STUDY PROGRAM: TECHNOLOGICAL ENGINEERING

UNDERGRADUATE ACADEMIC STUDIES

Book of Courses

Bor, 2018

Contents – List of courses

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

Level of study: Undergraduate Academic Studies

Course: MATHEMATICS I

Lecturer: PhD Darko Kocev, assistant professor

Status of the Course: Compulsory for Mining Engineering, Metallurgical Engineering and Technological Engineering and elective for Engineering Management

ECTS: 8

Prerequisites: Secondary acquired knowledge in mathematics

Goal of the Course: Application of acquired knowledge in the field of content items

Learning outcomes: Mastering the necessary fund of knowledge for following upcoming mathematical subjects, as well as subjects for which we need mathematical tools

Course description:

*Lectures***:**

Introducing ~~of~~ basic notions (sets, relations, algebraic structures, sets of numbers); Matrices (definitions, equality of matrices, addition and multiplication of matrices); Determinants; Matrix inverse; Rank of a matrix; Systems of linear equations (solving the system using Gaussian method of elimination, Cramer's rule and Kronecker-Capelli theorem); Real functions of a real variable (basic notions); Limits of functions; Continuity of functions; Derivative of a function; Differential of a function; Theorems about differentiation; L'Hopital's rule; Taylor's formula; Determination of intervals of monotonicity of a function and finding local extremums of a function; Intervals of convexity and concavity and inflection points; Analysis of a function and drawing the graph of a function; Functions of two variables (basic notions, definitions, partial derivatives, Taylor's formula, local extremums) .

*Practice***:**

Calculation 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.

Supplementary:

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

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

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

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	20	Written exam	40
Practical classes		Oral exam	
Preliminary exams	40		
Independent work			

Study program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: PHYSICS

Lecturer: PhD Čedomir Maluckov, associate professor

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

ECTS: 8

Prerequisites: High school knowledge in physics

Goal of the Course: Acquisition of basic knowledge of physical phenomena and relationships between physical quantities

Learning outcomes: Introduction to basic physical laws, in order to successful monitoring of teaching in higher years of study

Course description:

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

Practical classes: Exercises, Other forms of teaching, Study research work

Computer and laboratory exercises follow lectures.

Literature

Recommended:

1.B. Pavlović, Physics, part I, Faculty of Technology and Metallurgy, Belgrade, 2004. (in Serbain)
2.B. Pavlović, Physics, part II, Faculty of Technology and Metallurgy, Belgrade, 2000. (in Serbain)
3.B. Pavlović, S. Milojević, Practicum of computational exercises in physics, Scientific book, Belgrade, 1983. (in Serbain)

Supplementary:

1. B. Pavlović, S. Knežević, M. Radišić, D. Vesić, Practicum of laboratory exercises in physics, Technical faculty in Bor, 1991. (in Serbian)

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

Methods of teaching

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	20
Practical classes	10	Oral exam	20
Preliminary exams	40		
Testing	5		

Study Program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: GENERAL CHEMISTRY

Lecturer: PhD Milan Antonijević, full professor

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

ECTS: 8

Prerequisites: Acquired basic knowledge in the field of chemistry.

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

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

Course description:

Theoretical classes:

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

Practical classes: Exercises, Other forms of classes, Study research work

Laboratory classes.

Literature:

Recommended:

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

Supplementary:

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

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

Methods of teaching: Classical lectures with interactive discussions, calculation and laboratory exercises, consultations with teachers and assistants, colloquia.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	**10**	Written exam	**60**
Practical classes	**10**	Oral exam	
Preliminary exams	**20**		
Independent work			

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

Level of study: Undergraduate Academic Studies

Course: INFORMATICS I

Lecturer: PhD D. Brodić, associate professor, D. Stanujkić, associate professor

Status of the subject: Compulsory subject

ECTS: 4

Prerequisites: The basic informatics knowledge from the high school

Goal of the subject:
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:
Numeral systems and number translation: The essence of numeral system, the translation of numbers from one numeral system to another, the conversion from binary to octal and hexadecimal numeral systems, binary arithmetic, basic arithmetic operations in the system with an arbitrary basis. Representation of data in computer: BCD data, one's complement, two's complement, complement arithmetic, ASCII codes. Boolean and switching algebra: definition of Boolean algebra and basic examples, idempotence law, the law of involution operation of negation, De Morgan's theorem, the law of absorption, the simplification of logic expressions, minimization of logical expressions, Karnaugh maps, switching algebra, analysis and synthesis logic circuits. Switching and logic gates: Switching gates, AND, OR and NOT logic gates, examples of logic gates, analysis and synthesis of switching gates.

Literature
Recommended:
Milos Ercegovac, Thomas Lang, Jaime H. Moreno, Introduction to Digital Systems, John Wiley and Sons, ISBN: 978-8-126-52251-4
Supplementary:
Darko Brodic, Milena Jevtic, Book of Assignments in Computer Science I, translation in English

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

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

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes		Oral exam	40
Preliminary exams	40		
Term paper	10		

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

Level of study: Undergraduate Academic Studies

Course: ENGLISH LANGUAGE 1

Lecturer: Sandra Vasković, English language teacher

Status of the course: Compulsory

ECTS: 2+2

Prerequisite: Basic language user

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

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

Course description:

Topics: Everyday life, Appearances, Life stories, The future, Comparison, People and places, In your life, Food and health, Possibilities, Activities, The media, Planet Earth, Time, Work .

Grammar: Verb tenses (present simple and continuous, past simple and continuous, present and past perfect, going to vs. will), First conditional, Second conditional, Comparison of adjectives, Modals, compound nouns and adjectives, phrasal verbs.

Language functions: making arrangements, life events, leaving messages, shopping, giving directions, ordering a meal, polite requests, telephone expressions, arranging a time, small talk.

Literature

Recommended:

1. Tom Hutchinson, Lifelines, Pre-Intermediate, Student's Book, OUP, Oxford, 2009

Supplementary:

1. Slavica Stevanović, Elementary grammar workbook with answers, Tehnički fakultet u Boru, 2018.
2. Raymond Murphy & William R. Smalzer, Basic Grammar in Use, CUP, Cambridge, 2007

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

Methods of teaching

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance	10	Final exam	40
Active participation	10		
Preliminary exams	40		
Independent work			

Study Program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: INORGANIC CHEMISTRY

Lecturer: PhD Snežana Milić, associate professor

Status of the Course: Compulsory course for study Program: Metallurgical Engineering and Technological Engineering; Elective course for study Program: Mining Engineering

ECTS: 8

Prerequisites: Acquired knowledge from General Chemistry

Goal of the Course: Students acquire basic knowledge of properties of elements, their reactions and compounds

Learning outcomes: Better understanding of technological subjects.

Course description:

Theoretical lectures:

General characteristics of elements. Aboundance. Reactivity. Compounds. Application.
Chemistry of hydrogen and noble gases. Chemistry of nonmetals and metaloides. Chemistry of metals. s and p elements. Transition metals (d and f elements). Chemical aspects of environment pollution.

Practical lectures: Exercises and other types of lectures. Study research.

Laboratory exercises.

Literature:

Recommended:

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

Supplementary:

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

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

Methods of teaching

Classical lectures with interactive discussions, computational and laboratory exercises, consultation and Mid-term exam(s)s.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	60
Practical classes	10	Oral exam	
Preliminary exams	20		
Independent work			

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

Level of study: Undergraduate Academic Studies

Course: INFORMATICS II

Lecturer: dr. D. Brodić, associate professor, D. Stanujkić, associate professor

Status of the course: Compulsory subject

ECTS: 6

Prerequisites: Acquired IT knowledge in the subject Informatics 1

Goal of the course: Acquiring higher IT knowledge in information technology.

