	UNIVERSITY OF BELGRADE **TEHNICAL FACULTY IN BOR** Vojske Jugoslavije 12, 19210 Bor	
	ACCREDITATION OF STUDY PROGRAM	
	UNDERGRADUATE ACADEMIC STUDIES	MINING ENGINEERING

BOOK OF SUBJECTS

MINING ENGINEERING

UNDERGRADUATE ACADEMIC STUDIES
(I LEVEL OF ACADEMIC STUDIES)

2023

CONTENT

54.	Professional practice 1	60
55.	Technology of surface mining	61
56.	Technology of underground mining	62
57.	Mine ventilation	63
58.	Mines dewatering	64
59.	Environmental impact of mining	65
60.	Seismic effects of blasting	66
61.	Geographic information systems-GIS	67
62.	Dumping and stockpiling	68
63.	Mineral processing technologies 1	69
64.	Management and treatment of waste	70
65.	Technological process and environment	71
66.	Environmental protection	72
67.	Wastewater in mineral and recycling technologies	73
68.	Leaching and solutions processing	74
69.	Dewatering and tailing	75
70.	Reagents in mineral processing	76
71.	Technogenic waste materials processing	77
72.	Alternative and renewable energy sources	78
73.	Mine design	79
74.	Underground mining methods	80
75.	Economics and organization of business	81
76.	Regulations in mining	82
77.	Occupational health and safety in M&RT	83
78.	Process measurement technique	84
79.	Mineral processing technologies 2	85
80.	Recycling technology	86
81.	Professional practice 2	87
82.	Bachelor thesis	88
83.	Bachelor thesis - preparation and defense	89

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

Course: Mathematics 1

Lecturer/s: Ivana M. Stanišev

Status of the course: Compulsory for Mining Engineering, Metallurgical Engineering and Technological Engineering Elective for Engineering Management

ECTS: 8

Prerequisite: Basic high school knowledge in mathematics.

Course goals: Application of acquired knowledge in the field of content items.

Learning outcomes: Through the course students should be able to use matrix calculus (determinants) for solving systems of linear equations, solve the problems of minimum and maximum, learn the basic notions of functions of one or two variables and apply that knowledge in the upcoming mathematical courses as well as courses for which we need mathematical tools.

Course description:

Lectures: Introduction: 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. Intervals of monotonicity of a function and local extremums of a function. Intervals of convexity and inflection points. Drawing the graph of a function. Functions of two variables; partial derivatives. Local extremums of functions of two variables.

Practice: Calculation exercises

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.

Ancillary:

1. B.P. Demidovič, Sbornik zadač i upražnenii po matematičeskomu analizu, Nauka, Moskva, 1997.

Number of classes per week	**Lectures: 3**	**Practical classes: 3**	**Study research work: /**	**Other forms of teaching: /**

Teaching methods

Theoretical teaching of the frontal type, group, and individual work.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**20**	Written part of the final exam	**40**
Exercise attendance	**/**	Oral part of the final exam	/
Coloquium exam/s	**40**	.....	
Term paper	**/**		

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

Course: Physics

Lecturer: Čedomir A. Maluckov, full professor

Status of the course: Compulsory subject of study programs Technological Engineering, Mining Engineering and Metallurgical Engineering

ECTS: 8

Prerequisite: High school knowledge of physics

Course goals: Acquisition of basic knowledge about physical phenomena and connections between physical quantities

Learning outcomes: Acquaintance with the basic laws of physics, with the aim of successfully following classes at the higher years of study.

Course description:

Lectures:

International System of Units. MECHANICS. Straight and circular movement. Newton's laws of dynamics and defining the basic concepts of dynamics. Laws of posture. Basic concepts of statics. Newton's law of gravity. Elastic deformations. Oscillatory motion. Mechanical waves (polarization, interference and diffraction of waves). Fluid mechanics. HEAT AND TEMPERATURE. Expansion of the body during heating. Gas laws. The first and second laws of thermodynamics. Thermodynamic processes. Change of aggregate states. Real gases and critical temperatures. Transfer and passing of heat. ELECTROMAGNETICS. Coulomb's law. Force work in an electric field. Direct currents. Ohm's law. Kirchhoff's rules. Magnetic field. Magnetic induction. Electric oscillations and electromagnetic waves. Alternating current. OPTICS. Photometry. Geometric optics. Thin lenses. Wave optics (interference, diffraction and polarization of light). Photoelectric effect. ATOMIC AND NUCLEAR PHYSICS. Rutherford-Bohr model of the atom. The Rydberg constant and the interpretation of atomic spectra. X-ray radiation. Sommerfeld's theory of elliptic trajectories. Spatial quantization. Electron spin. Quantum numbers and the Pauli principle. Radioactive radiation. Law of radioactive decay. Radioactive arrays. Nuclear reactions. Proton-neutron hypothesis of the atomic nucleus. Dimension and bond energy of the nucleus. Nuclear forces. Elementary particles. Classification of elementary particles.

Practice:

Computational and laboratory exercises follow the lectures.

Literature:

Recommended:

1. H.D. Young, R. A. Freedman, A. L. Ford, Sears and Zemanskys University Physics, with Moder Physics, 13th edition, Addison Wesley, 2012.
2. Debora M. Katz, Physics for Scientists and Engineers: Foundations and Connections, Extended Version, Cengage Learning, 2016.

Ancillary:

1. I.E Irodov, Problems in General Physics, Mir Publishers, Moscow, 1981.

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

Teaching methods

Classic lectures with interactive discussions, computational and laboratory exercises, consultations and colloquia.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	10	Written part of the final exam	20
Exercise attendance	10	Oral part of the final exam	20
Coloquium exam/s	40		
Term paper			

Study program: Technological Engineering, Mining Engineering and Metallurgical Engineering

Course: GENERAL CHEMISTRY

Lecturer: PhD Ana A. Radojević, assistant professor

Status of the course: Compulsory for Mining Engineering, Metallurgical Engineering and Technological Engineering.

ECTS: 8

Prerequisite: High school chemistry knowledge.

Course goals: The course is designed to provide a basic knowledge in the field of general chemistry and set a foundation for understanding other subjects related to chemistry and chemical technology.

Learning outcomes: Mastering and understanding the basic terminology and laws in the field of chemistry. Mastering chemical calculations and basic laboratory techniques with the aim of easier understanding the material covered in subsequent specialized courses.

Course description:

Lectures:

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. Thermochemistry. 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.

Practice:

Laboratory and calculus classes covering the basic chemical laws. Calculations based on the chemical formulas and chemical equations (stoichiometry). Gas laws. Types of chemical reactions. Experimental techniques for separation and purification methods of substances. Solutions. Electrolytic dissociation and ionic reactions. The ionic product of water. Chemical kinetics. Properties of dilute solutions. Chemical equilibrium in homogeneous and heterogeneous systems. Hydrolysis. Energy changes during chemical reactions.

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.
4. A. Radojević, J. Milosavljević, Praktikum iz Opšte hemije, Tehnički fakultet u Boru, Bor, 2022.

Ancillary:

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, Tehnološko-metalurški fakultet, Beograd, 1985.

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

Teaching methods

Classical lectures with interactive discussions, calculus and practical classes, consultations and colloquia.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	5	Written part of the final exam	60
Exercise attendance	15	Oral part of the final exam	
Colloquium exams	20		
Term paper			

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

Course: INFORMATICS 1

Lecturer/s: Milena M. Gajić

Status of the course: Compulsory

ECTS: 4

Prerequisite: The basic informatics knowledge from the high school

Course goals: Acquiring basic computer knowledge in information technology

Learning outcomes: Introduce with the operation of computer systems and their application for data processing basic level

Course description:

Lectures:

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.

Practice:

During the exercises, students do tasks in the field of numerous systems and switching and logic circuits.

Literature:

Recommended:

1. Đorđević, J., Radivojević, Z., Punt, M., i Stanisavljević, Ž. Osnovi računarske tehnike. Akademska misao, Beograd, 2017.
2. Brodić, D. i Jevtić, M. Zbirka zadataka iz Informatike 1. Tehnički fakultet u Boru, Bor, 2015.

Ancillary:

1. Mladenović, I. Informatika 1. Tehnički fakultet u Boru, Bor. 2008.
2. Manojlović, V. Osnovi računarske tehnike, Prvi deo: Podaci i operacije, Akademska misao, Beograd, 2007.
3. Manojlović, V. Osnovi računarske tehnike, Drugi deo: Digitalna logika, Fakultet tehničkih nauka, Kosovska Mitrovica, 2013.

Number of classes per week	**Lectures: 2**	**Practical classes: 2**	**Study research work: /**	**Other forms of teaching: /**

Teaching methods

Teaching contains lectures, seminars and exercises, which include work in groups.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	**40**
Exercise attendance	**5**	Oral part of the final exam	
Colloquium exam/s	**40**	.....	
Term paper	**10**		

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

Course: English Language 1a

Lecturer/s: Sandra Vasković

Status of the course: Compulsory

ECTS: 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 intermediate level (CEFR-A2)

Learning outcomes: Students can express themselves in writing and orally using simpler language structures and vocabulary needed for everyday communication. Students can understand less complex texts and are able to find the required information in the texts.

Course description:
Lectures:
Topics: Everyday life, Travelling, Parents and teenagers, Fashion, Psychology, etc.
Grammar: Verb tenses (present simple and continuous, past simple and continuous, be going to, present perfect – yet,
just, already, will/won't – predictions, decisions, offers, promises), defining relative clauses, indefinite pronouns, quantifiers, comparison of adjectives and adverbs.
Language functions: Practical English (hotel problems, restaurant problems, in a store...)

Practice:

Determining and practicing the material covered in lectures using all language skills

Literature:

Recommended:

1. Christina Latham-Koenig, Clive Oxeden, Paul Seligson, English File third edition, Student's Book, OUP, Oxford, 2012
2. Tom Hutchinson, Lifelines, Pre-Intermediate, Student's Book, OUP, Oxford, 2009
3. Selection of texts from different sources

Supplementary::

1. Slavica Stevanović, English Language 1- Grammar Exercises, Workbook with Key, Technical Faculty in Bor, 2018

2. Raymond Murphy & William R. Smalzer, Basic Grammar in Use, CUP, Cambridge, 2007

3. Selection of exercises from various sources

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

Teaching methods

Eclectic

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	**30**
Exercise attendance	**5**	Oral part of the final exam	**40**
Midterm exam	**20**		
Term paper			

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

Course: English Language 1b

Lecturer/s: Sandra Vasković

Status of the course: Compulsory

ECTS: 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 intermediate level (CEFR-A2)

Learning outcomes: Students can express themselves in writing and orally using simpler language structures and vocabulary needed for everyday communication. Students can understand less complex texts and are able to find the required information in the texts.

Course description:
Lectures:
Topics: Films, Language, Books, Science, Music, etc.
Grammar: uses of infinitive with to, uses of gerund, modal verbs (should, have to, must, might), conditional sentences
1 and 2, passive, present perfect – for and since, present perfect and past simple, past perfect....
Language functions: Practical English (at the pharmacy, getting around, travelling...)

Practice:

Determining and practicing the material covered in lectures using all language skills

Literature:

Recommended:

1. Christina Latham-Koenig, Clive Oxeden, Paul Seligson, English File third edition, Student's Book, OUP, Oxford, 2012
2. Tom Hutchinson, Lifelines, Pre-Intermediate, Student's Book, OUP, Oxford, 2009
3. Selection of texts from different sources

Supplementary:

1. Slavica Stevanović, English Language 1- Grammar Exercises, Workbook with Key, Technical Faculty in Bor, 2018

2. Raymond Murphy & William R. Smalzer, Basic Grammar in Use, CUP, Cambridge, 2007

3. Selection of exercises from various sources

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

Teaching methods

Eclectic

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	**30**
Exercise attendance	**5**	Oral part of the final exam	**40**
Midterm exam	**20**		
Term paper			

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

Course: Informatics 2

Lecturer/s: Dragisa M. Stanujkic

Status of the course: Compulsory

ECTS: 6

Prerequisite: The basic informatics knowledge from the high school

Course goals: An introduction to the C programming language

Learning outcomes: After completing the course, students will be familiar with advanced methods and techniques of using computers to effectively apply them in a business environment. In addition, students will improve their skills related to the application of Microsoft Access and the C programming language.

Course description:

Lectures:

Software: Software, concept and role in computer system. Types of software.

Databases: Introduction to relational databases, fields, rows, tables, primary keys, foreign keys.

Microsoft Access: Tables, relations, forms, reports.

Introduction to programming and the C programming language: Basic elements of the C programming language: Keywords, identifiers, data types, operators, input and output commands. Basic program structures: if ... else, for, while, break and continue, switch ... case. Complex (nested) program structures. Functions: "built-in" functions, user-defined functions. Arrays.

Practice:

Software: Software, concept and role in computer system. Types of software.

Databases: Introduction to relational databases, fields, rows, tables, primary keys, foreign keys.

Microsoft Access: Tables, relations, forms, reports.

Introduction to programming and the C programming language: Basic elements of the C programming language: Keywords, identifiers, data types, operators, input and output commands. Basic program structures: if ... else, for, while, break and continue, switch ... case. Complex (nested) program structures. Functions: "built-in" functions, user-defined functions. Arrays.

Literature:

Recommended:

1. Stankić, R. Poslovna informatika. Ekonomski fakultet, Beograd. 2012.
2. Kraus L. Programski jezik C sa rešenim zadacima. 9. izdanje, Akademska misao, 2014.

Ancillary:

1. Sebesta R.W. Concepts of Programming Languages. 10th ed., Addison-Wesley Publishing Company, 2012.

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

Teaching methods

Teaching contains lectures, seminars and exercises, which include work in groups.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	**40**
Exercise attendance	**5**	Oral part of the final exam	
Coloquium exam/s	**40**	.....	
Term paper	**10**		

Study program Mining Engineering, Metallurgical Engineering, Technological Engineering

Course: MATHEMATICS II

Lecturer/s: Ivana Z. Đolović

Status of the course: Compulsory

ECTS: 8

Prerequisite: Fundamental knowledge in Mathematics I

Course goals: Application of the theoretical knowledge in further work

Learning outcomes: Students should be able to apply formal mathematical knowledge in recognizing and solving tasks in further studying process as well as real problems in engineering, sciences, business and technology fields

Course description:

Lectures:

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)

Practice:

Calculation exercises

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.

Ancillary:

1. Б.П.Демидович, Сборник задач и упражнении по математическому анализу, Наука, Москва, 1977

Number of classes per week	**Lectures: 3**	**Practical classes: 3**	**Study research work: /**	**Other forms of teaching: /**

Teaching methods

Frontal teaching emphasizing application in the vocational subjects in the coming semesters

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	/	Written part of the final exam	**40**
Exercise attendance	/	Oral part of the final exam	/
Coloquium exam/s	**60**	.....	
Term paper	/		

Study program: Technological Engineering, Mining Engineering and Metallurgical Engineering

Course: ENGINEERING GRAPHICS

Lecturer: PhD Dejan I. Tanikić, full professor

Status of the course: Compulsory for Technological Engineering, Mining Engineering and Metallurgical Engineering.

ECTS: 6

Prerequisite: /

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 outcomes: 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:

Lectures:

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.

Practice:

Practicals. Other forms of teaching. Practical use of AutoCAD software package.

Literature:

Recommended:

1. D. Tanikić, S. Kalinović, Inženjerska grafika, Tehnički fakultet u Boru Univerziteta u Beogradu, Bor 2019.
2. R. Gligorić, Nacrtna geometrija - primena, Poljoprivredni fakultet, Novi Sad, 2015.

Ancillary*:*

1. M. Hamad, AutoCAD 2019 Beginning and Intermediate, Mercury Learning & Information, 2018.
2. С. Илић, Основе AUTOCAD-а, Микро књига, 2017.

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

Teaching methods

Lectures, practicals, colloquiums.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final examination**	Points
Lecture attendance	20	Written part of the final exam	30
Exercise attendance	10	Oral part of the final exam	
Homework	10		
Colloquium exams	15+15		

Study program: Mining Engineering

Course: ELEVATIONAL PROJECTION

Lecturer/s: Dr Jelena Ivaz, assistant professor

Status of the course: Obligatory

ECTS: 8

Prerequisite: Basic knowledge on mathematics and descriptive geometry

Course goals: Introduction to basic elements of elevational projection for engineering purposes.

Learning outcomes: 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 throughan 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.

Practice:

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.

Ancillary:

2. V. Đurović. Descriptive geometry. Civil Engineering book, Belgrade 20002 .
3. M. Janić, N. Vušović. D. Tanikić. Descriptive geometry.
4. Authorized lectures, Technical Faculty in Bor, 2003.

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

Teaching methods

Oral lectures, practicals, field work, discussion

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	10	Written part of the final exam	
Exercise attendance	30	Oral part of the final exam	60
Coloquium exam/s		.....	
Term paper			

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: MECHANICS I

Lecturer: Dr Dejan Tanikić, full 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 outcomes:
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. Pavlović, Mehanika I (Statika), Izdavačka jedinica Univerziteta u Nišu, 2012.
2. Z. Golubović, M. Simonović, Z. Mitrović, Mehanika - Statika, Mašinski fakultet Univerziteta u Beogradu, 2007.
3. R. Marjanović, Mehanika I – Statika, Tehnički fakultet u Boru, 1985.
4. J. L. Meriam and L. G. Kraige, Engineering Mechanics: Statics,Wiley, 2016.
5. H. Goldstein, C. Poole, and J. Safko, Classical Mechanics, Pearson, 2001.

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		

Study program: Mining Engineering

Level of study: Undergraduate Academic Studies

Course: MACHINE ELEMENTS

Lecturer: Dr Dejan Tanikić, full professor

Course status: Obligatory course

ECTS: 6

Prerequisites:

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 outcomes:
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, Mašinski fakultet Univerziteta u Beogradu, 2014.
2. V. Miltenović, Mašinski elementi, Mašinski fakultet Univerziteta u Nišu, 2009.
3. R. L. Mott, Machine Elements in Mechanical Design, Pearson, 2018.
4. R. L. Norton, Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, McGraw-Hill, 2019.

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		

Study program: Mining Engineering

Course: Basics of Geology

Lecturer/s: dr. Mira Cocić, professor

Status of the course: Compulsory for

ECTS: 6

Prerequisite: Acquired physics and chemistry knowledge

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

Learning outcomes: Mastering of knowledge necessary for understanding other geological and professional mining subjects

Course description:
Lectures:
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 volcanism, 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: Subject 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.

Practice: -

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.

Ancillary:

1. Ž. Milićević, Basics of Geology, Authorized lectures, Bor, 2009.

