment for waste batteries and accumulators recycling. Discarded cars: History, Dump cars management. Characterization of discarded cars. Technologies and treatment for cars recycling. Construction waste material (GOM): History, GOM management. Characterization of GOM. GOM recycling technologies and treatment.
Practical teaching:
Analysis of technological schemes for recycling process of different waste materials. Get acquainted with technical and technological solutions and innovations on technologies for processing various types of waste on examples of installed plants in the world.

Literature:
Recommended:
1. M. Ž. Trumić, Tehnologije reciklaže sekundarnih sirovina, Autorizovana predavanja.
2. B. Branković, Postupci i uređaji za recikliranje otpadnog materijala, Beograd, 2002.
3. M. Vojnović, M. Simčić, P. Rakin, M. Marić, S. Dedić, M. Rakin, Prerada otpadnih olovnih akumulatora u \ ekološki povoljnim uslovima, DIT, Beograd, 2004.
4. M.Ignjatović,R.Ignjatović,M.Trumić,Principi rada separatora sa suspenzijama,Nauka,Beograd, 1999.

Supplementary:
1. Herbert F. Lund, Recycling Handbook, McGraw-Hill, Second Edition, 2001.
2. A.K.M. Rainbow, Why Recycle?, Procedings of the Recycling Council Annual Seminar, Birmingham, UK, 1994.
3. M. Ž. Trumić, G. Bogdanović, LJ. Andrić, M. S. Trumić, D. Antić, Waste Material Recycling Technology, TEMPUS-DEREL, 2013.

Number of classes per week				Other classes:
Lectures: 2	Practicals: 4	Other forms of teaching:	Study research work:	

Methods of teaching: Theoretical lectures are conducted with lectures and practical in the form of demonstration practicals according to the interactive principle with the active participation of students and seminar paper.

Grading system(max. number of points 100)

Pre-examination requirements	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	10	Written exam	20
Practicals	20	Oral exam	20
Independent work	30		

62. BACHELOR THESIS

Content

Study program: Mining Engineering
Level of study: Undergraduate Academic Studies
Course: BACHELOR THESIS
Lecturer: All professors on study program are potentional menthors
Course status: Obligatory course
ECTS: 3
Prerequisites: All exams passed at the study program Mining Engineering at undergraduate academic studies and completed professional practice
Course goals: The goal of research, writing and defending the bachelor thesis is to show the student's ability to independently examine a specific practical problem, define a problem solving program through the application of theoretical knowledge and experimental tests. The student acquires the first experience of self-examining and solving practical problems as well as the necessary skills for successful upcoming engineering practice.
Learning outcome: By researching, writing and defending final work students are able to spot technical and technological problems in industrial practice, to realistically examine them and find solutions to overcome them. In addition to training to work on appropriate jobs, students are trained to continue their studies at higher levels. Competencies acquired in this way are expressed through the ability of creative thinking, analysis, synthesis and making reliable decisions in real time.
Course description: The bachelor thesis is formulated for each student separately, in accordance to the specificities of the selected modules of the study program Mining Engineering. When choosing and formulating the bachelor thesis, special attention is paid to the scholars, when the course of thesis is in line with the needs of companies that provide scholarships, or in which future engineers will be employed. The bachelor thesis represents the independent student research work, which contains the following chapters: introduction, theoretical part, experimental part, research results discussion, conclusion and literature review. The bachelor thesis, in written form, is submitted in three copies, and is publicly defended in front of the three-member commission of the professors from this study program or the corresponding module of the same.
Methods of teaching: The mentor for research, writing and defending bachelor thesis is selected based on the topic on the appropriate module. The mentor formulates the topic of the bachelor thesis, with regard to the fact whether the student is a scholarship student. The student, in consultation with the mentor, independently creates a research program in order to accomplish the assigned task. Upon completion of the bachelor thesis, with the consent of the mentor that the work has been successfully completed, the student defends the thesis in front of a three-member commission of professors. The conditions for defending the bachelor thesis are passed all exams of the appropriate module and realized professional practice from the curriculum of the study program.

Grading system(max. number of points 100)	
Research, writing bachelor thesis	50
Presentation and defense of bachelor thesis	50