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

Course description:

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

Literature

Recommended:

1. John Walkenbach, Microsoft Excel 2013 Bible, John Wiley & Sons, ISBN: 978-1-118-49036-5
2. Faithe Wempen, Microsoft Powerpoint 2013 Bible, John Wiley & Sons, ISBN: 978-1- 118-48811-9
3. Roger Young, How Computers Work: Processor And Main Memory, ISBN: 978-1-442-11398-5

Supplementary:

Darko Brodic, Book of Assignment for Computer Science II, translation in English

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

Methods of teaching

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

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes		Oral exam	40
Preliminary exams	40		
Term paper	10		

Study Program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: MATHEMATICS II

Lecturer: PhD Ivana Đolović, full professor

Status of the course: Compulsory subject

ECTS: 8

Prerequisites: Fundamental knowledge in Mathematics I

Goal of the course: 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 studing process as well as real problems in engineering, sciences, business and technology fields

Course description:

Indefinite integral(definition, substitution rule, integration by parts); Integration of rational and irrational functions; Integration of trigonometric functions; definite integrals; Improper integrals; Application of definite integrals; Differential equations of first order; Separable differential equations of first order; First order homogeneous linear equation; Linear differential equation of first order; Bernoulli differential equation; Lagrange's differential equation; Clairauts' differential equation ; Exact differential equation;. Differential equations of second order; Reduction of order of differential equation;
Second order linear homogeneous differential equations with constant coefficients
Second order linear homogeneous differential equations with variable coefficients; Second order linear nonhomogeneous differential equations with constant coefficients;
Second order linear nonhomogeneous differential equations with variable coefficients.. Lagrange's method of variation of parameters (constants)

Literature

Recommended:

1. M.Janić, Matematika (I i II), TF Bor, 2003.
2. M.Janić, Zbirka rešenih zadataka iz matematike (1 i 2) TF Bor, 1996.
3. M. Uščumlić, P. Miličić, Zbirka zadataka iz više matematike I, Nauka Beograd, 1996.
4. D.Mitrinović, J.Kečkić, Matematika II, Građevinska knjiga, Beograd, 1991.
5. S. Vukadinović, D. Sučević, Z. Šami, Matematika II sa zbirkom zadataka, Saobraćajni fakultet, Beograd, 2003.

Supplementary:

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

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

Methods of teaching

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

Grading system (max. number of points 100)			
Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance	/	Written exam	40
Active participation	/	Oral exam	/
Preliminary exams	60		
Independent work	/		

Study Program: Mining Engineering, Metallurgical Engineering and Technological Engineering

Level of study: Undergraduate Academic Studies

Course: ENGINEERING GRAPHICS

Lecturer: PhD Dejan Tanikić, associate professor

Status of the Course: Compulsory course

ECTS: 6

Prerequisites:

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

Literature
Recommended:
1. R. Ljubojević, M. Stevanović, Inženjersko crtanje, TMF Beograd, 1989.
2. T. Pantelić, Tehničko crtanje, Naučna knjiga, Beograd, 1989.
Supplementary:
1. Grupa autora, Programirana zbirka zadataka iz tehničkog crtanja sa nacrtnom geometrijom, Naučna knjiga, Beograd, 1990.
2. Grupa autora, AutoCAD User's Guide, Copyright © 2001 Autodesk, Inc

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

Methods of teaching
Lectures, Exercises, Practical work, Preliminary exams

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**	
Attendance and active class participation	20	Written exam	0	60*
Active participation in practical classes	10	Oral exam		
Practical work	10			
Preliminary exams	30+30=60			

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

Study Program: Engineering Management , Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: STATISTICS

Lecturer: PhD Ivana Đolović, full professor

Status of the course: Compulsory subject

ECTS: 9

Prerequisites: Fundamental knowledge in mathematics

Goal of the course:
Students sholud 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 studing process as well as real problems in engineering, sciences, business and technology fields

Course description:
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; χ^2- 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; (χ^2-test of independence; χ^2- test of distribution); The correlation coefficient; Regression analysis; Coefficient of determination; standard error of the regression; Linear regression; Quadric regression; Exponential regression; Logarithmic regression

Literature

Recommended:

1. I.Đolović, Statistika, Univerzitet u Beogradu, Tehnički fakultet u Boru, Bor, 2016.
2. N.Vuković, Statističko zaključivanje, FON, Beograd, 2007.
3. S.Vukadinović, J.Popović, Matematička statistika, Saobračajni fakultet, 2004..
4. I.Đolović, Zbirka zadataka iz statistike, Univerzitet u Beogradu, Tehnički fakultet u Boru, Bor, 2011.

Supplementary:

1. Lj.Petrović, Teorijska statistika – Teorija statističkog zaključivanja, Centar za izdavačku delatnost Ekonomskog fakulteta, Beograd, 2006.
2. Mann S.P., Uvod u statistiku (srpsko izdanje), Centar za izdavačku delatnost Ekonomskog fakulteta, Beograd, 2009.

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

Methods of teaching
Frontal teaching for theoretical knowledge and group, individual and combined learning in practical parts of lessons (students engagement through active learning – applications and discussions)

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	20	Written exam	40
Practical classes	/	Oral exam	/
Preliminary exams	40		
Independent work	/		

Study Programs: Technological Engineering, Metallurgical Engineering, Mining Engineering

Level of study: Undergraduate Academic Studies

Course: PHYSICAL CHEMISTRY

Lecturer: PhD Marija B. Petrović Mihajlović, associate professor

Status of the Course: Compulsory course for Technological Engineering, Metallurgical Engineering; and elective course for Mining Engineering

ECTS: 9

Prerequisites: Acquired knowledge of General chemistry

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

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

Course description:

Theoretical instruction:

1. Structure of the atom; Chemical bonding (ionic, covalent, metallic bonds, hybridization of atomic orbitals, delocalized molecular orbitals, chemical bonding in complex compounds, Van der Waals and hydrogen bonding); Aggregate states of matter; 2. Introduction to chemical thermodynamics; Thermodynamic properties of a multicomponent homogeneous system; Conditions of the phase equilibrium and phase transformations; Equilibrium in solutions; The heat of chemical reaction; Chemical affinity; Chemical equilibrium; Surface phenomena; Transport phenomena; Chemical kinetics; 3. Properties of electrolyte solutions; Electrochemical thermodynamics; Irreversible processes on electrodes; Fundamentals of electrochemical kinetics.

Practical instruction: Exercises, Other forms of teaching, Study research work

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

1st cycle: Determination of partial pressure; Determination of vapour pressure of liquids; Determination of viscosity; 2nd cycle: Structural analysis; Adsorption; Determination of reaction order and the rate constant; 3rd cycle: Determination of electrical conductivity; Electromotive forces; Corrosion of metals.

Literature

Recommended:

1. S. Đ. Đorđević, V. J. Dražić, Fizička hemija, TMF, Beograd, 2005.
2. D. Minić, A. Antić-Jovanović, Fizička hemija, FFH, BF, Beograd, 2005.

Supplementary:

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

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

Methods of teaching: Lecturing with interactive discussions, calculation and laboratory exercises, consultations and Preliminary exams.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	30
Practical classes	5	Oral exam	40
Preliminary exams	20		
Independent work			

Study Program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: MINERALOGY AND PETROGRAPHY

Lecturer: PhD Mira Cocić, associate professor

Status of the course: Compulsory subject

ECTS: 8

Prerequisites: Basic chemistry knowledge

Goal of the course: 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:

Theoretical part:

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.