Number of classes per week	**Lectures: 3**	**Practical classes: 0**	**Study research work: -**	**Other forms of teaching: -**

Teaching methods

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	
Exercise attendance	-	Oral part of the final exam	45

Coloquium exam/s	**25 + 25**	.....	
Term paper			

Study program: Mining Engineering,				
Course: Mineralogy and petrography				
Lecturer/s: dr. Mira Cocić, professor				
Status of the course: Compulsory for				
ECTS: 8				
Prerequisite: Basic chemistry knowledge				
Course goals: Introducing students to basic knowledge of basic and special mineralogy, as well as subject of petrology and rock types				
Learning outcomes: Acquiring necessary knowledge for mineral deposit exploration as well knowledge necessary for other professional subjects in mining, metallurgy and technology areas				
Course description: Lectures: **Mineralogy:** Subject, 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:** Subject 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. Practice: 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. Ancillary: 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	**Lectures: 3**	**Practical classes: 3**	**Study research work: ?**	**Other forms of teaching: ?**
Teaching methods Lectures, practices, practical lectures, colloquiums				
Knowledge evaluation (maximum 100 points)				

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	
Exercise attendance	**5**	Oral part of the final exam	40
Coloquium exam/s	**25 + 25**	.....	
Term paper			

Study program: Engineering Management, Mining Engineering, Metallurgical Engineering, Engineering Technology

Name of the course : ENGLISH LANGUAGE 2a

Teacher : Mara, Z. Manzalovic

Status of the Course : compulsory

Number of ECTS: 4

Prerequisite : Completion of the program *English language 1b*.

Course objectives

Developing language competences (listening, reading, speaking, writing); acquiring grammatical structures, vocabulary and language functions according to CEFR level A2.

Course outcomes

Students understand written texts with language structures and vocabulary which are used by wider academic community. Students are able to give simple answers to the questions which are related to below mentioned topics, as well as to find the required information from a text.

The content of the course

Theoretical lectures

Language points: Revision of tenses (Present Simple and continuous, Past Simple and Continuous, Present and Past Perfect, going to - future, Future Simple); Modal verbs (can, may, must, should, needn't…); Conditionals (Zero, First, Second and Third); Word formation (common prefixes and suffixes)

Language functions: describing pictures and personality types, discussing, giving arguments - pros and cons, expalaining – giving opinion, comparing (different cultures), giving suggestions

Topics: Personality types, Communication, Cultural differences, Environment issues, Healthy Lifestyle

Language practice

Enhancing and practising the language structures introduced during lectures, by using the acquired language skills.

Literature

1. Mara Manzalovic - The Script for English language 2a – collection of texts with grammar and vocabulary exercises.
2. Raymond Murphy & William R.Smalzer - Grammar in Use, intermediate (CUP, Cambridge 2007)
3. A selection of grammar exercises taken from the Internet sites.

Number of lessons of active lectures	**Theoretical lectures: 1**	**Language practice : 1**

Teaching methods

Communicative Language Teaching, The Direct Method, Grammar-Translation Method, Audi-Visual;

Teaching models: frontal, pair, group and individual work.

Knowledge Assessment (maximum number of points is 100)

Pre-exam obligations	points	**Final exam**	points
Active approach of students during lectures	**10**	Written exam	**20**
Language practice		*oral exam	**40**
Colloquium	**30**	.....	

Seminar paper (presentation)	/		/
* Students have the right to take oral exam if they have gained at least 25 points at the colloquium and the written exam.			

Study program: Engineering Management, Mining Engineering, Metallurgical Engineering, Engineering Technology

Name of the course : ENGLISH LANGUAGE 2b

Teacher : Mara, Z. Manzalovic

Status of the Course : compulsory

Number of ECTS: 4

Prerequisite : Completion of the program *English language 2a*.

Course objectives

Developing language competences (listening, reading, speaking, writing); acquiring grammatical structures, vocabulary and language functions according to CEFR level B1.

Course outcome

Students understand written texts with language structures and vocabulary which are used by a wider academic community. Students are able to summarise the texts related to the below mentioned topics, as well as to express their own opinion.

The content of the course

Theoretical lectures

Language points: Relative Clauses; - ING form (various uses); Passive Voice ; Word formation – compound words, common prefixes and suffixes

Language functions: comparing, giving arguments, translating, explaining, planning, analyzing, making conclusions, scanning , skimming

Topics: Globalisation, Management Skills, The History of Money, Famous Failures, Moral Stories

Language practice

Enhancing and practising the language structures introduced during lectures, by using the acquired language skills.

Literature

4. Mara Manzalovic - The Script for English language 2a – collection of texts with grammar and vocabulary exercises.
5. Raymond Murphy & William R.Smalzer - Grammar in Use, intermediate (CUP, Cambridge 2007)
   A selection of grammar exercises taken from the Internet sites.

Number of lessons of active lectures	**Theoretical lectures: 1**	**Language practice : 1**

Teaching methods

Communicative Language Teaching, The Direct Method, Grammar-Translation Method, Audi-Visual;

Teaching models: frontal, pair, group and individual work.

Knowledge Assessment (maximum number of points is 100)

Pre-exam obligations	points	**Final exam**	points
Active approach of students during lectures	**10**	Written exam	**20**
Language practice		* Oral exam	**40**
Colloquium	**30**	.....	
Seminar paper (presentation)	/		/
* Students have the right to take oral exam if they have gained at least 25 points at the colloquium and the written exam.			

Study program: Mining Engineering

Course: Strength of materials

Lecturer/s: PhD Jelena M. Djoković, full professor

Status of the course: Compulsory for the Mining Engineering study program

ECTS: 8

Prerequisite: Passed the exam in 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 outcomes:

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:

Lectures:

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.

Practice:

Numerical examples from all theoretical lectures. Homeworks.

Literature:

Recommended:

1. Milovančević M., Anđelić N.: Strength of Materials, University of Belgrade, Faculty of Mechanical Engineering, Belgrade, 2015. (in Serbian)
2. Ružić D., Čukić R., Dunjić M., Milovančević M., Anđelić N., Milošević V,: Strength of Materials - Tables, University of Belgrade, Faculty of Mechanical Engineering, Belgrade, 2015. (in Serbian)
3. Printed materials for teaching

Ancillary:

4. Rašković D.:Strength of Materials, The Civil Engineering Book, Belgrade, 1988 (in Serbian)
5. Rašković D.: Solved problems in Strength of Materials, The Civil Engineering Book, Belgrade, 1988 (in Serbian)
6. Rašković D.: Tables for Strength of Materials, The Civil Engineering Book, Belgrade, 1987 (in Serbia)

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

Teaching methods

Classic lectures with interactive discussions, Practical classes, Homeworks, Colloquiums, Final exam

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	
Exercise attendance	**5**	Oral part of the final exam	**30**
Coloquium exam/s	**30 (10+10+10)**		
Term paper (homework)	**30 (10+10+10)**		

Study program: Mining engineering

Course: Basics of machines and devices

Lecturer: dr Saša Stojadinović, van. prof.

Course status: Obligatory

ECTS: 4

Prerequisites: completed course on Mechanical engineering

Course goal

Theoretical and practical knowledge regarding basic structure of machinery and equipment and their properties, especially those used in mining.

Course outcome

Ability and qualification to make decisions on selection and application of mining mechanization and equipment.

Course description

Theoretical

Introductory remarks. History, significance, present state and trends in machines and devices development. Basic terminology. Basic structure. Drive motors. Power transmission. Working elements. Couplings. Brakes. Operation control. Operation and operators. Productivity. Systematization. Tribology. Maintenance. Availability and utilization. HSE. Examples.

Practical

Practical assignments and calculation of basic machine parameters. Productivity calculation. Determination of availability and utilization. Practical assignments

Literature

1. S. Aleksić, ELEKTRIČNE MAŠINE I UREĐAJI U RUDARSTVU, Rudarsko-geološki fakultet, Beograd, 2017.
2. M. Tanasijević, S. Ivković, ELEMENTI RUDARSKIH MAŠINA, Rudarsko-geološki fakultet, Beograd, 2017.
3. P. Jovančić, ODRŽAVANjE RUDARSKIH MAŠINA, Rudarsko-geološki fakultet, Beograd, 2014.
4. V. Batalović, HIDRAULIČKE I PNEUMATSKE MAŠINE U RUDARSTVU, Rudarsko-geološki fakultet, Beograd, 1995.
5. D. Ignjatović, RUDARSKE MAŠINE, Skripta za studente rudarskog odseka, Rudarsko-geološki fakultet, Beograd, 2009.
6. D. Ignjatović, RUDARSKE MAŠINE, Skripta II deo, Rudarsko-geološki fakultet, Beograd, 2011.
7. I. Ristović, EFIKASNOST RADA I ODRŽAVANjE MEHANIZACIJE NA POVRŠINSKIM KOPOVIMA LIGNITA, Rudarsko-geološki fakultet, Beograd, 2007.
1. M. Žikić, Authorized lectures, 2019.
2. Additional literature as recommended by the lecturer.
3. Prospectus materials.

Number of classes per weak	**Theoretical: 2**	**Practical: 2**

Lecture methods

Classes are conducted in the form of lectures and auditory exercises with the effort to maximally involve students, i.e. to be interactive. This is realized directly in classes or in the form of presentations, which are previously prepared by a team of students or individually. The lectures present the theoretical part of the material with constant illustration of characteristic examples from practice. The exercises analyze specific cases and give instructions regarding the preparation of seminar papers. Classes and exercises are intensively supported by a distance learning platform (Moodle). Engaging students in lectures and exercises, as well as completed assignment papers are scored as preliminary activities.

Grading system (Maximum of 100 points)

Pre-examination requirements	points	**Final examination**	points
Active participation / lectures	**5**	Written exam	
Active participation/exercises	**5**	Oral exam	**60**
colloquium	-		
assignments	**10+20**		

Study program: Mining Engineering

Course: GEODESY

Lecturer: Vušović M. Nenad

Status of the course: Compulsory for ELMS module students

ECTS: 4

Prerequisite: does not have

Course goals: Acquaintance of students with theoretical and practical knowledge in the field of Geodesy, modern technologies for acquiring spatial data and solving problems from geodetic surveying

Learning outcomes: Acquiring practical knowledge in the field of cartographic projections, coordinate systems, theory of errors, geodetic networks, instruments, measurement methods and basic geodetic calculations for the needs of solving engineering problems in the field of geodetic surveying and marking

Course description:
Lectures: Definition and tasks of geodesy. Historical development of geodesy. Determining the shape and size of the Earth. Geoid. Spheres and spheroids. Geodetic dates. Coordinate systems. Cartographic projections. Gauss-Kriger projection. UTM projection. Basic concepts from the theory of errors. Measurement errors. Geodetic networks. Trigonometric network. Polygon network. Division of polygon trains. Leveling nets. Classification of leveling grid. Measuring angles. Principle of angle measurement. Theodolite. Methods of measuring horizontal angles. Measuring lengths. Direct measurement of lengths. Indirect determination of lengths. Electromagnetic measurement of lengths. Determination of height differences. Levelers. Methods of determining height differences in geometric leveling. Basic geodetic calculations. Triangulation. Calculation of coordinates of polygonal points in the train. Calculating the elevations of the benchmarks in the leveling train. Geodetic survey. Numerical recording methods. Graphic recording methods. Geodetic plans. Marking accuracy. Geometry control. Global navigation satellite systems-GNSS. Technological development of GNSS. Global navigation systems. GNSS system architecture. GNSS signal structure. Basic segments of GNSS. GNSS receivers. Principles of GNSS measurement. GNSS positioning methods. GNSS measurement accuracy standards. Digital photography. Recording cameras. Orientation of recordings. Types of recordings and stereophotogrammetry. The image as a central projection, the image coordinate system, the geometric relationship between the image and the terrain. Terrestrial photogrammetry. Digital cameras. Stereoscopic terrain coverage. Stereo cameras. Aerial photogrammetry. Landmarks. Processing of recordings. Orthophoto. LiDAR laser scanning technology. Terrestrial laser scanners (TLS). Aircraft Laser Scanning (ALS). Mobile laser scanning (MLS). Laser scanning of terrain and objects. Environment modeling from point clouds: TIN, DEM, DTM. FLI-MAP laser altimetry system. UAV-unmanned aerial vehicles. Remote detection. Basic principles and elements of remote sensing. Sensor platforms.
Practice: Lectures are followed by work with instruments, calculation exercises and an essay

Literature:

Recommended:

1. Vušović N.: Historical development and concepts of modern Geodesy and Mine surveying (2004) Volume 1. and Volume 2. Technical Faculty at Bor. Winia Čačak
2. Harvey B.R.: Survey Computations, Surveying & Geospatial Engineering, UNSW Sydney, Australia (2018)
3. Ogundare J.O.: Precision surveying: the principles and geomatics practice, Wiley (2015)

Ancillary:

1. Schofield W.: Engineering Surveying, Fifth edition, Kingston University, Butterworth-Heinemann (2001)

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

Teaching methods lectures through presentations (https://moodle.tfbor.bg.ac.rs), followed by exercises

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance		Written part of the final exam	20
Exercise attendance		Oral part of the final exam	50

Coloquium exam/s	3 x 10	.....	
Term paper	20		

Study program: Mining Engineering

Course: ROCK AND SOIL MECHANICS

Lecturer/s: Dr Radoje Pantović, full professor

Status of the course: Obligatory

ECTS: 8

Prerequisite:
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 outcomes:
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:
Lectures:
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 tests of physical-mechanical and elastic properties of rocks (volumetric properties, limit strengths) and soil (volumetric properties, consistency limits, shear strength parameters). Testing the speed of longitudinal and transverse waves. Calculation of voltage conditions around underground rooms. Dimensioning of safety posts. Calculation of slope stability for circular, plane and wedge fracture. Students will make an Elaborate on the laboratory and calculation exercises they were present at.

Literature:
Recommended:
1. M. Stević, Mehanika tla i stijena, RGF, Tuzla, 1991.
2. R. Obradović, N. Najdanović, Mehanika tla u inženjerskoj praksi, Rudarski institut, Beograd, 1999.
3. N. Gojković, R. Obradović, V. Čebašek, Stabilnost kosina površinskih kopova, RGF, Beograd 2004.
4. M. Maksimović, Mehanika tla, Građevinska knjiga, Beograd 2005.
Ancillary:
1. S. Zlatković, Uvod u mehaniku tla, Udžbenik Tehničkog veleučilišta u Zagrebu, 2006.6. E. Hoek, P.K. Kaiser and W.F. Bawden, Support of Underground Excavations in Hard Rock, 1995.
2. A. Verruijt, Soil mechanics, Delft University of Technology, 2004
3. E. Hoek, Practical Rock Engineering, 2000, http://www.rocscience.com/hoek/PracticalRockEngineering.asp.

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

Teaching methods
Oral lectures, laboratory and calculation practicals, discussion

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Oral part of the final exam	**55**
Term paper	**20**		
Coloquium exam/s	**15**		

Study program: Mining Engineering

Course: MATERIALS IN MINING

Lecturer/s: dr Dragan Zlatanović, assistant professor

Status of the course: Elective for ELMS students...

ECTS: 6

Prerequisite: Lectures in the subject Mechanics 1

Course goals:

Introducing students to the materials used in mining and their characteristics.

Outcome of the course

Qualified selection of appropriate materials under specific conditions.

Course description:

Lectures:

Introductory remarks. The historical development of the mining industry. Materials in mining. Construction materials. Propellant materials. Materials for special purposes. Wood. Steel. Concrete. Rubber. Textiles. Composite materials. Fibers. Special materials.

Practice:

Auditory, computational, and demonstration exercises that accompany the program of lectures.

Literature:

Recommended:

1. P.Trifunović, R. Tokalić, N. Đukanović, Materijali u rudarstvu, RGF, Beograd, 2009
2. M. Muravljov, Građevinski materijali (udžbenik), Naučna Knjiga, Beograd, 2000.

Number of classes per week	**Lectures: 2**	**Practical classes: 2**	**Study research work: ?**	**Other forms of teaching: ?**

Teaching methods

Lectures, exercises.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**20**	Written part of the final exam	
Exercise attendance	**20**	Oral part of the final exam	**60**
Coloquium exam/s		.....	
Term paper			

Study program: Mining Engineering

Course: MINING DOCUMENTATION

Lecturer/s: Dr Jelena Ivaz, assistant professor

Status of the course: Elective

ECTS: 6

Prerequisite:

Course goals: To gain basic knowledge on standardization and legislation and to understand the hierarchy of technical documents**.**

Learning outcomes: Competences to apply standards and follow regulations and use technical documentation.

Course description:

Lectures:

Introductory remarks. Historical development of mining related legislation. Overview of mining relatedlegislative acts. Mining and geology act. Construction act. Environmental safety act. Sublegal acts and documents related to mining. Enforcement. Legal sanctions. Form and content of technical documentation. Process of mine design,design review and design application.

Practice:

Assignment

Literature:

Recommended:

1. М. Жикић, С. Стојадиновић, Стандарди, законска регулатива и техничка документација у рударству, Технички факулет у Бору, Бор, 2018

Ancillary:

1. Standards catalogues, Legislation almanacs

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

Teaching methods

Oral lectures, calculation tasks, discussion.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	10	Written part of the final exam	
Exercise attendance	30	Oral part of the final exam	60
Coloquium exam/s		.....	
Term paper			

Study program: Mining Engineering and Technological Engineering

Course: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Lecturer/s: Dr. Zoran Stević, full professor

Status of the course: Compulsory for modules Mineral Processing and Recycling Technologies and Sustainable Development

ECTS: 8

Prerequisites: None

Course goals: Acquiring knowledge on basic electrical engineering laws and their application.

Learning outcomes: Knowledge on electrical machines and devices, their application and protection of man.

Course description:

Lectures:

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.

Practice:

Computational and laboratory exercises, laboratory research experiments and studies

Literature:

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	**Lectures: 3**	**Practical classes: 2**	**Study research work: None**	**Other forms of teaching: None**

Teaching methods

Interactive presentations, computational and laboratory exercises and demonstrations.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	**0-30** **(Total number of points includes points from colloquium exams.)**
Exercise attendance	**20**	Oral part of the final exam	**30**
Coloquium exam/s	**30**		
Term paper	**10**		

Study program: Technological Engineering, Mining Engineering and Metallurgical Engineering

Course: INORGANIC CHEMISTRY

Lecturer: PhD Snežana M. Milić, full professor

Status of the course: Compulsory for Technological Engineering, Mining Engineering (modules EMD and RTSD) and Metallurgical Engineering.

ECTS: 8

Prerequisite: Acquired knowledge of General chemistry.

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

Learning outcomes: Better understanding of technological courses.

Course description:
Lectures:
General characteristics of elements. Aboundance. Reactivity. Production. 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 environmental pollution.
Practice:
Laboratory exercises.

Literature:
Recommended:
1. D. Poleti, Opšta hemija, II deo - hemija elemenata, Tehnološko-metalurški fakultet, Beograd, 2000.
2. N. Nikolić, Osnovi neorganske hemije, Prirodno-matematički fakultet, Niš, 2014.
3. S.R. Arsenijević, Opšta i neorganska hemija, Partenon, Beograd, 2001.
4. S. Milić, Praktikum iz neorganske hemije, Tehnički fakultet u Boru, Bor, 2013.
5. M. Popović, D. Vasović, LJ. Bogunović, D. Poleti, O. Ćuković, Zbirka zadataka iz Opšte hemije, Tehnološko–metalurški fakultet, Beograd, 2003.