Practical part: Practices in mineralogical-petrographical collection: crystallography of minerals, recognition of minerals and rocks.

Literature

Recommended:

1. D. Babič, Mineralogy, Belgrade, 2003.
2. S. Janjić, Mineralogy, Naučna knjiga, Belgrade, 1995.
3. V. Đorđević, P. Đorđević, D. Milovanović, Basics of Petrology, Nauka, Belgrade, 1991.

Supplementary:

1. Ž. Milićević, Mineralogy, Authorized lectures available in electronic form, 2009.
2. Ž. Milićević, Petrography, Authorized lectures available in electronic form, 2009.

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

Methods of teaching

Lectures, practicals, practical lectures, preliminary exams

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	
Practical classes	5	Oral exam	40
Preliminary exam 1	25		
Preliminary exam 2	25		

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

Level of study: Undergraduate Academic Studies

Course: ENGLISH LANGUAGE 2

Lecturer: Mara Manzalović, teacher of English

Status of the course: Compulsory course

ECTS: 4+2

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

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

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

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

Literature
Recommended:

1. English language 2, Mara Manzalovic (a collection of texts with lexical and grammar exercises)

Supplementary:

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

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

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

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active participation	**10**	Written exam	**50**
Practical classes		Oral exam	**40**
Preliminary exams	(25+25)		
Term paper (optional)	up to 20		

Study Program: Mining Engineering or Metallurgical Engineering or Technological Engineering

Level of study: Undergraduate Academic Studies

Course: ANALYTICAL CHEMISTRY

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

Status of the Course: Compulsory course of Metallurgical Engineering and Technological Engineering and Elective course of Mining Engineering

ECTS: 8

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

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

Learning outcomes: By mastering this material, students will be able for easy monitoring and control of technological processes and also, the basics of their training for assessing the quality of the samples of various industrial raw materials and products are established.

Course description:

Theoretical:

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

Practical:

Gravimetric and volumetric determination of elements. Calculation exercises.

Literature

Recommended:

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

Supplementary:

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

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

Methods of teaching: Teaching with interactive discussions, experimental work and calculations, consultations, Preliminary exams

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	45
Practical classes	10	Oral exam	
Preliminary exams	20+20		
Independent work			

Study Program: Technological Engineering

Level of study: Bachelor (undergraduate) academic studies

Course: THERMODYNAMICS

Lecturer: PhD Jelena M. Djoković, full professor

Status of the Course: Compulsory course

ECTS: 8

Prerequisites: none

Goal of the Course:

Understanding and acquiring the fundamental thermodynamic principles and laws, and knowledge of thermodynamic states and state changes of matters included in energy transformations processes. Understanding the principles of operation of thermal engines and refrigeration devices, and knowledge of fundamentals of the energy transfer by heat.

Learning outcomes:

Students are trained to acquire the knowledge to apply in the further course of education, as well as in practice, in order to rationalize the use of energy and environmental resources which are available to us.

Course description:

Theoretical teaching:

Thermodynamic system, state properties, state changes. Postulates of thermodynamics. Ideal gas equation of state. Mixtures of ideal gases. Energy of the system, internal energy, modes of energy transfer, heat, work. First law of thermodynamics for closed system, specific heat capacity, enthalpy. Polytropic state changes of ideal gas. First law of thermodynamics for open system. Second law of thermodynamics, entropy, reversible and irreversible thermodynamic processes. Cycles of heat engines: Carnot cycle. Real pure substances – water vapor: phases, diagrams of state, state changes. Humid air. Combustion. Fundamentals of the energy transfer by heat: conduction, convection, radiation, combined transfer. Basic cycles of the internal combustion engines, gas-turbine and vapor-turbine. Basic refrigeration cycles.

Practical teaching:

Numerical examples from all theoretical teaching areas.

Literature

*Recommended***:**

1. Jelena Đoković, Termodinamika, Tehnički fakultet u Boru, Bor, 2013.
2. Bojan D. Đorđević, 2. Vladimir J. Valent, Slobodan P. Šerbanović, Termodinamika sa termotehnikom, TMF, Beograd, 2007.
3. Malić, D., Termodinamika i termotehnika, Građevinska knjiga, Beograd, 1963.
4. Bojić, M., Termodinamika, Skripta, Mašinski fakultet u Kragujevcu, 2008.

*Supplementary***:**

1. Bojan D. Đorđević, Vladimir J. Valent, Slobodan P. Šerbanović, Zbirka zadataka iz termodinamike sa termotehnikom, TMF, Beograd, 2004.
2. Voronjec, D., Đorđević, R., Vasiljević, B., Kozić, Đ. Bekvalac, V.: Rešeni zadaci iz termodinamike sa izvodima iz teorije, Mašinski fakultet u Beogradu, 1990.

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

Methods of teaching

Theoretical and practical teaching, Mid-term exam(s), Final exam

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes		Oral exam	40
Preliminary exams	50		
Independent work			

Study Program: Technological Engineering, Mining Engineering

Level of study: Undergraduate Academic Studies

Course: ORGANIC CHEMISTRY

Lecturer: PhD Slađana Alagić, associate professor

Status of the Course: Compulsory course of Technological Engineering and Elective course of Mining Engineering

ECTS: 6

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

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

Learning 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:

Theoretical:

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

Practical:

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

Literature

Recommended:

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

Supplementary:

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

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

Methods of teaching: Teaching with interactive discussions, experimental work and calculations, consultations, Preliminary exams

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	45
Practical classes	10	Oral exam	
Preliminary exams	20+20		
Independent work			

Study Program: Mining Engineering and Technological Engineering

Level of study: Undergraduate Academic Studies

Course: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Lecturer: PhD Zoran Stević, full professor

Status of the Course: Compulsory course

ECTS: 8

Prerequisites: -

Goal of the Course: Acquiring knowledge about basic electrical engineering laws and their application

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

Course description:

Electrostatics. Coulomb's law. Potential. Gauss's law. Conductors. Capacitors. Dielectrics. Energy. D.C. fields and circuits. Current field. Joule's law. Electric generators. Kirchhoff's current laws. Circuit solution using Kirchhoff's laws. Mesh analysis. Electric networks with capacitors. Time constant magnetic field. Magnetic flux and induction. Amper's law. Magnetic materials. Magnetic circuit. Time-varying magnetic and electric field. Faraday's law of electromagnetic induction. Inductance. Electric circuits of alternating current. Resonance. Resolving of AC circuits. Three-phase systems. Rotating electric field. Asynchronous and synchronous electric machines. Electricity transmission. Electrical installations and protection.

Literature

Recommended:

1. A. Đorđević, Fundamentals of Electrical Engineering, Part 1 to 4, Academic Mind, Belgrade, 2012.
2. G. Božilović, D. Olćan, A. Đorđević, Collection of problems for Fundamentals of electrical engineering, Part 1 to 4, Academic Mind, Belgrade 2012.

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

Methods of teaching

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	0 (30 without preliminary exams)
Practical classes	20	Oral exam	30
Preliminary exams	30		
Independent work	10		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: THEORETICAL FOUNDATIONS OF CHEMICAL TECHNOLOGY

Lecturer: PhD Marija B. Petrović Mihajlović, associate professor

Status of the Course: Compulsory course

ECTS: 6

Prerequisites: Acquiered knowledge of physical chemistry

Goal of the Course: This is one of the fundamental theoretical subjects for the field of inorganic chemical technology. Goal of the subject is to introduce students to theoretical foundations of technological processes, laws of chemical thermodynamic and kinetics that provide data regarding course of technological processes.

Learning outcomes: Students learn most important laws and terms regarding chemical engineering systems, thermodynamics and kinetics of inorganic chemical technology processes. Students build theoretical foundation for understanding narrowly professional subjects of the fourth year.

Course description:

*Theoretical instruction:*Laws of chemical thermodynamics. Thermochemistry of solutions. Heat of chemical reactions. Thermodynamic of ideal and real gases. Reaction equilibrium. Phase equilibrium. Gibbs phase rule. Phase transitions. Clausius-Clapeyron equation. Ideal and non-ideal solutions. Laws of chemical kinetics. Kinetic laws of complex chemical reactions. Effect of temperature on chemical reaction rate. Activated complex theory. Kinetics of heterogeneous-topochemical reactions. Examples of topochemical reactions. Kinetics of homogeneous and heterogeneous catalytic reactions.

Practical instruction: Practicals, Other forms of teaching, Study research work

Calculation exercises.

Literature

Recommended:

1. R. Ninković, M. Todorović, J. Miladinović, D. Radovanović, Teorijski osnovi neorganske hemijske tehnologije – I deo, TMF, Beograd, 2003
2. M. Rajčić-Vujasinović, Teorijske osnove hemijske tehnologije, Autorizovana predavanja, TF Bor
3. N. Petranović, Hemijska termodinamika, FHZ, Beograd, 196
4. Z. Zavargo, R. Paunović, Osnovi hemijske termodinamike, Tehnološki fakultet, Novi Sad, 1997.
5. D. Šepa, Osnovi hemijske kinetike, Akademskamisao, Beograd, 2001,

Supplementary:

1. M. Antić, N. Colović, Kinetika heterogenih hemijskih reakcija, Niš, 1983

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

Methods of teaching: Classical lectures with interactive discussions, calculations and demonstration exercises, consultations and Mid-term exam(s)s.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	30
Practical classes	5	Oral exam	40
Preliminary exams	10+10		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: TECHNOLOGICAL OPERATION 1

Lecturer: PhD Snežana Milić, associate professor

Status of the Course: Compulsory course

ECTS: 8

Prerequisites: Acquired basic knowledge in Thermodynamics and Physical Chemistry

Goal of the Course:
Mastering the basic laws of the operation of the transfer of the amount of fluid movement and heterogeneous systems in technological processes

Learning outcomes:
Use of basic transmission operations of heterogeneous flux transfer operations systems and their application in the processing of technological processes.

Course description:
Theory teaching:
Transmission Movement Operations. Properties of the fluid. Bernoulli equation. The fluid flow regime. Similarity theory and dimensional analysis. Border layer. Transport of fluids. Devices for transport fluids. Fundamentals of hydrodynamics of heterogeneous systems. Moving particles through the fluid. Classification and centrifuging. Moving the fluid through the porous environment. Filtering, fluidization and mixing. Bubble movement through the liquid.
Practical classes: Exercises, Other forms of teaching, Study research work
Computational and laboratory processing of theoretical lectures.

Literature
Recommended:

1. V. Stanković, Fenomeni prenosa i operacija u metalurgiji , I tom, Tehnički fakultet, Bor, 1998.
2. A. Tasić, R. Radosavljević, R. Cvijović, F. Zdanski , Tehnološke operacije – Mehaničke - zbirka zadataka, TMF, Beograd, 1991.
3. D. Vulićević, Tehnološke operacije – Dijagrami, nomogrami, tabele TMF, Beograd, 2012.
4. S. Šerbula, V. Stanković, Praktikum za tehnološke operacije, Tehnički fakultet, Bor, 2010.

Supplementary:

1. F. Zdanski, Mehanika Fluida – teorija operacija prenosa količine kretanja, Tehnološko-metalurški fakultet, Univerzitet u Beogradu, 1995.
2. D. Simonović, D. Vuković, S. Cvijović, S. Končar-Đurđević, Tehnološke operacije 1 – Mehaničke operacije, TMF, Beograd, 1980.

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

Methods of teaching:
Classical lectures with interactive discussions, calculus and laboratory exercises, consultations and Preliminary exams.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	20
Practical classes	15	Oral exam	40
Preliminary exams	20		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: INORGANIC CHEMISTRY 2

Lecturer: PhD Milan Radovanović, assistant professor

Status of the Course: Compulsory course of study Program Technological Engineering

ECTS: 6

Prerequisites: Acquired knowledge from Inorganic chemistry

Goal of the Course: Acquiring knowledge for a better understanding of the molecular structure and complex compounds.

Learning outcomes: A better understanding of the degradation and synthesis of compounds in technological processes.

Course description:

Theory teaching:

Atomic orbitals. Wave function. Wave equation. Hydrogen atomic orbitals. Multielectron atoms. Covalent bond. The valence bond method. Method of molecular orbitals. Multifaceted molecules. Polycentric bonds. Molecular spectra. Inter-atomic distances. Stereochemistry. Ionic bond. Ionic molecules. Ionic structures. Hydrogen bond. Complex compounds. Coordination theory. Magnetic properties of the complex. Ligand field theory. Nuclear magnetic resonance. Metal bond. Crystal structure of metals and alloys. Electronic theory of metals.

Practical teaching: Practicals, Other forms of teaching, Study research work.

Calculations and laboratory Practicals.

Literature

Recommended:

1. I. Filipović, S. Lipanović, Opća i anorganska kemija, I deo, Školska knjiga, Zagreb 1995.
2. I. O. Juranić, Hemijska veza, Hemijski fakultet, Beograd, 1997.
3. Materijal sa predavanja.

Supplementary:

1. D. Grdenić, Molekule i kristali, Školska knjiga, Zagreb, 2005.

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

Methods of teaching: Classical lectures with interactive discussions, calcululations and laboratory Practicals, consultations and Mid-term exam(s)s.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	
Practical classes	15	Oral exam	50
Preliminary exams	30		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: ECOLOGY

Lecturer: PhD Slađana Alagić, associate professor

Status of the Course: Elective course

ECTS: 8

Prerequisites: Fundamental knowledge on basic classes of organic compounds, structure and function of biomolecules.

Goal of the Course: Clarification of basic ecological terminology – ecology is principally biological science, not the science of environmental protection. Concretization of basic ecological principles. Acquiring knowledge about basic processes and phenomena in the environment emphasizing sensitive equilibrium in ecosystems and developing awareness of the need for preserving and protecting of the environment.

Learning outcomes: Starting from the basic principles of ecology, enable detection and definition of the most important problems in the area of environmental protection and improvement, as well as their ranking in relation to human health and the quality of life in general.

Course description:

Theoretical:

The importance and goal of studying ecology. Branches of ecology. Basic concepts of ecology: biotope, biocenosis, ecosystem. The structure of the ecosystem and its variability. Ecological factors and their division. Levels of the organization of living beings. Organism as a component of a higher-order system. Adaptation. Life forms. The main types of ecosystems on Earth. Natural cycles of the environment and the flow of energy. Biosphere as the unique ecological system of the Earth. The influence of man on the biosphere – beneficial and negative. Introduction to basic concepts of pollution and protection of water, air and soil as well as food, radioactivity, noise. Monitoring system for environmental pollution (monitoring system). Significance of statistical research in ecology. Ecological ethics. International cooperation in this field.