Ancillary:
1. N. Rajić, Praktikum neorganske hemije, Tehnološko-metalurški fakultet, Beograd, 2004.
2. LJ. Bogunović i saradnici, Praktikum opšte hemije, II deo, Tehnološko-metalurški fakultet, Beograd, 2004.
3. N.L. Glinka, Zadaci i vežbe iz opšte hemije, Naučna knjiga, Beograd, 1994.

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

Teaching methods
Classical lectures with interactive discussions, calculation and laboratory exercises, consultation and colloquiums.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	10	Written part of the final exam	60
Exercise attendance	10	Oral part of the final exam	
Colloquium exams	20		
Term paper			

Study program: Technological Engineering, Mining Engineering and Metallurgical Engineering

Course: ANALYTICAL CHEMISTRY

Lecturers: PhD Tanja S. Kalinović, assistant professor, PhD Ana A. Radojević, assistant professor

Status of the course: Compulsory for Technological engineering and Metallurgical Engineering; Elective for Mining Engineering (modules EMD and RTSD).

ECTS: 6

Prerequisite: Acquired knowledge of General chemistry and Inorganic chemistry.

Course goals: Acquiring and mastering theoretical foundations, basic techniques, operations and skills necessary for quantitative chemical analysis. Application of theoretical knowledge in calculations and practical work in the chemical laboratory.

Learning outcomes: Training students to assess the quality of samples of various industrial raw materials and products, as well as to monitor and control the parameters of technological processes and the quality of environmental parameters.

Course description:

Lectures:

Determining the necessary knowledge for successful monitoring and adoption of the planned course curriculum. Subject and aims of Analytical Chemistry. Classification of methods, principles, techniques and basic operations of quantitative chemical analysis. Gravimetric analysis: Principles of gravimetric analysis, precipitation reactions, types of precipitates, conditions for the precipitates formation, calculations in gravimetry, ion separation methods, gravimetric determination of individual cations and anions in aqueous solutions. Volumetric analysis: Principles of volumetric analysis, classification of volumetric methods, indicators and calculations in volumetrics, volumetric determination of individual cations and anions in aqueous solutions.

Practice:

Laboratory exercises: Gravimetric determinations; Volumetric determinations (neutralization methods, oxido-reduction methods, complexometric methods, precipitation methods). Calculation exercises.

Literature:

Recommended:

1. E. Lončar, Analitička hemija, Tehnološki fakultet, Novi Sad, 2013.
2. O. Vitorović, R. Šaper, Analitička hemija-teorijske osnove, Tehnološko-metalurški fakultet, Beograd, 1989.
3. J. Savić, M. Savić, Osnovi analitičke hemije, Svjetlost, Sarajevo, 1990.
4. Lj. Rajaković, A. Perić-Grujić, T. Vasiljević, D. Čičkarić, Analitička hemija, Kvantitativna hemijska analiza, Praktikum, Tehnološko-metalurški fakultet, Beograd, 2000.
5. Lj. Rajaković, Analitička hemija-Zbirka zadataka, Tehnološko-Metalurški fakultet, Beograd, 2005.

Ancillary:

1. D.A. Skoog, D. M. Holler, Osnove analitičke kemije, Školska knjiga, Zagreb, 1999.

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

Teaching methods

Classical lectures with interactive discussions, calculation and laboratory exercises, consultations and colloquium exams.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	5	Written part of the final exam	45
Exercise attendance	10	Oral part of the final exam	
Colloquium exams	20+20		
Term paper			

Study program: Technological Engineering and Mining Engineering

Course: ORGANIC CHEMISTRY

Lecturer: PhD Slađana Č. Alagić, full professor

Status of the course: Obligatory for Technological Engineering and elective for Mining Engineering (modules EMD and RTSD).

ECTS: 6

Prerequisite: 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 physical-chemical characteristics. Education on basic experimental techniques in organic chemistry laboratory, characterization of organic compounds and experimental synthesis of simple organic compounds.

Learning outcomes: Better understanding of many technological subjects 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:

Lectures:

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.

Practice:

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. Methods of solvent extraction of organic compounds from natural products; chromatography methods.

Literature:

Recommended:

1. Р. Палић, Н. Симић, Органска хемија, I издање, Универзитет у Нишу, ПМФ, Ниш, 2007.
2. G. A. Taylor, Органска хемија, III издање, Научна књига, Београд, 1995.
3. Presentation of the lecturer.
4. В. Савић, М. Симић, М. Петковић, Г. Тасић, П. Јовановић, З. Токић Вујошевић, С. Дилбер, Практикум из органске хемије, Фармацеутски факултет, Београд, 2017.
5. Ј. Риковски, Органска хемија, Грађевинска књига, Београд, 1979.

Ancillary:

1. С. Арсенијевић, Органска хемија, Научна књига, Београд, 1990.
2. K.P.C. Vollhardt, N.E. Schore, Organic chemistry, Structure and Function, 6th Ed., 1999, 2003, 2011, W.H. Freeman and Company, USA.
3. B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Longman Group UK Limited, 1989.
4. С.Д. Петровић, Д.Ж. Мијин, Н.Д. Стојановић, Хемија природних органских једињења, Технолошко–металуршки факултет, Београд, 2009.

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

Teaching methods

Teaching with interactive discussions, experimental work and calculations, consultations, colloquiums.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	5	Written part of the final exam	45
Exercise attendance	10	Oral part of the final exam	
Colloquium exams	20+20		
Term paper			

Study program: Mining Engineering
Course: Mineral Deposits
Lecturer/s: dr. Miodrag Banješević, Associate Professor
Status of the course: Compulsory subject for Mining Engineering (module: ELMS)
ECTS: 4
Prerequisite: Knowledge from courses Geology, Mineralogy and Petrology
Course goals: Introduction to the basic types and characteristics, genesis and conditions of the mineral deposits
Learning outcomes: The acquired knowledge is the basis for studying the subject of Exploration of mineral deposits
Course description: Lectures: 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 Practice:
Literature: Recommended: 1. Č. Mudrinić. Ležišta mineralnih sirovina, RGF, Beograd, 1997 Ancillary: 1. M. Banješević. Ležišta mineralnih sirovina, praktikum, TF, Bor, 2017 2. R. Jelenković, V. Simić, A. Kostić, D. Životić. Ležišta mineralnih sirovina, RGF, Beograd, 2010 3. S. Janković. Ležišta mineralnih sirovina – geneza rudnih ležišta, RGF, Beograd, 1981

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

Teaching methods Lectures, test, seminar
Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance		Oral part of the final exam	***60***
Coloquium exam/s	**15**	.....	
Term paper	**15**		

Study program: Mining Engineering

Course: GEOINFORMATICS

Lecturer: Vušović M. Nenad

Status of the course: Compulsory for ELMS module students

ECTS: 8

Prerequisite: Previously acquired knowledge in the subject of Geodesy

Course goals: Acquaintance of students with relevant terms from Geoinformatics theory as a basis for defining geospatial data models, spatial databases and modeling of spatial objects

Learning outcomes: Acquiring practical knowledge in the field of modeling geometry and topology of space, cartographic representation of data, raster and vector analysis and management of spatial data

Course description:

Lectures: Terminology, definitions and history of Geoinformatics. Basic tasks and division of Geoinformatics. Spatial data. Spatial information. Data sources. Methods of spatial data collection. Spatial databases. Basic spatial concepts. Geospatial data models and modeling. Modeling of spatial objects. Object-based models. Models based on continuous fields. Raster data. Vector data. Raster and vector models of spatial data. Basic geometric concepts of space. Geometric data types. Geometric primitives for spatial data (point, line, polygon). Modeling the geometry of space. Topological spatial concept. Topological connections (node, edge, appearance). Modeling the topology of space. Network topologies. Relations between geometry and topology. Geospatial data formats. Standard templates and models in the modeling and implementation of geometry, topology and thematic content of space elements. Cartographic presentation of data. Digitization. Vectorization. Georeferencing. Representation of spatial data and algorithms. Models and algorithms for spatial entities. Models and algorithms for representing spatial data over continuous fields. GIS applications (ESRI ArcGIS). Basic geometric algorithms. Interpolation with geospatial data. Geostatistical methods of interpolation. Raster GIS analysis (map algebra, filtering). Vector GIS analyzes (overlapping polygons, buffers, geocoding, network analyses). Cartographic interface. Geovisualization. Digital terrain model (DTM, DSM, DEM). Data acquisition for a digital terrain model: classic geodetic survey, photogrammetry, GNSS, LIDAR, SAR interferometry. Surface modeling. Standard templates for model representation. Terrain modeling. Networks of triangles. Automatisms in the generation of TIN and GRID. GIS applications of the digital terrain model. Spatial reasoning and uncertainty. Spatial data quality control (thematic and topological consistency control, accuracy assessment). Time component of spatial data. Maintenance of geospatial databases. Distribution of spatial data. Standardization in the field of geoinformatics.

Practice: Work in ArcGIS software with tools for modeling spatial objects, creating a spatial database and solving tasks in the field of GIS. Preparation of a seminar paper.

Literature:

Recommended:

1. Vusović N. Geoinformatics Technical Faculty in Bor. *in press* (2023)
2. Ghilani C.D., Wolf P.R.: Elementary surveying: An introduction to Geomatics, Prentice Hall, N. Jersey (2012)
3. McCloy K.R.:Resource Management Information Systems: Remote Sensing, GIS and Modelling, T & F (2006)
4. M. Behnisch, G.Meinel: Trends in Spatial Analysis and Modelling, Springer (2018)

Ancillary:

1. Kang-tsung C.: Introduction to Geographic Information Systems, McGraw-Hill, 4 edition (2006)

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

Teaching methods lectures through presentations (https://moodle.tfbor.bg.ac.rs), followed by exercises

Knowledge evaluation (maximum 100 points)			
Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	20
Exercise attendance	5	Oral part of the final exam	50
Coloquium exam/s		.....	
Term paper	20		

Study program: Mining Engineering				
Course: Exploration of mineral deposits				
Lecturer/s: dr. Mira Cocić, professor				
Status of the course: Compulsory for				
ECTS: 8				
Prerequisite: Acquired knowledge from subject: Mineral deposits				
Course goals: Introducing students to methods and resources for exploration of mineral deposits, methods of sampling and reserve calculation				
Learning outcomes: Acquired knowledge presents groundwork for exploration deposits projecting, calculation of mineral reserves and modeling of deposits necessary for mining projecting				
Course description: Lectures: 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. Practice: 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. M. Jeremić, Exploration of mineral deposits, University of Sarajevo, Faculty of Mining, Tuzla, 1964. 3. S. Gajić, Exploration of mineral deposits, Technical Faculty, Bor, 1981. Ancillary:				
Number of classes per week	**Lectures: 2**	**Practical classes: 2**	**Study research work: -**	**Other forms of teaching: -**
Teaching methods Lectures, practices, practical lectures, colloquiums				

Knowledge evaluation (maximum 100 points)			
Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	
Exercise attendance	**5**	Oral part of the final exam	*45*
Coloquium exam/s	**15 + 15**	.....	

Elaborate	**15**		

Study program: Mining Engineering				
Course: Mineral processing				
Lecturer/s: PhD. Jovica M. Sokolović, full professor				
Status of the course: Elective course on ELMS module				
ECTS: 8				
Prerequisite: Previously acquired knowledge in the study program				
Course goals: Introduction to mining students, the ELMS module, with 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 outcomes: 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: **Lectures:** 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 computational exercises and other forms of teaching.				
Literature: Recommended: 1. Knežević, D. (2012). Preparation of mineral raw materials, Faculty of Mining and Geology, Belgrade. 2. Ćalić, N. (1990). Theoretical basis of preparation of mineral raw materials, Faculty of Mining and Geology, Belgrade. 3. Wills, BA, Finch, James A. (2016). Wills' Mineral Processing Technology, An Introduction to the Practical Aspects of Ore Treatment and Mineral Recovery (Eighth Edition), Butterworth-Heinemann . 4. Sokolović, J., (2019). Internal manual for exercises in the preparation of mineral raw materials, Technical Faculty in Bor, Bor .				
Number of classes per week	**Lectures: 2**	**Practical classes: 2**	**Study research work:**	**Other forms of teaching:**
Teaching methods Theoretical knowledge of students (module ELMS) with processes of characterization of raw materials and mineral processing processes, as a phase of mining activity. Practical teaching refers to laboratory exercises and experiments in the same scientific field.				
Knowledge evaluation (maximum 100 points)				
Pre-examination obligations	Points	**Final exam**		Points
Lecture attendance	**10**	Written part of the final exam		
Exercise attendance	**10**	Oral part of the final exam		**60**
Coloquium exam/s	**10 x 2**			
Term paper				

Study program: Mining engineering

Course name: GEOENGINEERING

Lecturer: dr Saša S. Stojadinović, van. prof.; dr Dejan V. Petrović, doc.

Course status: elective

ECTS: 8

Prerequisites: Passed the exam in Mathematics 1 and 2, attended lectures in the subjects Basics of Machines and Devices and Mechanics of Rocks and Soils

Course goal

Introducing students to the basic principles of earthworks and construction of basic mine infrastructure.

Course Outcome

The student's ability to skillfully decide on the preparation of the ground and location for the construction of the mine.

Course description

Theoretical classes

Introductory remarks. Geoengineering, Engineering Geology, Geotechnical Testing, Earthworks, Excavations, Embankments, Earth dams, Canals, Mining Roads, Landfills and Loans.

Practical classes

Computational exercises that accompany the program of lectures, computational examples of sizing channels, embankments, dams and roads. Assignment – Dimensioning and construction of the structure (cut, fill, dam, road, landfill. Mine tour

Literature

1. M. Đinđić, Zemljani radovi, udžbenik, Građevinski fakultet, Niš, 1996.
2. Z. Joksić, Donji stroj saobraćajnica, Građevinska knjiga, Beograd, 1986.
3. T R Bonaci, Zemljani radovi, Građevinski fakultet Split, 2012.

Number of classes per weak	**Theoretical:2**	**Practical: 2**

Lecture Methods

Lectures, exercises, field work.

Grading

Prerequisites	Points	**Final examination**	points
Active participation / lectures	**10**	Oral exam	**60**
Active participation/exercises	**10**		
Assignment	**20**		

Study program: Mining Engineering

Course: TECHNOLOGY OF UNDERGROUND MINING FACILITIES CONSTRUCTION

Lecturer: Dr Dejan Petrović, assistant professor

Status of the course: Compulsory for EMD Module

ECTS: 4

Prerequisite: 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 outcomes: Necessary competences for independent underground facilities construction.

Course description:

Lectures:

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.

Ancillary:

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

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

Teaching methods

Oral lectures, calculation tasks, discussion

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance	**10**	Oral part of the final exam	**65**

Coloquium exam/s		.....	
Term paper	**15**		

Study program: Mining Engineering				
Course: HAULAGE AND HOISTING				
Lecturer/s: dr Dragan Zlatanović, assistant professor				
Status of the course: Compulsory for ELMS students...				
ECTS: 6				
Prerequisite: Basic knowledge on Mechanical engineering				
Course goals: Understanding of haulage and hoisting types and capacity calculations especially in mining.				
Outcome of the course Ability to independently select appropriate haulage and hoisting system and equipment.				
Course description: Lectures: 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 or hoisting system types. Written report: Selection of appropriate haulage or hoisting 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.				
Number of classes per week	**Lectures: 3**	**Practical classes: 2**	**Study research work: ?**	**Other forms of teaching: ?**
Teaching methods Oral lectures, practicals, field work, discussion				
Knowledge evaluation (maximum 100 points)				
Pre-examination obligations	Points		**Final exam**	Points
Lecture attendance	**10**		Written part of the final exam	
Exercise attendance	**10**		Oral part of the final exam	**60**
Coloquium exam/s			.....	
Term paper	**20**			

Study program: Mining Engineering

Course: Technology and sustainable development

Lecturer/s: PhD. Jovica M. Sokolović, full professor

Status of the course: Elective course on PMS and RTOR modules

ECTS: 6

Prerequisite: no prerequisites

Course goals: Acquisition of theoretical and practical knowledge in the field of technology application, as well as the role and importance of technology and its connection with sustainable development.

Learning outcomes: Theoretical and practical training for work in scientific, educational and economic organizations, which deal with planning and implementing the concept of sustainable development.

Course description:

Lectures: Technologies. Concept and significance of technology. The impact of technologies on the development of society. Technological systems. Technological processes. Input and output elements of the technological process. Basic criteria for the selection of input and output elements of the technological process. Impact of technological processes and technological stages on the environment. Industrial process design. Basics of mining technologies. Basics of metallurgical technologies. Basics of recycling technologies. Sustainable Development. Concept of sustainable development and sustainability. Basic components and characteristics of sustainable development. The concept of sustainable development. The importance and goals of the concept of sustainable development. Adoption of the concept of sustainable development. Ethics and morality in the concept of sustainable development. Ecology. Ecological conscience. Ecological ethics. Principles of sustainable development. Environment and environmental sustainability. Sustainable use of energy. Sustainable industrial activities. Sustainable mining. Indicators of sustainable development. Strategy of sustainable development.

Practice: Exercises, presentation of examples from practice, preparation and defense of a term paper.

Literature:

Recommended:

1. Stanojlović, R., Sokolović, J. (2016). Technologies and Sustainable Development, Textbook, University of Belgrade, Technical Faculty in Bor, Bor.
2. Đukanović, M. (1996). Environment and sustainable development, Elit, Belgrade.

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

Teaching methods

Lectures, exercises and practical work, organized on an interactive principle, which in addition to classical lectures and presentations, includes active participation of students in all types of teaching, discussions, consultations , preparation and defense of the term paper.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance	**10**	Oral part of the final exam	**50**
Coloquium exam/s	**10**		
Term paper	**20**		

Study program: Technological Engineering, Mining Engineering, Metallurgical Engineering

Course: PHYSICAL CHEMISTRY

Lecturer: PhD Marija B. Petrović Mihajlović, associate professor, PhD Maja M. Nujkić, associate professor

Status of the course: Compulsory for Technological Engineering and Metallurgical Engineering. Elective for Mining Engineering (moduls EMD and RTSD).

ECTS: 9

Prerequisite: Acquired knowledge from General chemistry.

Course goals: Students acquaint physicochemical concepts, laws and principles. Theoretical base is set for studying of principles of structure and states of matter, physical processes and phase equilibrium in material systems, as well as chemical reactions and chemical equilibrium. Fundamentals of chemical thermodynamics and kinetics, as well as electrochemistry are introduced.

Learning outcomes: Students master and adopt fundamental physico-chemical terms and principles. Students identify and understand physicochemical processes associated with technological, metallurgical and mining processes. They acquire knowledge of experimental physicochemical methods, measurements and data processing.

Course description

Lectures:

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 the electrodes; Fundamentals of electrochemical kinetics.

Practice:

Experiments in the field of gaseous state of matter, chemical thermodynamics, chemical equilibrium, solutions, phase equilibrium, adsorption, kinetics and electrochemistry. Calculation exercises.