Practical:

Introduction to the systematics of plant and animal species (parallels with biodiversity in the surrounding environment). Indication of the differences between plant and animal cells, tissues and organs. Creation of herbarium and insectarium. Creation of phenological maps. Detecting life forms of plants and animals in the polluted urban and industrial environment and comparison with forms from the unpolluted environment. Indication of the existence of any specific bioindicators. Extraction of water samples, soil and biological material for the purpose of their analysis in the laboratory. Experimental filtration, sedimentation, neutralization and precipitation of pollutants from water and air samples. Experimental determination of present pollutants, especially heavy metals in all environmental matrices, as well as in biological material. Research and prediction of conditions in surrounding ecosystems, formulation of plan of statistical research. Visits to National parks.

Literature

Recommended:

1. Power-Point presentation of the lecturer
2. A. Bibi i E.-M. Brenan, Osnove ekologije, KLIO, Beograd, 2008.
3. M. Vuković, Osnovi ekologije, Tehnički fakultet, Bor, 2004.

Supplementary:

1. S.E. Manahan, Environmental Chemistry, 7th edition, Lewis Publishers, 2000.
2. E.P. Odum, Fundamentals of Ecology, Third Edition. W.B. Saunders company. Philadelphia, London, Toronto, 1974.

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

Methods of teaching: Teaching with interactive discussions, experimental work and calculations, consultations, Mid-term exam(s).

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active	10	Written exam	70

class participation			
Practical classes	10	Oral exam	
Preliminary exams	10		
Independent work			

Study Programs: Technological Engineering, Mining Engineering

Level of study (or Level and type of studies): Undergraduate Academic Studies

Course: ENVIRONMENTAL PROTECTION

Lecturer: PhD Maja Nujkić, assistant professor

Status of the course: Elective course for Technological Engineering and Mining Engineering

ECTS: 8

Prerequisites (or Requirements)**:** Acquired fundamental knowledge from General chemistry

Goal of the Course (or Course objectives): Acquiring fundamentals knowledge about sources of that affect the relationship between different parts of the environment due to anthropogenic impacts and consideration of possibilities to improve the quality of the environment.

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

Course description (or Course content):

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

Practical instruction: Practicals, Other forms of teaching, Study research work

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

Literature

*Recommended***:**

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

Supplementary (or additional):

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

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

Methods of teaching (or Teaching methods)

Lecturing with interactive discussions, calculation and laboratory Practicals, consultations and Mid-term exam(s)s.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes	10	Oral exam	50
Preliminary exams			
Independent work	30		

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

Level of study: Undergraduate Academic Studies

Course: ENGLISH LANGUAGE III

Lecturer: Enisa Nikolić, teacher of English

Status of the course: Compulsory

ECTS: 2+2

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

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

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

Course description:

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

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

Literature

Recommended:

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

Supplementary:

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

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

Methods of teaching

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

Grading system (max. number of points 100)

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

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: GENERAL CHEMICAL TECHNOLOGY

Lecturer: PhD Mile D. Dimitrijević, full professor

Status of the Course: Compulsory course

ECTS: 8

Prerequisites: Necessary knowledge from physical chemistry

Goal of the Course: Students will acquire basic knowledge about technological processes, chemical reactors, fuels, ceramic materials technology and copper production.

Learning outcomes: Students are introduced to the general principles of technological processes and specific technologies of general importance, which will facilitate their understanding of other technologies.

Course description:

Theory teaching:

Basic technological indicators of chemical production. Raw materials and energy in the chemical industry. Material and energy balances. Formation of technological processes. Process analysis. Stoichiometric calculations. Chemical reactors. Calculation of ideal reactors. Renewable and non-renewable energy sources. Solid, liquid and gaseous fuels. Kinetics and fuel combustion mechanism. Nuclear fuels and nuclear reactors. Non-organic mortar binders, ceramics based on clay as raw materials. Modern ceramic materials. Reactions at elevated temperatures. Preparation of raw materials. Design, drying, baking and sintering. Refractory and building materials. Glass and glass production. Extractive copper metallurgy.

Practical teaching: Exercises, Other forms of teaching, Study research work

Calculation and laboratory Practicals.

Literature

*Recommended***:**

1. Lj. Kostić-Gvozdenović, R. Ninković, Neorganska hemijska tehnologija, TMF, Beograd, 1997.
2. S. Joksimović-Tjapkin, Procesi sagorevanja, TMF, Beograd, 1987.
3. Levenspiel O., Osnovi teorije i projektovanja hemijskih reaktora, Tehnološko-metalurški fakultet, Beograd, 1979.
4. M. Tecilazić-Stevanović, Osnovi tehnologije keramike, TMF, Beograd, 1990.
5. N. Pacović, Hidrometalurgija, ŠRiF, Bor, 1980.
6. I. S. Metcalfe, Chemical Reaction Engineering, A first Course, Oxford, Science Publications, 2012.

*Supplementary***:**

1. D. Skala, M. Sokić., Zbirka zadataka - osnovi teorije i projektovanja hemijskih reaktora, Tehnološko-metalurški fakultet, Beograd, 1979.
2. Lj. Kostić-Gvozdenović, M. Todorović, R. Petrović, Praktikum iz tehnologije keramike, TMF, Beograd, 2000.
3. M. Jovanović, Lj. Kostić-Gvozdenović, N. Blagojević, Praktikum iz tehnologije stakla, TMF, Beograd, 1997.

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

Methods of teaching: Teaching with interactive discussions, experimental work and calculations, consultations, and Mid-term exam(s).

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	**5**	Written exam	
Practical classes	**15**	Oral exam	**50**
Preliminary exams	**30**		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: TECHNOLOGICAL OPERATION 2

Lecturer: PhD Snežana Šerbula, full professor

Status of the Course: Compulsory course

ECTS: 8

Prerequisites: Acquired basic knowledge in Thermodynamics and Physical Chemistry

Goal of the Course:
Mastering the basic laws of heat and mass transport phenomena in technology processes.

Learning outcomes:
Use of basic heat and mass transport phenomena and their application in treatment of technological processes.

Course:
Basic equations and methods of determining stationary and non-stationary heat transport by conducting and by convection. Application theory of similarity and dimensional analysis to heat transport. Heat transfer in phase change. Energy transport by radiation. Sources and heaters. Heat exchange, cooling, condensation and evaporation. Basics of mass transport. Molecular and turbulent diffusion. Basic equations of stationary and non-stationary mass transport. Application of similarity theory and dimensional analysis to mass transport. Transmission analogues. Intermediate mass transfer and mass transport theory. Stage and inferential mass transport. Calculation of static and kinetic parameters of mass transfer operations. Simultaneous transmission of heat and mass. Mass transport and chemical reaction. Mass transfer operations. Distillation, rectification, absorption, adsorption, extraction, drying.
Practical project: laboratory, other forms of teaching.
Computational and laboratory processing of theoretical lectures.

Literature
Recommended:
1. V. Stanković, Fenomeni prenosa i operacija u metalurgiji, II tom, Tehnički fakultet, Bor, 1998.
2. S. Šerbula, V. Stanković, Praktikum za tehnološke operacije, Tehnički fakultet, Bor, 2010.
3. D. Vulićević, Tehnološke operacije – Dijagrami, nomogrami, tabele TMF, Beograd, 2012.

Supplementary:
1. Bird R.B., Stewart W.E., Lightfoot E.N., Transport phenomena, John Wiley&Sons, 2002
2. A. Tasić, R. Radosavljević, R. Cvijović, F. Zdanski, Zbirka zadataka iz tehnoloških operacija – toplotne operacije TMF, Beograd, 1991.
3. S. Cvijović, D. Simonović, S. Končar – Đurđević, D. Vuković, Tehnološke operacije II – toplotne, TMF, Beograd, 1980.
4. B. J. Valent, Sušenje u procesnoj industriji, TMF, Beograd, 2001.
5. F. Zdanski,Mehanika fluida, TMF, Beograd, 1995.