1st cycle: Determination of partial pressure; Determination of vapor 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 (Physical chemistry), TMF, Beograd, 2005. (in Serbian)
2. D. Minić, A. Antić-Jovanović, Fizička hemija (Physical chemistry), FFH, BF, Beograd, 2005. (in Serbian)
3. D. Vučinić, S. Popov, Fizička hemija (Physical chemistry), Rudarsko-geološki fakultet, Beograd, 2014. (in Serbian)

Ancillary:

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 (Physical chemistry - book of problems), TMF, Beograd, 2004. (in Serbian)
2. Z. Stanković, M. Rajčić-Vujasinović, Eksperimenti u fizičkoj hemiji (Experiments in physical chemistry), TF, Bor, 2006. (in Serbian)
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 (Experimental physical chemistry), TMF, Beograd, 2004. (in Serbian)
4. S. Mentus, Lj. Damjanović, Fizičkohemijska analiza (Physicochemical analysis), Fakultet za fizičku hemiju, Beograd, 2015. (in Serbian)

5. S. Golden, An introduction to theoretical physical chemistry, Addison-Wesley publishing company, INC., Reading Massachusetts, U.S.A., London, England, 1961.
6. R.I. Masel, Principles of adsorption and reaction on solid surfaces, A Wiley-interscience publication, John Wiley & Sons, INC., 1996.
7. J.E. House, Principles of chemical kinetics 2nd edition, Academic press, 2007.
8. M.K. Snyder, Chemistry: Structure and Reactions, Holt, Rinehart, Winston; 1966.

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

Teaching methods
Lecturing with interactive discussions, calculation and laboratory exercises, consultations and colloquiums.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	5	Written part of the final exam	30
Exercise attendance	5	Oral part of the final exam	40
Colloquium exam/s	20		
Term paper			

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

Course: STATISTICS

Lecturer/s: Ivana Z. Đolović

Status of the course: Compulsory for Metallurgical Engineering, Technological Engineering and Engineering Management ; Elective for Mining Engineering

ECTS: 9

Prerequisite: Fundamental knowledge in mathematics

Course goals: Students should be able to use appropriate mathematical and statistical concepts and tools in recognizing and solving problems

Learning outcomes: Students should be able to apply theoretical knowledge from statistics in recognizing and solving tasks in further studying process as well as real problems in engineering, sciences, business and technology fields

Course description:

Lectures:

Introduction (statistical data, frequency distribution, absolute and relative frequencies, cumulative frequency); Mean values (arithmetic mean, geometric mean, harmonic mean, median,); measures of dispersion (range, quartiles and interquartile range, mean absolute deviation, variance, standard deviation); Coefficient of variation and meaning; Coefficient of skewness; Pearson's moment coefficient of kurtosis (excess kurtosis); Discrete and continuous random variables; The Binomial probability distribution; The Poisson probability distribution; The normal distribution; - distribution; Student's t- distribution; Population and sample (types of sample, sample parameters); Point estimates of the population parameters; Confidence interval for population mean; Confidence interval for population proportion; Confidence interval for the difference of two population means; Confidence interval for the difference of two population proportions; Hypothesis tests; Hypothesis tests about the population mean; Hypothesis tests for the variance; Hypothesis tests of the equality of two means; Hypothesis tests about the population proportion; non-parametric tests; (- test of independence; - test of distribution); The correlation coefficient; Regression analysis; Coefficient of determination; standard error of the regression; Linear regression; Quadratic regression; Exponential regression; Logarithmic regression

Practice:

Calculation exercises and application in real problems (with and without some statistical packages - advantages and disadvantages)

Literature:

Recommended:

1. I.Đolović, Statistika, Univerzitet u Beogradu, Tehnički fakultet u Boru, Bor, 2016.

2. I.Đolović, Zbirka zadataka iz statistike, Univerzitet u Beogradu, Tehnički fakultet u Boru, Bor, 2011.

Ancillary:

1. Mann S.P., Uvod u statistiku (srpsko izdanje), Centar za izdavačku delatnost Ekonomskog fakulteta, Beograd, 2009.

2. Mann S.P., Introductory Statistics (many editions in English)

Number of classes per week	**Lectures: 3**	**Practical classes: 3**	**Study research work: /**	**Other forms of teaching: /**
Teaching methods Frontal teaching for theoretical knowledge and group, individual and combined learning in practical parts of lessons (students engagement through active learning – applications and discussions)				
Knowledge evaluation (maximum 100 points)				
Pre-examination obligations	Points	**Final exam**	Points	
Lecture attendance	**40**	Written part of the final exam	**40**	
Exercise attendance	**/**	Oral part of the final exam	/	
Coloquium exam/s	**20**	.....		
Term paper	**/**			

Study program: Mining Engineering			
Course: COMMINUTION AND CLASSIFICATION OF MATERIALS			
Lecturer/s: PhD Milan Trumić, full professor			
Status of the course: Compulsory for modules MP and RTSD			
ECTS: 7			
Prerequisite: Basic knowledge of mathematics and physics			
Course goals: Acquiring knowledge of students on theoretical and practical principles on which processes of comminution and classification of materials are based			
Learning outcomes: Students are able to more easily follow courses from subjects that rely on a processed program and to effectively apply acquired knowledge in practice			
Course description: Lectures: 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. Practice: Laboratory and calculus exercises according to the course of 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. Ancillary: 1. N. Magdalinović, Meljivost mineralnih sirovina, Nauka, Beograd, 1997. 2. N. Magdalinović, I. Budić, N. Ćalić, R. Tomanec, Kinetika mlevenja, Tehnički fakultet, Bor, 1994.			
Number of classes per week	**Lectures: 3**	**Practical classes: 3**	
Teaching methods Lectures with interactive work with students, practical work through laboratory and calculus exercises. Pre-examination of knowledge through two colloquiums.			
Knowledge evaluation (maximum 100 points)			
Pre-examination obligations	Points	**Final exam**	Points

Lecture attendance	**10**	Written part of the final exam (5 points min.)	**20**
Exercise attendance	**10**	Oral part of the final exam	**40**
Coloquium exam/s	**10 + 10**	.....	

Study program: Mining Engineering				
Level of study: Undergraduate Academic Studies				
Subject: Testing mineral and secondary raw materials				
Lecturer: dr Zoran Štirbanović, assistant professor				
Status of the subject: Obligatory subject for modules MP and RTSD				
ECTS: 6				
Precondition:				
Goal of the subject: Introducing students with theoretical and practical principles on which methods of testing mineral and other raw materials are based.				
Outcome of the subject: 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.				
Contents of the subject: ***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 calculus 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. Ancillary: 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	Exercises: 2	Other forms of teaching:	Study research work:	
Methods of teaching: Lectures with interactive work with students, practical work through laboratory and computational exercises. Pre-examination of knowledge through one colloquium.				
Knowledge rating (max. number of points 100)				

Pre-examination obligations	Number of points	Final examination	Number of points
Activity during the lecture	25	Written exam	
Practical classes	25	Oral exam	40
Colloquium	10		
Independent work			

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

Course title: ENGLISH LANGUAGE 3a

Lecturer/s: Enisa S. Nikolić

Course status: Compulsory for the students of all departments

ECTS credits: 2

Prerequisite: pre-intermediate to intermediate level of language proficiency

Course goals:

Further development of students' language competence in academic and professional contexts, which includes the development of all language skills. Introduction of professional vocabulary and the relevant language material related to the study programs taught at the Technical Faculty in Bor, so that the students could use professional literature and communicate in English (in written and oral form) in academic or professional settings.

Learning outcomes:

Students have mastered the specific vocabulary, grammar structures and language functions that are characteristic of academic and professional contexts and, to a greater or lesser extent, are able to: independently use professional literature and translate scientific and professional texts of various levels of complexity, present and discuss the topics that have been dealt with in classes and to express themselves in short written forms (short composition, summary, short comment, CV and the cover letter).

Course description:

Lectures: *Grammar points*: Revision of Tenses (Present Simple/ Continuous, Present Perfect Simple/ Continuous, PastSimple/ Continuous, Past Perfect Simple/ Continuous, Future Simple/Continuous, going to structure); Modalverbs referring to present, future and past; Noun groups, Compounds, Foreign Plurals, Word formation (common prefixes and suffixes); The Passive Voice (revision of passive structures, impersonal passive constructions, questions in the passive); Linking words 1;
Language functions: Seeking information, Giving advice, Expressing opinion, Agreeing/ Disagreeing,
Topics: Why English Matters, The Importance of English for Engineers, Science and Engineering, Famous Scientists, Types of Engineering, The Different Functions of Engineers, Our Technological World, New Technologies, Data mining , Environmental Issues (Air, Water and Soil Pollution).
Practice classes: Practice and reinforcement of grammatical structures and lexical content required by the curriculum; further practice and systematic development of all language skills (listening, speaking, reading and writing)

Literature:

Recommended:
1. E. Nikolić, English Language 3a - A Selection of texts with lexical exercises and communicative activities.
2. E. Nikolić, Engleski jezik 3: Grammar Guide and Practice, Univerzitet u Beogradu, Tehnički fakultet u Boru,
2020.

Ancillary:
1. John Eastwood, Oxford Practice Grammar (with answers), Oxford University Press, 2006.
2. Raymond Murphy, English Grammar in use (third edition), Cambridge University Press, 2004.

Number of classes per week 2	**Lectures: 1**	**Practice classes: 1**

Teaching methods
Eclectic (combined) method including the principles and techniques of different methods with a focus on communicative approach. Teaching modes: frontal, individual, group/team and pair work.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	**Points**	**Final examination**	**Points**
Student activity (lectures)	**5**	Written part of the exam	**20**
Student activity (practice classes)	**5**	Oral part of the exam*	**40**
Midterm exam/s	**30**		
Term paper/s			

*The prerequisite for taking the oral part of the exam is earning a minimum of 25 points in the midterm and written part of the final exam.

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

Course title: ENGLISH LANGUAGE 3b

Lecturer/s: Enisa S. Nikolić

Course status: Compulsory for the students of all departments

ECTS credits: 2

Prerequisite: pre-intermediate to intermediate level of language proficiency

Course goals:
Further development of students' language competence in academic and professional contexts, which implies the development of all language skills. Introducing grammatical structures and professional lexis related to the study programs taught at the Technical Faculty in Bor so that students can use professional literature and communicate in English (in written and oral form).

Learning outcomes:
Students have mastered specific vocabulary, grammatical structures and language
functions characteristic of academic and professional contexts and, to a greater or lesser extent, are able to: independently use professional literature and translate scientific and professional texts of various levels of complexity, present and discuss the topics that have been dealt with in classes and to express themselves in short written forms.

Course description:
Lectures: *Grammar points*: Conditionals (all three types); Reported Speech (Sequence of Tenses-Statements);Infinitive vs. -ing form; Participles used adjectivally and in reduced relative clauses; Word formation: common prefixes and suffixes; Linking words 2;
Language functions: Summarizing, Comparing and Contrasting, Sequencing/ Ordering, Problem solving, Defining things,Talking about cause and effect.
Topics: Sustainable Solutions: Recycling, Going Green, Corporate Social Responsibility; The World of Management: Management Functions, Management Levels in an Organization, Production Management; Safety at Work: Importance of workplace safety, Mine Safety, Lab Safety Rules; Presenting your Ideas: Tips for giving presentations.
Practice:
Practice and reinforcement of grammatical structures and lexical content required by the curriculum; further practice and systematic development of all language skills (listening, speaking, reading and writing).

Literature:
Recommended:
1. E. Nikolić, English Language 3a - A Selection of texts with lexical exercises and communicative activities.
2. E. Nikolić, Engleski jezik 3: Grammar Guide and Practice, Univerzitet u Beogradu, Tehnički fakultet u Boru, 2020.
Ancillary:

1. Ken Paterson & Roberta Wedge, Oxford Grammar for EAP, Oxford University Press, 2013.
2. Paul Emerson, Business Grammar Builder, Macmillan Publishers Limited, Oxford,2002.

Number of classes per week 2	**Lectures: 1**	**Practice classes: 1**

Teaching methods

Eclectic (combined) method including the principles and techniques of different methods with a focus on communicative approach. Teaching modes: frontal, individual, group/team and pair work..

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	**Points**	**Final examination**	**Points**
Student activity (lectures)	**5**	Written part of the exam	**20**
Student activity (practice classes)	**5**	Oral part of the exam *	**40**
Midterm exam/s	**30**		
Term paper/s			

* The prerequisite for taking the oral part of the exam is earning a minimum of 25 points in the midterm and written part of the final exam.

Study program: Mining Engineering

Course: TECHNOLOGY OF DRILLING AND BLASTING

Lecturer/s: Dr Radoje Pantović, full professor

Status of the course: Obligatory

ECTS: 6

Prerequisite:

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 outcomes:

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

Course description:

Lectures:

Purpose of drilling. Rock resistance to drilling. Percussive drilling. Percussion-rotary drilling. Rotary drilling with chisels. Drilling with rotary drills with triangular crowns. Drilling mode parameters. Basic characteristics of drilling equipment. Drilling efficiency indicators. Mechanization and automation of drilling. Drilling accuracy. Capacity of drills. Non-mechanical drilling procedures. Ergonomic conditions during drilling. Drilling costs. Explosion, detonation and deflagration. Characteristics of explosives. Dynamites. ANFO and Slurry explosive mixtures. Emulsion explosives. Gel explosives. Choice of explosives. Initiation systems. Non-electrical initiation systems. Electrical initiation systems. Mechanization of filling mine wells. Detonation of explosives and collapse of the rock mass. Basics of detonation theory. Energy balance of the explosion. Rock resistance to blasting. Determination of the specific consumption of explosives. Blasting in surface mines. Geometrical parameters of floor blasting. Constructions of explosive charges. Blasting during construction of mine premises. Contour-controlled blasting. Blasting parameters during underground excavation. Secondary blasting. Characteristics of blasting in pits with methane mode. Safety during blasting. Seismic tremors, air shock waves, flying pieces of rock and the appearance of poisonous gases during blasting. Storage of explosives and means of initiation.

Practice:

Hammer drill - principle of operation. An example of choosing a drill. Calculation of the speed and capacity of the drill. Determining the characteristics of explosives and initial means-demonstration exercises. Calculation of reduction parameters in surface mining. Calculation of blasting parameters during the construction of ore rooms. Calculation of blasting parameters during underground mining of ores.

Literature:

Recommended:

1. R. Pantović, Tehnologija bušenja, Tehnički fakultet, Bor, 2004.
2. M. Savić, Miniranje na površinskim kopovima, Institut za bakar, Bor, 2000

Ancillary:

1. G. Berta, Exsplosives - an engineering tools, Italesplosivi, Milano, 1990.
2. S. Olofsson, Applied exsplosives technology for construction and mining, Arla, Sweden, 1988.

3. S. Bhandari, Engineering Rock Blasting Operations, Balkema , 1997.			
Number of classes per week	**Теоријска настава: 3**	**Практична настава: 2**	
Teaching methods Oral lectures, practicals, field work, discussion			
Knowledge evaluation (maximum 100 points)			
Pre-examination obligations	поена	**Завршни испит**	поена
Lecture attendance	**10**	усмени испит	**55**
Term paper	**20**		
Coloquium exam/s	**15**		

Study program: Mining Engineering				
Course: OCCUPATIONAL HEALTH AND SAFETY IN MINING				
Lecturer/s: Dr Jelena Ivaz, assistant professor				
Status of the course: Obligatory				
ECTS: 4				
Prerequisite:				
Course goals: Acquiring theoretical and practical knowledge on occupational safety and health in mining and mineral processing.				
Learning outcomes: Danger identification and assessment. Injuries and occupational diseases reporting and analysis. Hazardous gassesconcentration measurement and protective and preventive measures planning. Personal breathing protection. Principlesof technical safety organization and management.				
Course description: Lectures: Regulations in the field of occupational safety in mining. Ergonomics and work safety in mining. Occupational injuriesand 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 andrescue 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. Ancillary: 1. M. Miljković, Rudarske katastrofe, Monografija, Institut za bakar, Bor, 2003. 2. M. Miljković, Rudarska ergonomija, TF, Bor, 2002.				
Number of classes per week	**Lectures: 3**	**Practical classes: 2**	**Study research work: 3**	**Other forms of teaching:**
Teaching methods Oral lectures, practicals, field work, discussion				
Knowledge evaluation (maximum 100 points)				
Pre-examination obligations	Points	**Final exam**		Points

Lecture attendance	10	Written part of the final exam	
Exercise attendance	20	Oral part of the final exam	40
Coloquium exam/s	30	.....	
Term paper			

Study program: Mining Engineering

Course: MINE SURVEYING

Lecturer: Vušović M. Nenad

Status of the course: Elective for ELMS module students

ECTS: 8

Prerequisite: Previously acquired knowledge in the subject of Geodesy

Course goals: Acquaintance with theoretical and practical knowledge in the field of mining measurements and the problem of shifting undermined terrain and protecting buildings from the impact of mining operations

Learning outcomes: Acquisition of practical knowledge about mining measurements on the surface and in the pit

Course description:

Lectures: Definition, tasks and historical development of mine surveying. Basic mine trigonometric network. Polygon trains on the track and in the pit. Basic mine leveling network. Instruments and methods of measuring horizontal directions, vertical angles and lengths. Leveling through a vertical shaft. Connecting the basic pit polygon trains with the geometric base on the terrain surface. Connection through one window using the method of connection triangles. Calculating and marking the direction of the breakthrough in the horizontal and vertical plane. Breakthrough accuracy analysis. Measurement works during the marking of mine facilities. Geometric elements for marking points. Marking the angle, length and given height. Marking points with given coordinates. Measurements during shaft construction. Marking the center and axis of the shaft. Marking of the axis of the ramp. Markings of the mine room in the curve. Recordings of cross-sectional profiles of mine rooms. Movement of undermined terrain due to the impact of mining operations. Geometric characteristics of the displacement process. Basic linear elements. Deformations. Angular parameters of the displacement process. Classification of methods for prognostic calculation of displacements and deformations. Perception of movement of undermined terrain. Perception networks. Protection of buildings in the zone of influence of mining works. Criteria for the protection of buildings. Construction of protective pillars for shaft, building and road. Calculation of cubic volumes of excavated masses. Application of GPS in mining. Production management via GPS/GPRS/GIS/SCADA system. Formation of spatial information system of mines in GIS. Mine spatial data management. Creation of a SCADA system for monitoring, management and acquisition of data from mining machinery. Mining measurements today. LiDAR laser scanning technology. Aircraft Laser Scanning (ALS). Remote detection. Unmanned aerial vehicles (UAV). Mobile Terrestrial Laser Scanning (MTLS). Robotic and automated recording systems. 3D systems for controlling the operation of auxiliary machinery.

Practice: The lectures are followed by measurement exercises, calculation exercises and preparation of elaborate

Literature:

Recommended:

1. Вушовић Н.: Рударска мерења – одабрана поглавља, ТФ, Бор (1997)
2. Ђорђевић Д., Вушовић Н.: Прогнозни прорачун померања и деформација поткопаног терена, Рударскогеолошки факутет, Београд (2014)

3. Ogundare J.O.: Precision surveying: the principles and geomatics practice, Wiley (2015)

Ancillary:

4. Патарић М.: Рударска мерења I део, РГФ, Београд (1990)
5. Патарић М., Стојановић А.: Померање поткопаног терена и заштита објеката од рударских радова, Рударско-геолошки факутет, Београд, (1994)

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

Teaching methods lectures through presentations (https://moodle.tfbor.bg.ac.rs), followed by exercises

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	5	Written part of the final exam	20
Exercise attendance	5	Oral part of the final exam	50
Coloquium exam/s		.....	
Term paper	20		

Study program: Mining Engineering

Course: Underground substructure systems

Lecturer/s: dr Radoje Pantović, full professor

Status of the course: Elective

ECTS: 8

Prerequisite:

Acquired knowledge from the subjects Resistance of materials and Rocks and soil mechanics

Course goals:

Acquaintance of students with substructure systems of underground mining facilities.

Learning outcomes:

Training students for independent selection and calculation of underground systems in mining.

Course description:

Lectures:

The shape and size of the cross-section of the pit rooms. Subgrade and its influence on the shape of the cross-section. Substructure materials: wood; steel; concrete; reinforced concrete; sprayed concrete; materials based on synthetic resin; factory-made foundation elements made of concrete, reinforced concrete and steel. Stress deformation state around the underbuilt room. Load on the corridor substructure. Calculation of loads on the substructure under conditions of stable contour. Calculation of loads on the substructure in conditions of unstable contour. Static load on the substructure. Roof load. Load from the floor. Measurement of the magnitude of displacement of the contour of the room and massif. Subgrade pressure measurement.

Practice:

Computational exercises that accompany the thematic areas of lectures and preparation of essays.

Literature:

Recommended:

1. P. Jovanović, Design and calculation of the subgrade of horizontal underground rooms, Book 1, Shape, dimensions, subgrade materials, construction conditions and grouting, Faculty of Mining and Geology, Belgrade, 1994.

Ancillary:

2. P. Jovanović, Design and calculation of the subgrade of horizontal underground rooms, Book 2, Stress state in the rock massif and load on the subgrade, Faculty of Mining and Geology, Belgrade, 1994.

3. P. Jovanović, Design and calculation of the subgrade of horizontal underground rooms, Book 3, Constructive forms and calculation of the subgrade, Faculty of Mining and Geology, Belgrade, 1995.

Number of classes per week	**Lectures: 2**	**Practical classes: 2**	**Study research**	**Other forms**

			work:	**of teaching:**
Teaching methods Lectures and calculation exercises				
Knowledge evaluation (maximum 100 points)				
Pre-examination obligations	Points	**Final exam**		Points
Lecture attendance	**10**	Written part of the final exam		
Practice attendance	**10**	Oral part of the final exam		**60**
Term paper	**20**			

Study program: Mining engineering			
Course: QUARRYING			
Lecturer: dr Saša S. Stojadinović, van. prof.			
Course status: Elective			
ECTS: 8			
Prerequisites: Passed the exam in Mathematics 1 and 2, attended lectures in the subject Basics of Machines and devicec			
Course goal Introducing students to the technologies of stone exploitation and calculation of basic parameters.			
Course outcome The ability of the student to make qualified decision on the selection of technology for the exploitation of stone and perform calculation of the basic parameters of stone production .			
Course description *Theoretical classes* Introductory remarks. Historical development, significance, condition and trends in the exploitation of stone. Classification of stone. Application of stone. Construction stone. Architectural stone. Decorative stone. Stone for industrial needs. surface exploration of the stone. Underground mining of stone. *Practical classes* Computational exercises that accompany the program of lectures, defining and calculating the parameters of the quarry. Tour of the quarry			
Literature 1. M. Maksimović, Eksploatacija, ispitivanje i primena arhitektonskog kamena, Contractor D.O.O., Beograd, 2006. 2. Digitalni udžbenik, Eksploatacija arhitektonsko građevinskog kamena, RGN, Zagreb, 2003. 3. V. Popović, Tehnologija površinske eksploatacije, RGF, Beograd, 1992. 4. Matii Heinio Ed., Rock excavation handbook, Tamrock, 1999, elektronsko izdanje.			
Number of classes per weak	**Theoretical: 2**	**Practical: 2**	
Lecture methods Predavanja, vežbe, terenska nastava			
Grading system (Maximum of 100 points)			
Predispitne obaveze	points	**Final examination**	points
Active participation / lectures	**15**	Oral exam	**70**
Active participation / exercises	**15**		

Study program: Mining Engineering

Course: STABILITY AND REHABILITATION OF SLOPES

Lecturer/s: Dr Radoje Pantović, full professor

Status of the course: Elective

ECTS: 8

Prerequisite:

Passed the Rock and Soil Mechanics exam

Course goals:

Acquaintance of students with the causes of landslides, methods of slope stability analysis and ways of rehabilitating landslides on surface mines, cuttings, natural slopes.

Learning outcomes:

Students should acquire knowledge about the factors that influence slope stability, slope stability calculation methods, which are used for certain conditions and landslide rehabilitation procedures.

Course description:

Lectures:

Causes of landslides. Causes of rock mass sliding. Forms of sliding surfaces in soil and rock. Geomechanical, geological, hydrogeological factors of slope stability. Tension cracks. Selection of parameters for slope stability calculation. Safety factor. Methods of testing slope stability in soil. The influence of water filtration on slope stability. Stability of flotation landfills. Stability of the embankment on a sloping ground. Application of monitoring to assess the risk of landslides. Methods of testing slope stability in rock massifs. Influence of discontinuity on slope stability. Effect of frost on slope stability. Straight fracture. Wedge fracture. Landslide rehabilitation procedures. Drainage. Anchoring. Improvement of soil and rock characteristics in slopes. Supporting walls. Active and passive pressure. Stability of supporting walls.

Practice:

Laboratory tests of soil shear strength: direct shear, triaxial test. Laboratory exercises for testing the shear strength of rock masses: shear along one and two shear surfaces, shear along discontinuities. Calculations of slope stability in soil using software. Calculations of slope stability in rock mass using software.

Literature:

Recommended:

1. R. Obradović, N. Najdanović, Mehanika tla u inženjerskoj praksi, Rudarski institut, Beograd, 1999.
2. M. Stević, Mehanika tla i stijena, RGF, Tuzla, 1991.
3. N. Gojković, R. Obradović, V Čebašek, Stabilnost kosina površinskih kopova, RGF, Beograd, 2004.

Ancillary:

4. E. Hoek , Practical Rock Engineering, 2007.
5. A. Verruijt, Soil Mechanics, Delft University of Technology, 2004.
6.S. Zlatović, Uvod u mehaniku tla, Tehničko veleučilište u Zagrebu, 2006.

Number of classes per week	**Lectures: 2**	**Practical classes: 2**	**Study research work:**	**Other forms of teaching:**
Teaching methods Oral lectures, laboratory and computational exercises with calculations of slope stability using software and preparation of reports				
Knowledge evaluation (maximum 100 points)				
Pre-examination obligations	Points	**Final exam**		Points
Lecture attendance	**10**	Oral part of the final exam		**50**
Coloquium exam/s	**10**			
Term paper	**30**			

Study program: Mining Engineering
Course: Physical methods of concentration
Lecturer/s: PhD. Jovica M. Sokolović, full professor
Status of the course: Compulsory course on PMS and RTOR modules
ECTS: 7
Prerequisite: Basic knowledge of mathematics i of physics
Course goals: Acquisition of theoretical and practical knowledge in the field of Physical methods of concentration.
Learning outcomes: Training students to apply the acquired knowledge in practice or continue training in this area.
Course description: **Lectures:** Introduction. Types and division of physical methods of concentration. Theoretical foundations of body movement in fluids. Basic characteristics of fluids. Basic laws of movement of bodies in fluids. Free fall. The final velocity of falling grains in the fluid. Movement of grains under conditions of disturbed fall. Equal falling grains. Gravitational methods of concentration. Theoretical foundations of the gravitational concentration process. Criterion of gravitational concentration. Characteristics of raw materials. Evaluation of the efficiency of the gravitational concentration process. Concentration results. Gravitational concentration in water and air. Devices in the process of gravitational concentration in water and air. Gravitational concentration in difficult environments. Characteristics of heavy liquids and suspensions. Devices in the process of gravitational concentration in difficult environments. Regeneration of difficult environments. Magnetic methods of concentration. Theoretical foundations of the process of magnetic concentration. Magnetic properties. Magnetic field. Magnetic systems. Magnetic separators. Magnetic flocculation. Electrical methods of concentration. Theoretical basis of the electrical concentration process. Electrical properties. Electric field. Electrification of grains. Electrostatic concentration, corona, corona-electrostatic, pyroelectrostatic, triboelectrostatic and dielectric concentration. Electrostatic separators. Optical methods of concentration. Theoretical basis of optical concentration process. Optical properties. Optical separators. X-ray methods of concentration. Theoretical basis of X-ray concentration process. Principle of operation of radiometric sorters and separators. Radiometric methods of concentration. Theoretical basis of X-ray concentration process. Principle of operation of radiometric triagers and separators. Concentration of raw materials by disintegration and decryption. **Practice:** Appropriate laboratory and calculation exercises accompany all the mentioned teaching units.
Literature: Recommended: 1. Ignjatović, R. (1983). Physical methods of concentration, Technical Faculty in Bor, Bor. 2. Ćalić, N. (1990). Theoretical basis of preparation of mineral raw materials, Faculty of Mining and Geology, Belgrade. 3. Wills, BA, Finch, James A. (2016). Wills' Mineral Processing Technology, An Introduction to the Practical Aspects of Ore Treatment and Mineral Recovery (Eighth Edition), Butterworth-Heinemann. 4. Svoboda, J. (2004). Magnetic techniques for the treatment of materials, Springer, 2004.

5. Sokolović, J. (2019). Internal manual for exercises in physical methods of concentration, Technical Faculty in Bor, Bor				
Number of classes per week	**Lectures: 3**	**Practical classes: 3**	**Study research work:**	**Other forms of teaching:**
Teaching methods Theoretical teaching is conducted through lectures and interactive consultations. Practical teaching is carried out in the form of computational and laboratory exercises.				
Knowledge evaluation (maximum 100 points)				
Pre-examination obligations	Points	**Final exam**		Points
Lecture attendance	**10**	Written part of the final exam		**30**
Exercise attendance	**10**	Oral part of the final exam		**30**
Coloquium exam/s	**10 x 2**			
Term paper				

Study program: Mining Engineering		
Course: FLOTATION		
Lecturer/s: Dr Maja Trumić, Associate Professor		
Status of the course: Obligatory subject		
ECTS: 7		
Precondition: Basic knowledge of mineralogy, petrography		
Course goals: Acquaintance of students with the theoretical and practical principles of flotation as a separation technique in the separation of solid phases, mineral and secondary raw materials		
Learning outcomes: Acquiring the necessary knowledge from the flotation of materials and secondary raw 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). *Practical classes-exercises:* Laboratory and computational exercises 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. Ancillary: 1. J. Drzymala, Mineral Processing, Foundations of theory and practice of minerallurgy, Wroclaw University of Technology, Wroclaw 2007, 2. Lynch, G. Harbort and M. Nelson, History of Flotation, (AusIMM), Brisbane, 2010, 3. S. Bulatovic, Handbook of Flotation Reagents, Elsevier, 2007. 4. Cytec, Mining Chemical Handbook, 2010, Cytec Industries, Inc. I		
Number of classes per week	Lectures: 3	Practical classes: 3
Teaching methods: Lectures with interactive work with students, practical work through laboratory and computational exercises. Pre-examination of knowledge through two colloquiums.		

Knowledge rating (max. number of points 100)			
Pre-examination obligations	points	**Final examination**	points
Lecture attendance	10	Written part of the final exam (5 points minimum)	20
Exercise attendance	10	Oral part of the final exam	40
Coloquium exam 1	10		
Coloquium exam 2	10		

Study program: Mining Engineering
Level of study: Undergraduate Academic Studies
Course: AUXILIARY OPERATIONS IN MART
Lecturer: Dr Dejan Tanikić, full professor
Course status: Obligatory course
ECTS: 6
Prerequisites:
Course goals: Introduction into the basics and calculations of the systems and machines used for transport of the mineral resources
Learning outcomes: Using acquired, as well as other relevant knowledge, students became capable for calculation, dimensioning, choosing and maintening of the transport systems which are used in mineral resources processing
Course description: *Theoretical teaching:* General informations about the transport systems which are used in mineral resources processing. Characteristics of the transported loads. Loose materials. Hydromixes. Belt conveyors. Construction and basic characteristics. Elements, dimensioning and calculation of the belt conveyors. Articulated conveyors. Elevators. Spiral transporters. Vibrating conveyors. Rake conveyors. Special transporters. Objects for mineral resources storage. Stocks. Bunker locks. Feeders. Scrapers. Hydraulic transport. General informations. Pumps, pipelines and armatures. Control and regulation. Calculation of the hydraulic transport systems. Oblique and vertical transport. Calculation and dimensioning of the equipement. Gravitational transport through pipeline. Gravitational transport through channel. Transport by hanging conveyors. *Practical teaching:* Practicals. Other forms of teaching. Application of the obtained knowledge in solving specific problems of the transport systems used in mineral processing.
Literature: 1. B. Kolonja, D. Knežević, Transport u pripremi mineralnih sirovina, Rudarsko-geološki fakultet Univerziteta u Beogradu, 2000. 2. R. Borović, Transportni uređaji u pripremi mineralnih sirovina, Rudarsko geološki fakultet Univerziteta u Beogradu, 1985. 3. R. Milanović, Transport u rudarstvu, Tehnički fakultet u Boru Univerziteta u Beogradu, 1988. 4. D. Knežević, B. Kolonja, R Stanković, Hidraulički transport mineralnih sirovina, Rudarsko geološki fakultet Univerziteta u Beogradu, 1996. 5. B. A. Wills, T. J. Napier-Munn, Mineral Processing Technology: An Introduction to the Practical Aspects of Ore Treatment and Mineral Recovery, Elsevier, 2006.

6. M. C. Fuerstenau, K. N. Han., Principles of Mineral Processing, Society for Mining, Metallurgy, and Exploration (SME), 2003.

Number of classes per week:				**Other classes:**
Lectures: 3	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	30
Practicals	10	Oral exam	30
Seminary works	20		

Study program: Mining Engineering

Course: BASICS OF MINING ENGINEERING

Lecturer: Dr Dejan Petrović, assistant professor

Status of the course: Elective for MP module

ECTS: 6

Prerequisite: Completed second year courses

Course goals: Understanding of basic concepts and mining engineering processes

Learning outcomes: Acquiring the necessary knowledge on the basics of mining engineering technologies

Course description:
Lectures:
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.

Ancillary:

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	Lectures: 2	Practical classes:	Study research work:	Other forms of teaching:
Teaching methods Oral lectures, discussion				
Knowledge evaluation (maximum 100 points)				
Pre-examination obligations	Points	**Final exam**		Points
Lecture attendance	**30**	Written part of the final exam		
Exercise attendance		Oral part of the final exam		**70**
Coloquium exam/s		.....		
Term paper				

Study program: Metallurgical Engineering
Course: FUNDAMENTALS OF THE EXTRACTIVE METALLURGY
Lecturer/s: Dr. Nada Štrbac, full professor
Status of the course: Elective for the study program Metallurgical Engineering and Elective subject for study program Mining Engineering
ECTS: 6
Prerequisite: Knowledge in Physical chemistry and Mineralogy is required
Course goals: The objective of the course is transfer to students basic knowledge in the field of metal production from primary and secondary raw materials of ferrous and non-ferrous metallurgy, as a significant industrial branch.
Learning outcomes: After completing the course, students have the necessary knowledge on the basis 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, Osnovi ekstraktivne metalurgije, Autorizovana predavanja, TF Bor, 2015. *(in Serbian)*

2. F. Habashi, Principles of extractive metallurgy, Laval University, Quebec, Canada, 2008.

Ancillary:

1. R.Vračar, Teorija i praksa dobijanja obojenih metala, SIMS, Beograd, 2010. *(in Serbian)*
2. S.Muhamedagić,, Metalurgija gvožđa, Famultet za metalurgiju i materijale, Zenica, 2005. *(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	**Lectures: 2**	**Practical classes:**	**Study research work:**	**Other forms of teaching:**

Teaching methods

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

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	10	Written part of the final exam	
Exercise attendance		Oral part of the final exam	60
Coloquium exam/s	10	.....	
Term paper	20		

Study program: Mining Engineering		
Course: CONSTRUCTION WASTE RECYCLING TECHNOLOGY		
Lecturer/s: Dr Maja Trumić, Associate Professor		
Status of the course: Elective subject, module RTSD		
ECTS: 6		
Precondition: Previous knowledge acquired in the study program Mining Engineering		
Course goals: Acquaintance of students with construction waste recycling technologies. Through this subject, the technological procedures, machines and devices used for recycling construction waste are studied, in terms of achieving economic and ecological effects. By recycling construction waste, its exploitation achieves almost complete utilization, i.e saving natural raw materials, material gain and environmental protection.		
Learning outcomes: The ability of students to, based on the acquired knowledge, more easily follow classes in other subjects related to recycling technologies.		
Course description: *Theoretical teaching:* Construction waste material. General about procedures and machines and devices for recycling construction waste material. Theoretical and practical study of the procedures applied for recycling of construction waste material such as: shredding - crushing and grinding, classification and screening, concentration - gravity, magnetic, flotation, electric, leaching, special procedures, drainage, etc. *Practical classes-exercises:* Acquaintance of students with all stages of the process of preparation and recycling of construction waste materials, as well as machines and devices used in these processes through catalogs, presentation and technological schemes..		
Literature Recommended: 1. Божидар Бранковић: Поступци и уређаји за рециклирање отпадног материјала, ИТНМС, Београд, Министарство здравља и заштите животне околине републике Србије-Управа за заштиту животне околине 2002. 2. Божидар Бранковић, Љубиша Андрић, Милосав Адамовић, Слободан Голубовић, Велимир Антанацковић, Покретна постројења за рециклирање грађевинског отпадног материјала, ИТНМС, Београд, Министарство здравља и заштите животне околине републике Србије-Управа за заштиту животне околине 2002. 3. Ф. Барбич, Рециклирање отпадног материјала и секундарних сировина у функцији заштите животне средине, ИТНМС, Београд, 1995. 4. Милан Ж. Трумић, Љубиша Д. Андрић, Маја С. Трумић: "Управљање и третман отпада", Универзитет у Београду, Технички факултет у Бор, 2014., 172 стране, ИСБН978-86-6305-020-4.		
Number of classes per week	Lectures: 2	Practical classes:2

Teaching methods: Theoretical teaching is conducted through lectures, and practical in the form of interactive demonstration exercises principle with the active participation of students and the preparation of a seminar paper.			
Knowledge rating (max. number of points 100)			
Pre-examination obligations	points	**Final exam**	points
Lecture attendance	10	Oral part of the final exam	50
Exercise attendance	10		
Seminar	30		

Study program: Mining Engineering
Course: HAZARDOUS WASTE TREATMENT
Lecturer/s: Dr Grozdanka Bogdanović, Full Professor
Status of the course: Elective for module RTSD
ECTS: 6
Prerequisite: Required knowledge in solid waste management
Course goals: Introducing students with integrated hazardous waste management system, with special emphasis on hazardous waste treatment technologies.
Learning outcomes: Acquiring basic knowledge in the field of hazardous waste management and treatment; theoretical and practical training of students for work in scientific, educational, state and economic organizations dealing with this issue
Course description: Lectures: Introduction: Definition of hazardous waste. Review of legislation. Hazardous Waste Management Strategy. Classification of hazardous waste: types of waste and characterization. Sources, types and characteristics of hazardous waste that can be found in municipal solid waste. Persistent organic pollutants in hazardous waste. Polychlorinated biphenyls, dioxins and furans. Medical waste. Assessment of health risks from hazardous waste. Collection of hazardous waste and on-site storage. Transfer and transport of hazardous waste. Hazardous waste treatment technologies: Biological treatment; Chemical treatment; Physical-chemical treatment; Incineration; Pyrolysis; Stabilization / Solidification; Remediation. Recycling of hazardous waste. Disposal of hazardous waste. Toxicology of some hazardous and harmful substances. **Practice:** Demonstration exercises for the process of processing certain types of hazardous waste.
Literature: 1. M. Ristić, M. Vuković, Solid Waste Management, Solid Waste Processing Technology (in Serbian), TF Bor, 2006 2. M.Trumić, Lj.Andrić, M.Trumić, Management and Treatment of Waste (in Serbian), TF Bor, 2014 (Selected chapters) 3. B. Škrbić, Polychlorinated biphenyls (In Serbian), Faculty of Technology Novi Sad, 2003. 4. B.Jakšić, M.Ilić, Hazardous Waste Management(in Serbian), The Urban Planning Institute of Banja Luka, 2000.