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

Methods of teaching:
Lectures with interactive discussions, laboratory and practical project, Programming for solving problems.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation		Written exam	
Practical classes		Oral exam	60
Preliminary exams	20 + 20		
Independent work			

Study Program: Metallurgical Engineering

Level of study: Undergraduate Academic Studies

Course: ELECTROCHEMISTRY

Lecturer: PhD Mirjana M. Rajčić Vujasinović, full professor

Status of the Course: Elective course in Metallurgical Engineering and Technological Engineering

ECTS: 4

Prerequisites: Knowledge from physical chemistry

Goal of the Course: Goal of the subject is to introduce students with the basic subjects and lows related to the structure of electrochemical systems and electrode processes which appear in electrochemical engineering

Learning outcomes: Student capable for independent managing and control of electrochemical processes in metallurgy an inorganic chemical technology

Course description:
Lectures: Electrochemical system (structure, electrodes, electrolyte). Electrochemical sources and consumers of electrical energy. Thermodynamics of electrochemical systems. Conductivity of solutions and melts. Basic kinetics equations in electrode processes. Current efficiency and energy consumption. Measurement methods in electrochemistry. The most important electrochemical processes in metallurgy and inorganic chemical technology (hydrogen evolution and oxidation, evolution and reduction of oxygen, electrochemical extraction and refining of metals, chlorine-alkaline electrolysis, electroplating, anodizing, electrochemical synthesis of oxides)
Laboratory Practicals follow content of the lectures

Literature
Recommended:
1. М. Рајчић-Вујасиновић, З. Станковић, Електрохемија, Ауторизована предавања, ТФ Бор, 2006. 2. А. Деспић, Основе електрохемије 2000, Завод за уџбенике и наставна средства, Београд, 2003. (*in Serbian)*
Supplementary:
1. М. Рајчић-Вујасиновић, В. Златковић, Теорија хидро и електрометалуршких процеса, Практикум за вежбе, ТФ Бор, 2001. (*in Serbian)*
2. З. Станковић, М. Рајчић-Вујасиновић, Практикум за вежбе из Физичке хемије, ТФ Бор, (*in Serbian)*
3. С. Ђорђевић и други, Галванотехника, Техничка књига, Београд, 1998. (*in Serbian)*
4. J. O`M. Bockris, Modern Aspects of Electrochemistry, Plenum Press, New York, 1973. 5. K. Izutsu, Electrochemistry in Nonaqueous Solutions, Wiley-Vch Verlag GmbH and Co, 2002.

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

Methods of teaching
Lectures with interactive discussions, experimental Practicals, visits to other laboratories, seminar work, consultations.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes	10	Oral exam	60
Preliminary exams	20		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: TOXICOLOGY

Lecturer: PhD Slađana Alagić, associate professor

Status of the Course: Compulsory course

ECTS: 4

Prerequisites: Fundamental knowledge on basic classes of organic molecules, especially structure and function of biomolecules.

Goal of the Course: Introduction of students into the field of basic classes of inorganic and organic hazardous substances of natural or anthropogenic origin, connection with principles of their acting (direct chemical irritation of tissues, enzyme inhibition, metabolism disturbance, inhibition of oxygen transport, inhibition of cell transpiration, oxidative stress, necrosis and apoptosis), and biochemical transformations in organisms.

Learning outcomes: Understanding of xenobiotic and natural toxic substances (inorganic and organic), which represent serious threat in the environment (including occupational environment). Understanding of biochemical acting mechanisms in organisms, transformations in the environment and risk assessment.

Course description:

Theoretical:

Subject, outcome, and multidisciplinary basis of toxicology. Understanding of basic fundamentals in toxicology: definition and classifications of toxic substances, exposition to toxic substances, toxic substances in metabolism, toxico-kinetic/dynamic, toxic effects on organs and organ systems. Toxic effects of elements and compounds (inorganic and organic): heavy metals, waste gases, medicines, addiction causing agents, genotoxic compounds, organic solvents, persistent organic pollutants. Toxic effects of natural products. Ekotoxicology: transfer of toxic substances through environmental matrices, air, water, and soil pollution, food contamination, transfer of toxic substances into organisms, bioconcentration, biodegradation and biomarkers.

Practical:

Toxicity tests and risk assessment, statistical analyses and results interpretation. Preparation of microscopic objects. Experimental analysis and detection of inorganic and organic toxic substances in the environment and living organisms. Experimental investigations of influence of toxic substances on plant development.

Literature

Recommended:

1. S.Č. Alagić, Toksikologija, Tehnički fakultet u Boru, Univerziteta u Beogradu, Bor, 2012.

Supplementary:

1. M.P. Milošević, S.Lj. Vitorović, Osnovi toksikologije sa elementima ekotoksikologije, Naučna knjiga, Beograd, 1992.
2. D. Đurić, Lj. Petrović, Zagađenje životne sredine i zdravlje čoveka - Ekotoksikologija, 1996.
3. S.E. Manahan, Toxicological chemistry and biochemistry, Third Edition, Lewis Publishers, A CRC Press Company, Boca Raton, London, New York, Washington, D.C., 2003.
4. F. Plavšić, I. Žuntar, Uvod u analitičku toksikologiju, Školska knjiga, Zagreb, 2006.

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

Methods of teaching: Teaching with interactive discussions, experimental work and calculations, consultations, and Mid-term exam(s).

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	70
Practical classes	10	Oral exam	
Preliminary exams	10		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: FUNDAMENTALS OF INSTRUMENTAL ANALYSIS

Lecturer: PhD Milan B. Radovanović, assistant professor

Status of the Course: Compulsory course for Technological Engineering

ECTS: 8

Prerequisites: Required knowledge of Analytical and Physical Chemistry

Goal of the Course: Acquiring knowledge of theoretical basis and principles on which the application of non-spectroscopic, spectroscopic, thermal and electroanalytic methods are based.

Learning outcomes: Learning the structure and operating parameters of the instruments, used for analyses in various areas of chemical technology, including environmental protection. In addition, the goal is to learn the application fields for each method, and their combiantion for the best solution of the analysis.

Course description:

Theoretical instruction:

Optical properties of matter. Refractometry. Polarimetry. Interferometry. Nephelometry and turbidimetry. Atomic and molecular spectrum. Spectrochemical analysis. Absorption and emission methods. Colorimetry. UV-VIS spectrophotometry. Atomic Absorption Spectrophotometry. IR spectrophotometry. Flame photometry. Fluorimetry. X-ray diffraction analysis. Mass spectrometry. Nuclear magnetic resonance. Thermal methods. Electroanalytic methods.

Practical instruction: Practicals, Other forms of teaching, Study research work

Laboratory Practicals.

Literature

Recommended:

1. J. Mišović, T. Ast, Instrumentalne metode hemijske analize, TMF, Beograd, 1978.
2. D.A. Skoog, D.M. West, F.J. Holler, Osnove analitičke hemije, Školska knjiga, Zagreb, 1999.
3. M. Todorović, P. Đurđević, V. Antonijević, Optičke metode instrumentalne analize, Hemijski fakultet, Beograd, 1997.
4. P. Bugarski, Analitika, Institut za bakar Bor, Bor, 1995.
5. Lj. Fotić, M. Laušević, D.Skala, M. Bastić, Instrumentalne metode hemijske analize – praktikum za vežbe, TMF, Beograd, 1990.
6. B. Vučurović, L. Sajc., S. Stanković, Elektroanalitičke metode – praktikum za laboratorijske i računske vežbe, TMF Beograd, 2001.