5. B.Jakšić, M.Ilić, M.Balaban, Medical Waste Management (in Serbian), The Urban Planning Institute of Banja Luka, 2001.

6. F. R. McDougall, P.R. White, M.Franke, P.Hindle, Integrated Solid Waste Management - A Life Cycle Inventory 2nd Edition, Blackwell Science, Oxford, 2003 (Selected chapters)

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

Teaching methods: Lectures with interactive discussion, exercises

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	10	Written part of the final exam	
Exercise attendance	10	Oral part of the final exam	50
Term paper	30		

Study program: Mining Engineering

Course: PROFESSIONAL PRACTICE 1

Lecturer/s: Dr Maja Trumić, Associate Professor, Dr Jelena Ivaz, Assistant professor

Status of the course: Obligatory subject

ECTS: 2

Precondition: Enrolled V semester

Course goals: The aim of the professional practice 1 is to instantly introduce students to industrial technological processes, process stages and integral, industrial process equipment and process control and regulation. 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 outcomes: 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:

Theoretical teaching:

The content of professional practice 1 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.

Practical classes-exercises: Writing an essay-report of professional practice

Literature

Recommended:

1. Technical documentation from industry - plants

Number of classes per week	Lectures: 0	Practical classes: 6

Teaching methods: The professional practice 1 of undergraduate academic studies is done in the sixth 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 essay-report 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 essay-report 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 precondition for the certification of the sixth semesters.

Knowledge rating (max. number of points 100)			
Pre-examination obligations	points	**Final exam**	points
Presence on professional practice:	25	Oral exam	50
Essey-report	25		

Study program: Mining engineering
Course: TECHNOLOGY OF SURFACE MINING
Lecturer: dr Saša Stojadinović, van. prof.
Course status: Obligatory
ECTS: 6
Prerequisites: N/A
Course goal Introducing students to surface mining technology and techniques and procedures of calculating basic parameters.
Course outcome The student's ability to make a qualified decision on the selection of surface mining technology and confidence to calculate/determine the basic parameters of the surface mine as well as the basic parameters of the equipment.
Course description *Theoretical classes* Introductory remarks. Historical development, significance of the state and trends in surface mining. Basic concepts and terms. Technology of surface mining of horizontal deposits. Technology of exploitation of steep deposits. Disposal and deposition technology. Stability of slopes of surface excavations, waste dumps and landfills. surface mining systems. Remediation and recultivation of surface mines and waste dumps. *Practical classes* Development of a demonstration project of surface mine, for the given deposit, with the calculation of all technological phases.

Literature

1. N. Popović, NAUČNE OSNOVE PROJEKTOVANjA POVRŠINSKIH KOPOVA, NIRO „Zajednica“ – NIŠRO „Oslobođenje“, Sarajevo, 1984.
2. V. Pavlović, TEHNOLOGIJA POVRŠINSKOG OTKOPAVANjA, Rudarsko-geološki fakultet, Beograd, 1992.
3. N. Spasić, TEHNOLOGIJA POVRŠINSKE EKSPLOATACIJE MINERALNIH SIROVINA, Zavod za udžbenike i nastavna sredstva SAP Kosovo, Priština, 1979.
4. S. Vujić, I. Miljanović, J. Cvejić, D. Dražić, PROJEKTOVANjE REKULTIVACIJE I UREĐENjE PREDELA POVRŠINSKIH KOPOVA (naučna monografija), Rudarsko-geološki fakultet, Beograd, 2009.
5. V. Pavlović, REKULTIVACIJA POVRŠINSKIH KOPOVA I ODLAGALIŠTA, Rudarsko- geološki fakultet, Beograd, 2000.
6. Additional literature as recommended by the lecturer.

Number of classes per weak	**Theoretical: 3**	**Practical: 3**

Lecture methods

Classes are conducted in the form of lectures and auditory exercises with the effort to maximally involve students, i.e. to be interactive. This is realized directly in classes or in the form of presentations, which are previously prepared by a team of students or individually. The lectures present the theoretical part of the material with constant illustration of characteristic examples from practice. The exercises analyze specific cases and give instructions regarding the development of the demonstration project. Classes and exercises are intensively supported by a distance learning platform (Moodle). The student's involvement in lectures and exercises, as well as the made demonstration project are scored as pre-examination activities.

Grading system (Maximum of 100 points)

Prerequisites	points	**Final examination**	points
Active participation / lectures	**5**	written exam	
Practice		oral exam	**60**
Assignment	**35**		

Study program: Mining Engineering

Course: TECHNOLOGY OF UNDERGROUND MINING

Lecturer: Dr Dejan Petrović, assistant professor

Status of the course: Compulsory for EMD Module

ECTS: 6

Prerequisite: Acquired knowledge in the occupational courses on undergraduate studies**.**

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

Learning outcomes: 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.

Practice:

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.

Ancillary:

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	**Lectures: 3**	**Practical classes: 3**	**Study research work:**	**Other forms of teaching:**

Teaching methods

Oral lectures, calculation tasks, discussion.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	**30**
Exercise attendance	**25**	Oral part of the final exam	**40**
Coloquium exam/s		.....	
Term paper			

Study program: Mining Engineering

Course: Mine Ventilation

Lecturer/s: PhD Dusko N. Djukanovic, assistant professor; PhD Dragan M. Zlatanovic, assistant professor

Status of the course: Compulsory for Mining Engineering (ELMS)

ECTS: 4

Prerequisite: Acquired subject knowledge from the third year of basic academic studies

Course goals: Acquaintance of students with theoretical foundations and ventilation systems in pit and surface mining facilities

Learning outcomes: Acquiring the necessary knowledge about the ventilation of mines with underground exploitation and surface excavations

Course description:

Lectures:

Composition of pit air. Basic – permanent components of pit air. Impurities in pit air. Methane. Pit dust. Properties of pit air. Pressure, temperature, humidity, density and enthalpy of pit air. Theoretical foundations of pit ventilation. Basic laws of aerostatics. Basic laws of aerodynamics. Aerodynamic resistances of pit rooms. Pit ventilation networks. Determining the required amount of air. Characteristics of the pit and pit rooms. Laws of air movement in pit ventilation networks. Analytical and graphical methods of calculation of ventilation networks. Natural depression - compression. Artificial depression - compression. Ventilators. Characteristics and selection of fans. Air regulation in the pit. Ventilation devices. Separate ventilation of pit rooms. Supplying the pit with compressed air. Ventilation of surface excavations.

Practice:

Creation of tasks and exercises that accompany the lectures.

Literature:

Recommended:

4. V. Jovicic, „Ventilacija rudnika“ – Mine ventilation, Novi dan, Belgrade , 1973.
5. M. Miljkovic, D. Bogdanovic, „Ventilacija rudnika“– Mine ventilation, Mining and Metallurgy Institute, Bor, 2002

Ancillary:

5. K. Djinovic, A. Cvjetic, „Eksploatacija rudnickih ventilatora“-Exploitation mine ventilators, Belgrade.

Number of classes per week	**Lectures: 2**	**Practical classes: 2**	**Study research work: No**	**Other forms of teaching: No**

Teaching methods: Lectures with interactive discussions, consultations, preparation of reports.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	10	Written part of the final exam	
Exercise attendance	30	Oral part of the final exam	60
Colloquium exam/s			
Term paper			

Study program: Mining Engineering

Course: MINES DEWATERING

Lecturer: Dr Dejan Petrović, assistant professor

Status of the course: Compulsory for EMD Module

ECTS: 4

Prerequisite: 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 outcomes: 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. Overburden dumps dewatering. Dewatering equipment.

Practice:

Mine visits.

Personal assignment – Surface and underground mine dewatering design.

Literature:

Recommended:

1. Ljubić Z., Stojković Z. Odvodnjavanje rudnika Technical Faculty in Bor, 2006.

Ancillary:

1. Ignjatović M., Miljković M. Rudarska hidrotehnika Mining and Metallurgy Institute Bor, 2004.
2. Avakumović D. Odvodnjavanje. Faculty of Civil Engineering Belgrade, 2005.

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

Teaching methods

Oral lectures, calculation tasks, discussion.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance	**5**	Oral part of the final exam	**55**
Coloquium exam/s		.....	
Term paper	**30**		

Study program: Mining Engineering

Course: ENVIRONMENTAL IMPACT OF MINING

Lecturer/s: dr Dragan Zlatanović, assistant professor

Status of the course: Elective for ELMS students...

ECTS: 5

Prerequisite: Not foreseen

Course goals:

Students of Mining Engineering are familiar with the impact that mining has on the environment, which is usually negative. It is important to develop an awareness in them that they should constantly strive to eliminate or reduce the impact of mining on the environment.

Outcome of the course

The students' skills and dedication to designing or executing mining are honed in such a way that their negative impact on the environment is minimized.

Course description:

Lectures:

Introductory remarks. Historical development, significance, conditions, and trends related to the impact of mining on the environment. Basic concepts and terms. The impact of surface and underground exploitation on the environment. Degradation of the environment by mining works. Rehabilitation and recultivation of the degraded area. Environmental factors. Environmental Impact Assessment Act, Environmental Impact Assessment Study. Other regulations related to environmental protection. Examples of bad and good practice.

Exercises: Preparation of seminar papers related to the impact of mining on the environment.

Practice:

Visit to the environmental services of certain mines and analysis of the collected data.

Literature:

Recommended:

1. I. Savić, V. Terezija, Ekologija i zaštita životne sredine, Zavod za udžbenike, Beograd, 2002.
2. R. Ratajac i dr., Ekologija i zaštita životne sredine, Zavod za udžbenike, Beograd, 2004.
3. V. Rekalić, Analiza zagađivača vazduha i vode, Tehnološko-metalurški fakultet, Beograd, 1989.
4. Pozitivna zakonska akta Republike Srbije
5. Međunarodni ugovori, zakoni i uredbe, međunarodne konvencije

Number of classes per week	**Lectures: 2**	**Practical classes: 2**	**Study research work: ?**	**Other forms of teaching: ?**

Teaching methods

Lectures, exercises and preparation of seminar work.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	
Exercise attendance		Oral part of the final exam	**60**
Coloquium exam/s		.....	
Term paper	**35**		

Study program: Mining Engineering

Course: SEISMIC EFFECTS OF BLASTING

Lecturer/s: Dr Radoje Pantović, full professor

Status of the course: Elective

ECTS: 5

Prerequisite:

Attended lectures on Drilling and Blasting Technology

Course goals:

Acquaintance of students with the negative effects of blasting and ways of forecasting and reducing the intensity of seismic waves.

Learning outcomes:

The ability of students to assess the intensity of seismic waves and to implement the necessary preventive measures in order to reduce the intensity of vibrations and protect buildings.

Course description:

Lectures:

Explosive energy, explosive energy losses, wave motion, parameters of wave motion, ground vibrations due to blasting, ground vibration parameters, ground oscillation speed, measurement of ground oscillation speed, instruments for measuring ground oscillation speeds, relationship between oscillation speed and mass of

explosives, law of oscillation, maximum permissible ground oscillation speeds, standards, measures to mitigate the negative effects of blasting.

Practice:

Auditory and computational exercises that accompany the lecture program.

Literature:

Recommended:

1. L. Kričak, Seismic mining, RGF, Mining Center, Belgrade, 2006.
2. R. Pantović, Seismic effects of blasting, authorized lectures

Ancillary:

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

Teaching methods

Lectures, exercises, field teaching

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	**20**
Practice attendance	**10**	Oral part of the final exam	**40**
Term paper	**20**		

Study program: Mining Engineering

Course: GEOGRAPHIC INFORMATION SYSTEMS-GIS

Lecturer: Vušović M. Nenad

Status of the course: elective for ELMS module students

ECTS: 5

Prerequisite: Previously acquired knowledge in Geodesy and Geoinformatics

Course goals: Introducing students to the theoretical and practical aspects of the development of geoinformation systems, spatial data modeling, spatial database design, GIS tools for spatial data processing

Learning outcomes: Training students for independent work in the ArcGIS software environment and developing the ability to interpret, present and spatially analyze geospatial data

Course description:

Lectures: Introduction to GIS. Basic concepts and terminology. Types and areas of application of GIS. Components and functions of GIS. Software GIS architecture and functionality. Geometric and attribute elements of geospatial data. Spatial data structure, spatial classes, differences between raster and vector data. Modeling of spatial objects. GIS data model (raster and vector models, geometry of spatial objects, topology and topography of space). Vectorization of geometric primitives. Spatial reference systems and reference frames. Cartographic projections. Decomposition of elements of space. Spatial database design. Principles and architectures of spatial databases. Analysis of the system and user requirements. Logical organization of data. CASE tools for designing the relational schema and physical organization of the database. Database Management System (DBMS). Relational databases. Creation of geospatial data. Architecture of spatial

databases. SQL and spatial objects. Implementation of spatial queries. Internet and Web-based GIS applications (ESRI ArcGIS, QGIS). Interpolation techniques in GIS. Visualization of geospatial data. Spatiotemporal analysis of geospatial data. Spatial queries. Errors and quality control. Web GIS services. Distributed GIS. Standards for distributed GIS services. Spatial data metadata. Standards for metadata-ISO 19115. Techniques and tools for searching spatial data (Data Mining). Commercial software, tools and components for the development of Web GIS applications (ESRI, Intergraph). Applications of distributed GIS. Data exchange and data warehouse (Data Warehouse). Applications of GIS systems in mining and geology. Spatial Data Infrastructure (SDI). Elements of geospatial data infrastructure. Basic concepts of geospatial infrastructure. Service architecture of the SDI system. Exchange of geospatial data. Geoservices. Classifications of geoservices. Geoportals. Geoportal architecture. National Geospatial Data Infrastructure-NIGP. National Geoportal. INSPIRE-European Infrastructure for Spatial Information. INSPIRE directives.

Practice: Work in ESRI ArcGIS software, modeling spatial objects, designing and implementing a spatial database and solving spatial analysis tasks. Preparation of a seminar paper.

Literature:

Recommended:

1. Vušović N. Geoinformatics Technical Faculty in Bor. *in press* (2023)
2. Burrough, P., McDonnell, R. Principi geografskih informacionih sistema Građevinski fakultet, Beograd (2006)
3. Kang-tsung (Karl) Chang: Introduction to Geographic Information Systems, McGraw-Hill, 4 edition (2006)
4. Longley P.A.,Goodchild F.M., Maguire D.J., Rhind D.W.: GIS and Science (2001)
5. M. Behnisch, G.Meinel: Trends in Spatial Analysis and Modelling, Springer (2018)

Ancillary:

6. Вушовић Н.: Базе података, Технички факултет у Бору (2009)

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

Teaching methods lectures through presentations (https://moodle.tfbor.bg.ac.rs), followed by exercises

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	5	Written part of the final exam	20
Exercise attendance	5	Oral part of the final exam	50
Term paper	20		

Study program: Mining engineering

Course: Dumping and stockpiling

Lecturer: dr Saša Stojadinović, van. prof.

Course status: elective

ECTS: 5

Prerequisites: N/A

Course goal

Introducing students to the technology and equipment for dumping and stockpiling of excavated material.

Course outcome

Ability to make a qualified decision on the selection of technology and equipment for dumping and stockpiling, and competence to calculate the basic parameters.

Course description

Theoretical

Introductory remarks. Historical development, significance, condition and trends related to the disposal and stockpiling of excavated materials and the equipment used. Basic concepts and terms. Disposal technologies and equipment. Stockpiling technologies and equipment. Slope Stability. Remediation and reclamation of waste dumps and landfills.

Practical classes

Preparation of assignment papers related to dumps or landfills, with the calculation of all technological phases and the selection of appropriate equipment.

Literature

1. N. Popović, NAUČNE OSNOVE PROJEKTOVANjA POVRŠINSKIH KOPOVA, NIRO „Zajednica“ – NIŠRO „Oslobođenje“, Sarajevo, 1984.
2. V. Pavlović, TEHNOLOGIJA POVRŠINSKE EKSPLOATACIJE, Rudarsko-geološki fakultet, Beograd, 1992.
3. N. Spasić, TEHNOLOGIJA POVRŠINSKE EKSPLOATACIJE MINERALNIH SIROVINA, Zavod za udžbenike i nastavna sredstva SAP Kosovo, Priština, 1979.
4. V. Pavlović, REKULTIVACIJA POVRŠINSKIH KOPOVA I ODLAGALIŠTA, Rudarsko- geološki fakultet, Beograd, 2000.
5. S. Vujić, I. Miljanović, J. Cvejić, D. Dražić, PROJEKTOVANjE REKULTIVACIJE I UREĐENjE PREDELA POVRŠINSKIH KOPOVA (naučna monografija), Rudarsko-geološki fakultet, Beograd, 2009.
6. Additional literature as recommended by the lecturer.

Number of classes per weak	**Theoretical: 2**	**Practical: 2**

Lecture methods

Classes are conducted in the form of lectures and auditory exercises with the effort to maximally involve students, i.e. to be interactive. This is realized directly in classes or in the form of presentations, which are previously prepared by a team of students or individually. The lectures present the theoretical part of the material with constant illustration of characteristic examples from practice. The exercises analyze specific cases and give instructions regarding the preparation of the seminar paper. Classes and exercises are intensively supported by a distance learning platform (Moodle). The student's involvement in lectures and exercises, as well as the made seminar papers are scored as pre-examination activities .

Grading system (Maximum of 100 points)

Predispitne obaveze	points	**Final examination**	points
Active participation / lectures	**5**	written exam	
Active participation/exercises		oral exam	**60**
colloquium			
Assignment	**35**		

Study program: Mining Engineering

Course: Mineral processing technologies 1

Lecturer/s: PhD. Jovica M. Sokolović, full professor, PhD. Vladan Milošević, assistant professor

Status of the course: Compulsory course on PMS module

ECTS: 4

Prerequisite: The necessary knowledge from the narrow professional subjects 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 non-metallic and energy mineral raw materials.

Learning outcomes: 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:

Lectures: Introduction. Technological operations. Technological schemes and ways of presentation. Products and technological indicators in PMS. Concentration balances. 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. Basic characteristics and classification. Production, purpose and use of coal. Product quality standards and market requirements. Industrial processes of separation (concentration) of coal: shredding, sieving, classification, manual selection, gravity and flotation concentration. Technological schemes of mine coal processing.

Practice: Appropriate experimental and laboratory tests follow all the mentioned teaching units

Literature:

1. Ćalić, N. (1990). Theoretical basis of preparation of mineral raw materials, Faculty of Mining and Geology, Belgrade.
2. Pavlica, J., Draškić, D. (1997). Preparation of non-metallic mineral raw materials, Faculty of Mining and Geology, Belgrade.
3. Domestic non-metallic mineral raw materials for use in the economy, Editor: Siniša Milošević, ITNMS, Belgrade, 1998.
4. Draškić, D. (1975). Industrial application of the preparation of mineral raw materials, Book I, Student Publishing and Information Center, Belgrade.
5. Ignjatović, M., Milanović, D., Magdalinović, S., Urošević, D. (2011). Coal - industrial preparation and cleaning technologies. Copper Institute, Bor.
6. Andrić, Lj. (2010). Production of non-metallic mineral raw materials", Chapter in the monograph: "Mineral raw material complex of Serbia today: challenges and crossroads", Academy of Engineering Sciences of Serbia (AINS), Faculty of Mining and Geology, University of Belgrade, Chamber of Commerce of Serbia, Belgrade, p.189 -202.
7. Andrić, Lj. (2011). "Preparation of non-metals in Serbia", Chapter in the monograph: "State and perspectives of the preparation of mineral raw materials in Serbia", Engineering Academy of Serbia, (IAS), Belgrade, p. 39-60.
8. Andrić, Lj. (2014). editor of the chapter: "Exploitation of non-metallic mineral resources", in the monograph: "Serbian mining and geology in the second half of the 20th century", Academy of Engineering Sciences of Serbia, Matica Srpska, Mining Institute, p. 413-461.
9. Andrić, Lj. , Radulović, D., Petrov, M., (2018). Non-metallic mineral raw materials as the basis of the long-term development of the economy of Serbia, IX Colloquium on the preparation of mineral raw materials, University of Belgrade, Faculty of Mining and Geology, Belgrade, p. 50-92.

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

Teaching methods

Lectures, exercises and practical work, organized on an interactive principle, which besides classical lectures and presentations includes discussions and active participation of students in all aspects of lectures, colloquium, written and oral exam.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance	**10**	Oral part of the final exam	**60**
Coloquium exam/s	**10 x 2**		
Term paper			

Study program: Mining Engineering

Course: MANAGEMENT AND TREATMENT OF WASTE

Lecturer/s: Dr Milan Trumić, Full Professor, Dr Maja Trumić, Associate Professor

Status of the course:: Obligatory subject, module RTSD

ECTS: 4

Prerequisite: /

Course goals: Theoretical and practical training of students with integrated waste management system and methods for waste treatment.

Learning outcomes: Students are able to more easily follow courses from subjects that rely on a processed program and to effectively apply acquired knowledge in preparation and implementation of an integrated waste management plan

Course description:

Lectures:

Introduction. Review of legislation. Overview of solid waste management strategies and plans. Municipal waste: generation, classification, collection, transportation, treatment methods, disposal. Industrial waste: preservation of natural resources, treatment and disposal. Hazardous waste: characterization, colection and transportation, treatment methods, disposal. Mining waste: types, possibilities for mining waste utilization. Radioactive waste: formation, recycling, disposal.

Practice:

Getting acquainted with the waste management plan content and calculation and analysis of the necessary data for the development of the plan (calculation and analysis of morphological composition, elemental and technical analysis of waste and separated fractions, etc.) and life cycle analysis and assessment of sustainability (LCA - Life Cycle Analysis) using a system analytical tool - a model developed for the solid waste management system IWM-2 (Integrated Waste Management).

Literature

Recommended:

1. Trumić M. Ž., Andrić Lj. D., Trumić M. S.: "Waste Management and Treatment", University of Belgrade, Technical Faculty in Bor, 2014., p.172.
2. Strategy for Integrated Solid Waste Management, Ministry of Natural Resources and Environmental Protection, Belgrade, 2003.

Ancillary:

3. M.Ilic , S. Miletic, Solid Waste Management Basis, Institute for Material Testing, Belgrade, 1998.
4. M. Ristic and M. Vuković, Solid Waste Management, Solid Waste Processing Technology, TF, Bor, 2006.
5. English-Serbian Dictionary of Waste Management Terminology, OSCE, Belgrade, 2004.
6. F. R.Mc Dougall, P.R. White, M. Franke, P. Hindle, Integrated Solid Waste Management: a Life Cycle Inventory, Blackwell Science Ltd, UK, 2001.

Number of classes per week	Lectures: 2	Practical classes:2

Teaching methods: Theoretical lectures are conducted by lectures, and practical in the form of elaborate according to the interactive principle with the active participation of students.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	10	Written part of the final exam	
Exercise attendance	20	Oral part of the final exam	50
Coloquium exam/s	20		

Study program: Mining Engineering

Course: Technological process and environment

Lecturer/s: PhD. Jovica M. Sokolović, full professor

Status of the course: Elective course on PMS and RTOR modules

ECTS: 8

Prerequisite:

Course goals: Acquisition of theoretical and practical knowledge in the field of technological processes and environment.

Learning outcomes: Theoretical and practical training for work in scientific, educational and economic organizations, which deal with the design of technological processes and environmental impact assessment.

Course description:

Lectures: Introduction. Technological processes. Basic terms. Technological processes as part of the production system. Types of production and technological processes. Structure and characteristics of the technological process. Input and output elements of the technological process. Basic criteria for the selection of input and output elements of the technological process. Designing technological processes. Impact of technological processes on the environment. Environment. Basic terms. Components and characteristics of the environment. Environmental capacity. Environmental pollution. Pollutants and pollutants. Environmental

pollution control. Basic types of environmental control. Air pollution control. Water pollution control. Control of soil pollution. Basic parameters that are controlled and norms of environmental pollution. Basic requirements of environmental control. Ecological risks in the environment. Types and sources of risk. Risk analysis and assessment. Analysis and assessment of environmental impact.
Practice: Exercises, presentation of examples from practice, preparation and defense of a term paper.

Literature:
Recommended:

1. Sokolović Sećerov, R. (2000). Designing technological processes, Faculty of Technology, Novi Sad.
2. Mitrović, R. (1991). Designing technological processes, Scientific book, Belgrade.
3. Stević, Z. etc. (2010). Engineering and technology in the function of the environment, SMEITS, Belgrade.
4. Mijailović, M. (1998). Environmental Quality Control, University of Niš, Faculty of Occupational Safety, Niš..

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

Teaching methods
Lectures, exercises and practical work, organized on an interactive principle, which in addition to classical lectures and presentations, includes active participation of students in all types of teaching, discussions, consultations, preparation and defense of the term paper.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance	**10**	Oral part of the final exam	**50**
Coloquium exam/s	**10**		
Term paper	**20**		

Study programs: Technological Engineering and Mining Engineering

Course: ENVIRONMENTAL PROTECTION

Lecturer: PhD Maja M. Nujkić, associate professor

Status of the course: Elective for Technological Engineering (compulsory for module ICT) and Mining Engineering (modules EMD and RTSD).

ECTS: 8

Prerequisite: Acquired knowledge in the field of chemistry.

Course goals: Acquiring basic knowledge about the sources of environmental pollution, which include, to a large extent, different anthropogenic influences. Considerating all possibilities that can prevent soil, water and air degradation, which are leading to a new and clean technologies.

Learning outcomes: Students need to acquire knowledge about new measures, primarily from the domain of technology, which can restore damaged ecosystems, or improve the state of basic abiotic ecological factors.

Course description:
Lectures:
Principles of the environment and ecology. The significance of chemistry in environmental protection. Anthropogenic factor – the driving force in the environment. Structure and chemistry of the biosphere. Interaction of organisms in ecosystems. Food chains. Geochemical and biogeochemical cycles. Ecological importance and composition of 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 substances in nature and their degradation.
Practice:
Calculation examples and experiments related to monitoring and determination of the air, water, and soil pollution, and their purification. Use of library material and electronic databases in order to create a Independent work.

Literature:
Recommended:
1. L. Kolomejceva-Jovanović, Chemistry and Environmental Protection (in Serbian), Union of Engineers and Technicians of Serbia, Belgrade, 2010.
2. M. Nujkić, Ž. Tasić, Practicum of air, water and soil testing (in Serbian), University of Belgrade, Technical faculty in Bor, Bor, 2021.
3. M. Vuković, Basics of ecology (in Serbian), Grafomed-trade, Bor, 2005.

Ancillary:
1. P. Pfendt, Environmental chemistry (in Serbian), I part, Zavod za udžbenike, Belgrade, 2009.
2. M. Jakovljević, M. Pantović, Soil and water chemistry (in Serbian), Scientific book, 1991.
3. J. Švarc-Gajić, Sampling and preparation of samples for analysis (in Serbian), Faculty of Technology Novi Sad, 2012.
4. M. Stanojević, Treatment of drinking water (in Serbian), Construction book, Belgrade, 2009.

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

Teaching methods
Lecturing with interactive discussions, laboratory exercises, consultations and working on term paper.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	5	Written part of the final exam	
Exercise attendance	5	Oral part of the final exam	60
Colloquium exam/s			
Term paper	30		

Study program: Mining Engineering

Course: WASTEWATER IN MINERAL AND RECYCLING TECHNOLOGIES

Lecturer/s: Dr Grozdanka Bogdanović, Full Professor

Status of the course: Compulsory for modules MP and RTSD

ECTS: 4

Prerequisite: Previous knowledge acquired in the study program

Course goals: Acquiring the necessary knowledge about the origin and quality of the wastewater in mineral and recycling technologies, classification of wastewater and methods for their purification.

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

Course description:

Lectures: Introductory part: classification of wastewater - by species, by composition, by way of formation; Requirements for the degree of wastewater treatment - legal regulations, treatment options. Primary treatment (removal of inert material, clarification, settling, filtration). Secondary treatment: physico-chemical methods

(coagulation, flocculation, flotation, adsorption, ion exchange, extraction, membrane processes); chemical methods (neutralization, precipitation, oxidation, reduction); biological methods (biological filtration, activated sludge, aeration lagoons, anaerobic processes). Tertiary treatment (removal of nitrogen and phosphorus). Sludge treatment. The examples of wastewater treatment plants (selection of treatment technology and technological scheme).

Practice: Water sampling for physical-chemical analyzes and laboratory exercises.

Literature:

1. D. Ljubisavljević, A. Đukić, B.Babić, Wastewater Treatment (in Serbian), Faculty of Civil Engineering, Belgrade, 2004.
2. M. Bogner, M. M.Stanojević, About water: Theory, regulations and examples from practice (in Serbian) , Eta Belgrade, 2006. (Selected chapters)
3. C. Forster, Wastewater Treatment and Technology, London, 2003.
4. D.G. Rao, R. Senthilkumar, J. Anthony Byrne, S. Feroz, Wastewater Treatment-Advanced Processes and Technologies, London, 2013.
5. F. Habashi, A Textbook of Hydrometallurgy, Metallurgie Extpactive Quebec, Enr., 1992 (Selected chapters)

Number of classes per week	**Lectures: 3**	**Practical classes: 1**

Teaching methods: Classical lectures with interactive discussions, laboratory exercises and independent work.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance	**10**	Oral part of the final exam	60
Coloquium exam/s	**10+10**	.....	

Study program: Mining Engineering

Course: LEACHING AND SOLUTIONS PROCESSING

Lecturer/s: Dr Grozdanka Bogdanović, Full Professor

Status of the course: Compulsory for modules MP and RTSD

ECTS: 6

Prerequisite: Acquired knowledge in Chemistry

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

Course description:
Lectures: Introduction to leaching. Physico-chemical basis of the leaching processes. Chemical and electrochemical reactions. Potential-pH equilibrium diagrams. Leaching kinetics. Leaching agents. Metals leaching. Leaching of primary raw materials (oxide, carbonate, silicate and sulphide minerals). Leaching of

technogenic 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 metaland metal compounds from solution. Crystallization and precipitation processes. Electrochemical separation of metals.
Practice: Calculation exercises and solutions in the field of thermodynamics and kinetics of the leaching process. Experimental exercises related to the determination of the kinetics of the leaching process; purification and concentration metals and metal compounds from solutions

Literature:

1. M. R. Vujasinović, V. Grekulović, Theory of Hydro and Electrometallurgical Processes (in Serbian), Bor, 2017
2. N. Pacović, Hydrometallurgy (in Serbian) , ŠRIF, Bor, 1980.
3 G.D. Bogdanović, M.M. Antonijević, Behavior and oxidation of chalcopyrite in an aqueous environment (in Serbian), Technical Faculty, Bor, 2011.
4. 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 (Selected chapters)

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

Teaching methods: Oral presentations with interactive discussions; Experimental exercises; Consultations

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance	**20**	Oral part of the final exam	50
Coloquium exam/s	**10+10**	.....	

Study program: Mining Engineering

Course: DEWATERING AND TAILING

Lecturer/s: PhD Grozdanka Bogdanović, full professor, PhD Milan Trumić, full professor

Status of the course: Elective for module MP

ECTS: 8

Prerequisite: Previous knowledge acquired in the study program

Course goals:

Introducing students with methods for dewatering and disposing of products formed by the mineral processing and concentration.

Learning outcomes:

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:
Lectures:
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.
Practice:

Exercises: Sedimentation curve, Specific surface thickening and filtering, Technological indicators of thickening and filtering process. Show exercises 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.

Ancillary:

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

Number of classes per week	**Lectures: 2**	**Practical classes: 3**

Teaching methods

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

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	
Exercise attendance	**20**	Oral part of the final exam	**50**
Coloquium exam/s	**20**	.....	

Study program: Mining Engineering

Course: Reagents in mineral processing

Lecturer: PhD Zoran Štirbanović, associate professor

Status of the course: Elective for module MP

ECTS: 8

Prerequisite: Enrolled course: Organic chemistry

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

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

Course description:
Lectures:

Introduction. Inorganic and organic chemical compounds used in mineral processing and their classification. IUPAC names. 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).

Practice:

Laboratory exercises 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. D. Salatić, Flotation reagents, Belgrade, 1987. (*In Serbian*)
2. S. Alagić, Toxicology, Technical Faculty in Bor, Bor, 2012. (*In Serbian*)
3. M. Mokranjac, Toxicological chemistry, Grafopan, Belgrade, 2001. (*In Serbian*)
4. D. Soldatović, Handbook of important poisons, Nauka, Belgrade, 2004. (*In Serbian*)

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

Teaching methods

Lectures with interactive work with students, practical work through laboratory and computational exercises. Pre-examination of knowledge through one colloquium.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**15**	Written part of the final exam	
Exercise attendance	**15**	Oral part of the final exam	**50**
Coloquium exam/s	**20**	.....	
Term paper			

Study program: Mining Engineering

Course: TECHNOGENIC WASTE MATERIALS PROCESSING

Lecturer/s: Dr Grozdanka Bogdanović, Full Professor

Status of the course: Elective for module RTSD

ECTS: 8

Prerequisite: Required knowledge in the study program

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

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

Course description:

Lectures: 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.

Practice: 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 indicator

Literature:

1. M. Ristić, M. Vuković, Solid Waste Management, Solid Waste Processing Technology (in Serbian), TF Bor, 2006.

2. M.Dimitrijević, S.Milić, Sulphide mining waste. Characteristics, environmental impact and treatment (in Serbian), TF Bor, 2017.

3.M.Trumić, Lj.Andrić, M.Trumić, Management and Treatment of Waste (in Serbian), TF Bor, 2014 (Selected chapters)

4. B. Branković, Procedures and Equipment for Recycling Waste Material (in Serbian) , Beograd, 2002.

5. F. Barbič, Recycling of Waste Material and Secondary Raw Materials in the Function of Environmental Protection (in Serbian), Beograd, 1995.

6. F. R. McDougall, P.R. White, M.Franke, P.Hindle, Integrated Solid Waste Management - A Life Cycle Inventory 2nd Edition, Blackwell Science, Oxford, 2003 (Selected chapters)

Number of classes per week	**Lectures: 2**	**Practical classes: 3**

Teaching methods: Lectures, exercises and practical classes with interactive discussion

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	
Exercise attendance	**10**	Oral part of the final exam	60
Coloquium exam/s		.....	
Term paper	**25**		

Study program: Mining Engineering

Course: Alternative and renewable energy sources

Lecturer: PhD Zoran Štirbanović, associate professor

Status of the course: Elective for module RTSD

ECTS: 8

Prerequisite: none

Course goals: Introducing students with theoretical and practical principles of alternative and renewable energy sources.

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

Course description:
Lectures:

Energy. Conversion of energy from one form to another and energy losses, storage and transmission of energy. The concept of alternative and renewable energy sources. 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 hydropower plants. Industrial and municipal waste as alternative sources of energy (incineration, pyrolysis, gasification, plasma process, anaerobic digestion, landfill gas). Cogeneration.

Practice:

Practical work is conducted in classroom and laboratory in the form of experimental and computational exercises, according to the program of theoretical lectures.

Literature:

Recommended:

1. N. Đajić, Energy for a Sustainable World, Faculty of Mining and Geology, Belgrade, 2002. (*In Serbian*)
2. D. Gvozdenac, B. Nakomčić-Smaragdakis, B. Gvozdenac-Urošević, Renewable energy sources, Faculty of Technical Sciences, Novi Sad, 2011. (*In Serbian*)
3. B. N. Grgur, Alternative energy sources - principles of conversion and storage, Engineering Society for Corrosion, Belgrade, 2015. (*In Serbian*)
4. M. Radaković, Renewable energy sources and their economic assessment, AGM, book, Belgrade, 2010. (*In Serbian*)
5. S, Gaćeša, Lj. Vrbaški, J. Baras, L. Knežić, M. Klašnja, F. Zdanski, Biogas production and application, Faculty of Technology, Novi Sad, 1985. (*In Serbian*)
6. Z. Predojević, Biomass fuels, Bioethanol and biodiesel, Faculty of Technology, Novi Sad, 2010. (*In Serbian*)
7. M. Ž. Trumić, Lj. Andrić, M. S. Trumić, Waste management and treatment, Technical Faculty in Bor, Bor, 2014. (*In Serbian*)

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

Teaching methods

Lectures through interactive work with students, practical work through laboratory and computational exercises. Pre-exam knowledge check through one colloquium and one term paper..