Supplementary:

1. N. Marjanović, Instrumentalne metode analize – metode razdvajanja, Tehnološki fakultet, Banja Luka, 2001.

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

Methods of teaching

Lecturing with interactive discussions, calculation and laboratory Practicals, consultations and Mid-term exam(s)s.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	
Practical classes	20	Oral exam	50
Preliminary exams	25		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: INORGANIC CHEMICAL TECHNOLOGY

Lecturer: PhD Milan Radovanović, assistant professor

Status of the Course: Compulsory course

ECTS: 8

Prerequisites: Acquired knowledge from the course of General chemical technology

Goal of the Course:
Introducing students to major inorganic chemical technologies.

Learning outcomes:
Students will have specific knowledge that they can apply in industrial plants where these technologies are present.

Course description:
Theoretical lectures:
Water technology. Obtaining gases. Oxygen, hydrogen, carbon-dioxide, carbon-monoxide, *nitrous oxide*s. Ammonia, nitric acid and nitrates synthesis technology. Catalysts in synthesis of ammonia and nitric acid. Sulfuric acid production technologies - contact procedure, catalysts, construction materials. Hydrogen halid acids. Phosphoric acid. Technologies of producing alkalis. Inorganic salts and fertilizers. Production of iron and steel.
Practical lectures: Practicals, Other forms of teaching, Study research work.
Calculations and laboratory Practicals.

Literature:
*Recommended***:**
1. Lj. Kostić-Gvozdenović, R. Ninković, Neorganska hemijska tehnologija, TMF, Beograd, 1997.
2. R. Ninković, L. Knežević, Lj. Kostić-Gvozdenović, N. Blagojević, B. Božović, V. Pavićević, Neorganska hemijska tehnologija – praktikum, TMF, Beograd, 2001.
3. V. Trujić, N. Mitevska, Metalurgija gvožđa, Institut za bakar Bor, 2007.
4. M. Gojić, Metalurgija čelika, Metalurški fakultet, Sisak, 2005.

*Supplementary***:**
1. D. Vitrović, Hemijska tehnologija, Naučna knjiga, Beograd, 1990.
2. D. Đokić, L. Knežić, Praktikum iz neorganske hemijske tehnologije – Veštačka đubriva, TMF, Beograd, 1972.

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

Methods of teaching
Classical lectures with interactive discussions, calcululations and laboratory Practicals, consultations and Mid-term exam(s)s.

Grading system (max. number of points 100)			
Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	
Practical classes	15	Oral exam	50
Preliminary exams	30		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: DESIGN IN CHEMICAL TECHNOLOGY

Lecturer: PhD Ana Simonović, assistant professor

Status of the Course: Compulsory course

ECTS: 8

Prerequisites: Acquired knowledge in the field of Technological Operations 1 and 2

Goal of the Course: Introduction students with basic principles of design in chemical technology

Learning outcomes: Gaining the skills and knowledge necessary for on your own collecting relevant information about process, as well as finding the best solution for a particular project task. Students are trained to select the best available technology and based on that the device and equipment needed for the selected technological process.

Course description:

Theory teaching:

Basics of design in chemical industry. Phases in the development on the technological process-the idea, theoretical consideration of the initial idea, laboratory tests and analysis of the research results, the previous technical studies, prototype plant and semi industrial plant. Choice of technological process based on the results. Principal and technological scheme of the process. Material, heat and energy balance. Technical schemes. Spatial arrangement of basic and auxiliary devices. Economic analysis. Environmental impact assessment.

Practical teaching: Practicals, Other forms of teaching, Study research work

Practical application of theoretical knowledge in the chosen case. Create individual or group project.

Literature

Recommended:

1. R. Šećerov Sokolović, Projektovanje tehnoloških procesa, Tehnološki fakutet, Novi Sad, 2000.
2. R. V. Mitrović, Projektovanje tehnoloških procesa, Naučna knjiga, Beograd, 1991.
3. Ž. Markov, Projektovanje u hemijskoj industriji, TF, Bor, 1988.

Supplementary:

1. B. M. Bugarski , Projektovanje procesa i uređaja u biotehnologiji i biohemijskom inženjerstvu, Akadmeska misao, Beograd, 2005.
2. M. Bogner, P, Zekonja, D. Ivanović, Priručnik za izradu projektne dkumentacije, ETA, Beograd, 2007.
3. S. Walas, Chemical Process Equipment: Selection and Design, Elsevier Butterworth-Heinemann, 1988.
4. E.E.Ludwig, Applied Process Design for Chemical and Petrochemical Plants, Elsevier Gulf, 2001.
5. N.P. Cheremisinoff, Handbook of Chemical Processing Equipment, Elsevier Butterworth-Heinemann, 2000.

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

Methods of teaching: Classical lectures with interactive discussions, computational exercises, consultations and Mid-term exam(s)s

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	5	Written exam	
Practical classes	15	Oral exam	30
Preliminary exams			
Independent work	50		

Study Program: Technological Engineering

Level of study: Undergraduate academic studies

Course: CHEMICAL PROCESS EQUIPMENT

Lecturer: PhD Jelena M. Djoković, full professor

Status of the Course: Compulsory course

ECTS: 6

Prerequisites: Technological Operations 1 and 2

Goal of the Course:
The educational goal of this course is to introduce students with the characteristics of equipment encountered in chemical plants.

Learning outcomes:
Theoretical and practical knowledge about chemical process equipment.

Course description:
Theoretical teaching:
Introduction. Drivers for moving equipment. Equipment for preparation of raw material: Types of crushing equipment. Equipment for size separation of material: Gravity separators, Centrifugal air classifiers, Hydrocyclones, Screening devices. Mechanical separation equipment, Thickeners, Filtration equipment. Centrifugal separation equipment: Centrifugal equipment, Cyclones, Scrubbers. Mixing equipment. Drying: Drying equipment. Equipment for extarction and leaching: Extractors, Adsorption equipment. Heat exchange equipment. Heat devices. Cooling equipment. Fluid transport equipment.
Practical teaching:
Numerical examples from all theoretical teaching areas.

Literature
Recommended:
1. J. M. Coulson and J. F. Richardson with J. R. Backhurst and J. H. Harker, Chemical Engineering, Volume 1, Sixth edition, Fluid Flow, Heat Transfer and Mass Transfer, Butterworth-Heinemann, Oxford, 1999.
2. J. F. Richardson and J. H. Harker with J. R. Backhurst, Chemical Engineering, Volume 2, Fifth edition, Particle Technology and Separation Processes, Butterworth-Heinemann, Oxford, 2002.
3. R. K. Sinnott, Chemical Engineering, Volume 6, Fourth edition, Chemical Engineering Design, Elsevier, Oxford, 2005.
4. S. M. Walas, Chemical Process Equipment, Butterworth-Heinemann series in chemical engineering, Newton, 1990.
5. N. Magdalinović, Usitnjavanje i klasiranje mineralnih sirovina, Naučna knjiga,Beograd, 1991.
Supplementary:
1. Materijal sa predavanja.

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

Methods of teaching

Theoretical and practical teaching, Preliminary exams, Final exam

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes		Oral exam	60
Preliminary exams	30		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: THE TECHNOLOGY OF NEW MATERIALS

Lecturer: PhD Marija B. Petrović Mihajlović, associate professor

Status of the Course: Compulsory course

ECTS: 6

Prerequisites: Acquired knowledge in the field of physical chemistry

Goal of the Course: This course introduces to students fundamental principles of interaction between structure, properties and processing of materials. Within the subject, distinctive representatives of the basic classes of engineering materials (metals, ceramics, polymers and composites), used in chemical engineering, are studied.