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**15**	Written part of the final exam	
Exercise attendance	**15**	Oral part of the final exam	**50**
Coloquium exam/s	**10**	.....	
Term paper	**10**		

Study program: Mining engineering

Course: MINE DESIGN

Lecturer: dr Saša Stojadinović, van. prof.

Course status: Obligatory

ECTS: 6

Prerequisites: demonstrated knowledge in other mining courses

Course goal

To familiarize students with the activities and stages of mining projects

Course outcome

Competence in mine design and understanding of mine projects

Course description

Theoretical

Introduction. The task of design and basic definitions. Types of mining projects, legal design regulations, procedures that precede project development (exploration of deposits, determination of ore reserves, selection of design organization, project task, preparation of studies of exploitation possibilities and individual technological processes), project development, revision of project documentation, long-term program, annual mine plans.

Methods of determining the optimal parameters of the mine: mathematical methods, methods of operation research, application of computers in design. Design of mines with underground exploitation, design of surface exploitation of reservoirs, economics of mining projects.

Practical classes: Development of project- studies in the field of underground and surface exploitation of mineral deposits.

Literature Preporučena:

1. Ž. Milićević, R. Nikolić, Osnove projektovanja rudnika, TF, Bor, 2003.
2. Ž. Milićević, Projektovanje rudnika – Projektovanje rudnika sa podzemnom eksploatacijom, TF, Bor, 2007.
3. N. Popović, Naučne osnove projektovanja površinskih kopova, Veselin Masleša, Sarajevo, 1975.

Pomoćna:

1. Lj. Redžić, Osnovi projektovanja rudnika sa podzemnom eksploatacijom, RMF, Kosovska Mitrovica, 1997.
2. V. Simeunović, Projektovanje rudnika sa podzemnom eksploatacijom, RGF, Beograd, 1995.

Number of classes per weak	**Theoretical:4**	**Practical: 2**	
Lecture methods: Predavanja sa interaktivnim diskusijama, konsultacije, izrada elaborata.			
Grading system (Maximum of 100 points)			
Predispitne obaveze	points	**Final examination**	points
Active participation / lectures	**10**	written exam	
Active participation/exercises	**35**	oral exam	**55**
colloquium			
Assignment			

Study program: Mining Engineering
Course: UNDERGROUND MINING METHODS
Lecturer: Dr Dejan Petrović, assistant professor
Status of the course: Compulsory for EMD Module
ECTS: 6
Prerequisite: Completed third year of undergraduate mining studies
Course goals: Introduction to underground mining methods
Learning outcomes: Personal competences for mine method selection, application and design in coal and hardrock mining.

Course description:

Lectures:
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. Rope 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.

Practice:

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.

Ancillary:

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	**Lectures: 3**	**Practical classes: 3**	**Study research work:**	**Other forms of teaching:**

Teaching methods

Oral lectures, calculation tasks, discussion

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**5**	Written part of the final exam	**30**
Exercise attendance	**25**	Oral part of the final exam	**40**
Coloquium exam/s		.....	
Term paper			

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Subject: ECONOMICS AND ORGANIZATION OF BUSINESS

Lecturer: dr. Dejan Riznić, full proffesor

Status of the subject: Obligatory subject

ECTS: 6

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

Goal of the subject:
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. Subject 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.

Outcome of the subject:
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.

Contents of the subject:
Introduction - the subject, 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

Ancillary:
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	Exercises:	Other forms of teaching:	Study research work:	

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

Knowledge rating (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Activity during the lecture	20	Written exam	15
Practical classes		Oral exam	35
Colloquium	30		
Independent work			

Study program: Mining Engineering

Course: REGULATIONS IN MINING

Lecturer/s: Dr Jelena Ivaz, assistant professor

Status of the course: Elective

ECTS: 6

Prerequisite:

Course goals: To gain basic knowledge on standardization and legislation and to understand the hierarchy of technical documents**.**
Learning outcomes: Competences to apply standards and follow regulations and use technical documentation.
Course description: Lectures: Introductory remarks. Historical development of mining related legislation. Overview of mining relatedlegislative acts. Mining and geology act. Construction act. Environmental safety act. Sublegal acts and documents related to mining. Enforcement. Legal sanctions. Form and content of technical documentation. Process of mine design,design review and design application. Practice: Assignment
Literature: Recommended: 6. М. Жикић, С. Стојадиновић, Стандарди, законска регулатива и техничка документација у рударству, Технички факулет у Бору, Бор, 2018 Ancillary: 1. Standards catalogues, Legislation almanacs

Number of classes per week	**Lectures: 3**	**Practical classes: 3**	**Study research work: 3**	**Other forms of teaching:**
Teaching methods Oral lectures, calculation tasks, discussion.				

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	30	Written part of the final exam	
Exercise attendance		Oral part of the final exam	70
Coloquium exam/s		.....	
Term paper			

Study program: Mining Engineering
Course: Occupational health and safety in M&RT
Lecturer: PhD Zoran Štirbanović, Associate Professor
Status of the course: Elective for modules MP and RTSD
ECTS: 6
Prerequisite: none

Course goals: Acquisition of practical and theoretical knowledge of occupational health and safety in mineral processing and recycling processes.

Learning outcomes: Training for identification and assessment of potential hazards in mineral processing and recycling facilities. Ability to keep records and analyze injuries and occupational diseases. Training in the use of means of protection and planning of protection measures. Knowledge of the principles of occupational health and safety in mineral processing and recycling processes.

Course description:

Lectures:

Legeslation in the field of occupational health and safety. Assessment of safety and health hazards at work in mineral processing and recycling facilities. Work injuries and occupational diseases. Sources of occupational disease and protection measures. Dust in mineral processing and recycling facilities. Noise and vibrations in mineral processing and recycling facilities. Fires in mineral processing and recycling facilities. Explosions in mineral processing and recycling facilities. Chemicals in mineral processing and recycling plants. Other sources of endangerment of human work and health. Protection measures in mineral and recycling processes. Personal protective equipment. Safe handling of reagents in mineral processing and recycling facilities. Ways of responding and providing first aid in accident situations.

Practice:

Practical work according to the theoretical leactures includes the analysis and assessment of potential safety and health hazards in mineral processing and recycling facilities, as well as the determination of necessary protection measures for the prevention and reduction of negative impacts of certain processes, equipment and materials used in mineral processing and recycling facilities.

Literature:

Recommended:

1. Law on Occupational Safety and Health, Official Gazette of the Republic of Serbia
2. S. Alagić, Toxicology, Technical Faculty in Bor, Bor, 2012. *(In Serbian)*
3. M. Mokranjac, Toxicological chemistry, Grafopan, Belgrade, 2001. *(In Serbian)*
4. D. Soldatović, Handbook of important poisons, Nauka, Belgrade, 2004. *(In Serbian)*
5. V. Jovičić, M. Miljković, J. Nuić, H. Uljić, Safety and technical protection in mines, Tuzla, 1987. *(In Serbian)*

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

Teaching methods

Lectures include interactive work with students, practical work with example analysis. Pre-exam knowledge check through one colloquium.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**15**	Written part of the final exam	
Exercise attendance	**15**	Oral part of the final exam	**50**
Coloquium exam/s	**20**	.....	
Term paper			

Study program: Mining Engineering

Course: PROCESS MEASUREMENT TECHNIQUE

Lecturer/s: Dr. Zoran Stević, full professor

Status of the course: Elective for modules Mineral Processing and Recycling Technologies and Sustainable Development

ECTS: 6

Prerequisites: Basic knowledge from the subject 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 outcomes: Learning physical principles of measurements in industrial processes and understanding modern measurement techniques.

Course description:

Lectures:

Fundamentals of metrology. Planning the experiment. Measurement errors. Gross error. A systematic error. Accidental error. Expression of measurement errors. Absolute and relative error. Confidence interval. Measurement uncertainty. Measurement characteristics. Accuracy and precision of measurements. Sensitivity and resolution. Measuring range. Measuring area. Dynamic range. Linearity. Accuracy class. Errors of indirect measurements. Presentation of measurement results. Tabular and graphical presentation of results. Measure elements (sensors and transducers). The most commonly used sensors in the process industry. Resistant, inductive and capacitive sensors. Magnetoelastic, piezoelectric and optoelectric sensors. Thermocouples. Non-contact temperature measurement. Digital sensors. Executive elements (actuators). Types of actuators and their application. Electromagnetic actuators (DC and AC motors, stepper motors and electromagnets). Fluid actuators (hydraulic and pneumatic). Piezoelectric actuators. Relays. Contactors. Signal adjustment. Analog/digital and digital/analog conversion. Connecting sensors, measuring transducers and actuators with a computer. Intelligent sensors.

Programmable logic controllers (PLC). Typical input/output modules of programmable logic

controllers. Distributed measurement systems. Virtual instrumentation and virtual laboratories.

Practice:

Computational exercises that follow the lecture program and laboratory exercises with the use of specialized computer laboratory.

Literature:

1. D. B. Denić, I. Ranđelović, D. Živanović, Računarski merno-informacioni sistemi u industriji,

Elektronski fakultet, Niš, 2005.

2. D. Stanković: Fizičko tehnička merenja – senzori, Univerzitet u Beogradu, Beograd 1997.

3. M. Popović: Senzori i merenja, Viša elektrotehnička škola, Beograd 2000.

Number of classes per week	**Lectures: 3**	**Practical classes: 3**	**Study research work: None**	**Other forms of teaching: None**

Teaching methods

Theoretical teaching is conducted in classrooms, using modern didactic tools and methods.

Exercises are performed in a specialized computer laboratory.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**10**	Written part of the final exam	/
Exercise attendance	**40**	Oral part of the final exam	**50**
Coloquium exam/s	/		
Term paper	/		

Study program: Mining Engineering

Course: Mineral processing technologies 2

Lecturer: PhD Zoran Štirbanović, Associate Professor

Status of the course: Compulsory for module MP

ECTS: 6

Prerequisite: Enrolled courses: Mineral processing technologies 1, Comminution and classification, Flotation, Physical methods of classification, Leaching and enrichment of solutions and Auxiliary operations in MP and RT

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

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

Course description:

Lectures:

Introduction. Classification of industrial processes for the preparation and concentration of metallic 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. Product quality standards and market requirements.

Practice:

Creation of technological schemes based on the given characteristics of mineral raw material. Computational exercises: Determination of the material balance of technological schemes. Technological indicators and control of industrial processes.

Literature:

Recommended:

7. D. Draškić, Industrial application of mineral processing, Book I, Student Publishing and Information Center, Belgrade, 1975. (*In Serbian*)
8. D. Draškić, Industrial application of mineral processing, Book II, Faculty of Mining and Geology, Belgrade, 1986. (*In Serbian*)

Ancillary:

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

Teaching methods

Lectures, exercises and practical work are organized on an interactive basis, which in addition to classic lectures and presentations, includes discussions and active participation of students in all types of teaching. Pre-exam knowledge check through two colloquiums.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance	**15**	Written part of the final exam	**10**
Exercise attendance	**15**	Oral part of the final exam	**40**
Coloquium exam 1	**10**	.....	
Coloquium exam 2	**10**		

Study program: Mining Engineering

Course: RECYCLING TECHNOLOGY

Lecturer/s: Dr Maja Trumić, Associate Professor

Status of the subject: Obligatory subject, module RTSD

ECTS: 6

Prerequisite: 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 outcomes: Students are able to more easily follow courses from subjects 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.

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:

7. M. Ž. Trumić, Recycling technologies of secondary raw materials, Authorized lectures.B. Branković, Postupci i uređaji za recikliranje otpadnog materijala, Beograd, 2002.
8. M. Vojnović, M. Simčić, P. Rakin, M. Marić, S. Dedić, M. Rakin, Processing of waste lead batteries in environmentally friendly conditions, DIT, Beograd, 2004.

Ancillary:

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

Number of classes per week	Lectures: 4	Practical classes: 2

Teaching methods: Theoretical lectures are conducted with lectures and practical in the form of demonstration exercises according to the interactive principle with the active participation of students and seminar paper.

Knowledge rating (max. number of points 100)

Pre-examination obligations	points	**Final examination**	points
Lecture attendance	10	Written part of the final exam	
Exercise attendance	10	Oral part of the final exam	50
Seminar	30		

Study program: Mining Engineering

Course: Professional practice 2

Lecturer/s: PhD Zoran Štirbanović, Associate Professor; PhD Jelena Ivaz, Assistant Professor

Status of the course: Compulsory for modules MP and RTSD

ECTS: 4

Prerequisite: Completed seventh semester

Course goals: The goal of professional practice 2 is to introduce students with the individual stages of the production process in more detail according to the optional module. This implies a detailed introduction to the operation of the industrial process, taking samples from individual phases of the process, analysis of technical and technological indicators of the process and presentation results in written form. The primary goal of professional practice 2 is the direct engagement of students on familiarization and control of certain phases of the process, performing experiments, presentation and analysis of the results as well as the presentation of the same in written form, with the aim of training for independent preparationof their graduation work.

Learning outcomes: Enabling students to recognize and apply previously acquired theoretical knowledge in real life industrial production processes. By sublimating the theoretical knowledge and the practical realization of professional practice, students acquire a new quality and competencies for better understanding, more efficient studying and independent preparation of the graduation work.

Course description:

Lectures:

The content of professional practice 2, is defined in agreement with the management of the company in which it is being performed and is different for students of individual modules of the Mining study program engineering Due to the specificity of mining industrial processes, according to the optional module, (M1: exploitation of mineral deposits, M2: mineral processing or M3: recycling technologies and sustainable development), special contents of professional practice 2 are formed for smaller groups of students. The professional practice program for students is created by the teacher-coordinator of professional practice 2, with consultation with the teachers of the corresponding module of the Mining Engineering study program and the specifics of the technological process of the company in which professional practice is carried out.

Practice:

Writing an essay – report of professional practice 2.

Literature:

Recommended:

1. Technical documentation from the industrial plant

Number of classes per week	**Lectures: 0**	**Practical classes: 6**	**Study research work:**	**Other forms of teaching:**

Teaching methods

Professional practice 2 takes place in the eighth semester, every Friday of the week at industrial plants. The method of carrying out professional practice 2 implies practical work in industrial production process, taking samples from certain phases of the process, laboratory tests on with excluded raw material samples, presentation of the obtained results, as well as their analysis. After the completion of professional practice, the student submits to the teacher-coordinator three copies of the professional practice report, in which all research results are presented. Teacher - professional practice 2 coordinator examines the essay – report of professional practice with a check of all data in it, and with his signature in to the index confirms that the student has successfully completed the same, which is a prerequisite for certification of the eighth semester.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Professional practice attendance	**25**	Written part of the final exam	
Essay – report	**25**	Oral part of the final exam	**50**
Coloquium exam/s		.....	
Term paper			

Study program: Mining Engineering

Course: BACHELOR THESIS

Lecturer/s: All professors on study program are potential mentors

Status of the course: Obligatory subject

ECTS: 4

Prerequisite: Enrolled VII semester

Course goals: Preparation and training of students for independent research work in accordance with the level of education in undergraduate academic studies, as well as acquiring the basis for later training in master's academic studies.

Learning outcomes: Practical application of acquired knowledge from the study program, which trains the student for independent research work and solving engineering tasks within the scope of the study program.

Course description:

Theoretical teaching:

The bachelor thesis represents the student's independent research work in which he gets acquainted with research methodology in the scientific and professional field of the current study program. The bachelor thesis it must be from the field of the elective area - the module that the student enrolled. The student overcomes the theoretical and practical stages of scientific research methods and uses available literature and literature bases (COBSON, SCOPUS, SCIENCE DIRECT, etc.). With the help of a mentor, he overcomes the work on the appropriate one equipment and software for processing experimental data. The student in consultation with the elected the mentor defines the program, goals and expected results, processes theoretical knowledge as a basis for performing experimental or practical work in solving a given engineering problem.

Literature

Recommended:

1. Relevant literature in the field of mining engineering in paper and electronic form.

Number of classes per week	Lectures: 0	Practical classes: 5

Teaching methods:

Mentoring approach. The mentor guides the candidate in his work and provides him with assistance in the entire process research, through: choosing the topic of the final paper, formulating the title of the paper, setting the objective of the course work, engineering methods and methods of its solution, approach to the problem, choice of processing method problems, experimental work and data collection. Independent production (with constant supervision and consultation with the mentor) of individual chapters of the final paper in accordance with the content and plan and program given by choosing the topic of the final paper.

Knowledge rating (max. number of points 100)

Pre-examination obligations	points	**Final examination**	points
Lecture attendance	50	Oral part of the final exam	50

Study program: Mining Engineering

Course: BACHELOR THESIS - PREPARATION AND DEFENSE

Lecturer/s: All professors on study program are potential mentors

Status of the course: Compulsory for Mining Engineering study program

ECTS: 4

Prerequisite: Passed all exams provided for the undergraduate studies on the study program Mining Engineering and completed out professional practice.

Course goals: The goal of preparing and defending the bachelor thesis is for the student to demonstrate the ability to independently perceive a certain practical problem, define the program for solving it through the application of theoretical knowledge and experimental tests. Thus, the student gains the first experience of independent observation and solving of practical problems, necessary skills for a successful future engineering practice.

Learning outcomes: By preparing and defending the final thesis, students are trained to notice technical-technological problems in industrial practice, to see them realistically and find solutions to overcome them. In addition to being trained to work in appropriate jobs, students are trained to continue their education at higher levels of study.

Course description:

Lectures:

Bachelor thesis - preparation and defense is formulated for each student separately, in accordance with the specifics of the selected modules of the Mining Engineering study program. The final paper represents the student's independent research work, which contains the following chapters: introduction, theoretical part, experimental part, research results with their discussion, conclusion and literature review. The mentor guides the candidate in his work and provides him with assistance in the entire process of preparing and defending the final thesis. The student, in consultation with the mentor, independently creates a research program for the implementation of the assigned task and, with the help of the mentor, performs data processing and analysis of the obtained results. The final paper, in the form of an essay, is submitted in three copies, and is publicly defended before a three-member committee of teachers from this study program, i.e. the corresponding module of the same.

Practice:

Laboratory and field research.

Literature:

Recommended:

1. Relevant literature in the field of mining engineering in paper and electronic form.

Number of classes per week	**Lectures:**	**Practical classes:**	**Study research work: 4**	**Other forms of teaching:**

Teaching methods

The mentor for the preparation and defense of the bachelor thesis is chosen in accordance with the elective area of the corresponding module. The mentor formulates the topic of the bachelor thesis. After completing the thesis, with the consent of the mentor that the thesis has been successfully completed, the student defends the thesis before a three-member committee of teachers. The condition for the defense of the bachelor thesis is to pass all the exams of the corresponding module and complete the professional practice from the curriculum of the study program.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	Points	**Final exam**	Points
Lecture attendance		Written part (Preparation of bachelor thesis)	**50**
Exercise attendance		Oral part (Defending of bachelor thesis)	**50**
Coloquium exam/s		.....	
Term paper			