Learning outcomes: Students master the theoretical knowledge that is necessary for understanding the properties of materials, the importance and material properties dependence on the structure, and the particular conditions of material production. Additionally, students adopt a critical way of thinking in order of selecting the most suitable materials of certain characteristics, as well as methods for production and characterization of materials.

Course description:

Theoretical lectures: The properties and structure of the materials; Classification of materials; Crystal structures; Crystal imperfections; Non-stoichiometric solids; Solid solutions; Liquid crystals; Glass state; Structure of silicates; Silicate melt; Metal glass; Crystallization; Technologies for production, characterization and application of some classes of new materials: Methods for obtaining highly pure and amorphous metals; Electroslag remelting (ESR); Self-propagating high-temperature synthesis (SHS); Methods for obtaining mono-crystals; CVD; "Smart" materials; Semi and superconductors; Carbon nanotubes; Powder metallurgy; Sintering; Ceramics; Polymeric materials; Biomaterials.

Practical classes: Practicals, Other forms of teaching, Study research work

Powders production; Powders characterization; Examination of basic physicochemical, technological and corrosion characteristics of powders; Methods for shaping and compacting powders; Sintering; Ceramic, polymeric and metallic composite materials; Introduction to modern methods and techniques of analysis of microstructure, crystal structure, morphology of surface, texture and mechanical properties, chemical composition and atomic structure of solid materials.

Literature:

Recommended:

1. M. Ristić, Principi nauke o materijalima, Srpska Akademija Nauka i Umetnosti, Beograd, 1993.
2. L. Matija, D. Kojić, A. Vasić, B. Bojović, T. Jovanović, Đ. Koruga, Uvod u nanotehnologije: Nanonauka, nanomaterijali, nanosistemi, primena, DonVas/Nauka, Beograd, 2010.
3. V. V. Srdić, Procesiranje novih keramičkih materijala, Tehnološki fakultet, Novi Sad, 2004.
4. M. Mitkov, D. Božić, Z. Vujović, Metalurgija praha, Beograd, 1998.
5. S. Putić, Mehanička svojstva polimernih kompozitnih materijala, TMF, Beograd, 2005.
6. S. Nestorović, Sintermetalurgija, Praktikum, Bor, 2001.

Supplementary:

1. J. F. Shackelford, Introduction to Materials Science for Engineers, Pearson Prentice Hall, 2010.
2. Jones, D. R. H., Ashby, M., Engineering Materials I, Elsevier Butterworth-Heinemann, 1996.
3. Jones, D. R. H., Ashby, M., Engineering Materials II, Elsevier Butterworth-Heinemann, 1998.

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

Methods of teaching: Classical lectures with interactive discussions, calculation and laboratory Practicals, consultations with teachers and assistants, Mid-term exam(s)s.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	**5**	Written exam	
Practical classes	**10**	Oral exam	**50**
Preliminary exams	**10**		
Independent work	**25**		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: SOIL POLLUTION AND PROTECTION

Lecturer: PhD Ana Simonović, assistant professor

Status of the Course: Compulsory course

ECTS: 8

Prerequisites: Acquired knowledge from the study Program Ecology

Goal of the Course: Students are introduced with soil chemistry, contamination and methods of remediation of the polluted soil.

Learning outcomes: Students are enabled to define soil pollutants and accordingly propose methods for soil protection.

Course description:

Theoretic lectures:

Soil chemistry and content. Mineral and organic parts of soil. Soil colloids. Soil buffer capacity. Soil acidity and alkalinity. Soil liquid phase. Soil gas phase. Soil pollution and contamination sources. Pollution sings. Soil pollution with nitrogen and phosphorous. Soil pollution with sulphur. Heavy metals and microelements – arsenic, cadmium, cobalt, chromium, copper, mercury, molybdenum, nickel, lead, selenium, vanadium, zinc, iron. Soil pollution with pesticides. Methods of soil remediation.

Practical classes: laboratory classes, other forms of teaching, study research work

Laboratory classes and independent work.

Literature

Recommended:

1. M. Jakovljević, M. Pantović, Hemija zemljišta i voda, Naučna knjiga, Beograd, 1991.
2. V. Hadžić, M. Belić, LJ. Nešić, Praktikum iz pedologije, Poljoprivredni fakultet, Novi Sad, 2004.
3. L. Kolomejceva-Jovanović, Hemija i zaštita živitne sredine, Beograd, 2010.

Supplementary:

1. R. Kastori, I. Kadar, P. Sekulić, D. Bogdanović, M. Milošević, M. Pucarević, Uzorkovanje zemljišta i biljaka nezagađenih i zagađenih staništa, Naučni institut za ratarstvo i povrtarstvo, Novi Sad, 2006.
2. I. Molnar, D. Milošev, P. Sekulić, Agroekologija, Poljoprivredni fakultet, Novi Sad, 2003.
3. M. Jablanović, P. Jakšić, K. Kosanović, Uvod u ekotoksikologiju, Univerzitet u Prištini, Kosovska Mitrovica, 2003.

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

Methods of teaching: Lectures with interactive discussions, calculation and laboratory classes, consultations and independent work.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes	10	Oral exam	30
Preliminary exams			
Independent work	50		

Study Program: Mining Engineering and Technological Engineering

Level of study: Undergraduate Academic Studies

Course: WASTEWATERS

Lecturer: PhD Grozdanka D. Bogdanović, full proffesor

Status of the Course: Compulsory course

ECTS: 6

Prerequisites: Required knowledge in Chemistry and Physical Chemistry

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

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

Course description:

Theoretical instruction:

Introductory part: classification of wastewater - by species, by composition, by way of formation; requirements for the degree of wastewater treatment - legal regulations, treatment options. Industrial methods for wastewater treatment: chemical methods (neutralization, precipitation, destructive methods), physico-chemical methods (adsorption, hemisorption - ion exchange), flotation processes, solvent extraction, membrane processes, electrochemical processes (reduction of metal ion, anode oxidation of organic compounds, electrodialysis), biochemical methods, combined processes. Basic and auxiliary wastewater treatment operations: separation of suspensions (thickening, clarification, filtration, drying). Sludge treatment.

Practical instruction:

Practicals, Other forms of teaching, Study research work

Laboratory Practicals and seminar work.

Literature

Recommended:

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

Supplementary:

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

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

Methods of teaching

Classical lectures with interactive discussions, laboratory practicals and independent work.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes	10	Oral exam	40
Preliminary exams			
Independent work	40		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: POLLUTION AND AIR PROTECTION

Lecturer: PhD Snežana Šerbula, full professor

Status of the Course: Compulsory course for study Program Technological Engineering (module Engineering Environment)

ECTS: 8

Prerequisites: Basic knowledge in Transport phenomena

Goal of the Course: Introducing students with sources of air pollution, and methods of air purification

Learning outcomes: Monitoring of air pollution and technological operation of air protection of pollutants from industrial and other pollution sources.

Course:

Concept, types and sources of air pollution. Emission, immission and transmission of air pollution. Regulatives of air quality. Testing methods for air pollution. The greenhouse effect. Acid rain. Earth's ozone layer damage. The impact of air pollution on humans. Physical methods for purification of contaminated waste gases. Chemical and physical-chemical methods for purification of waste gases. Air quality monitoring. Protection from air pollution. Biomonitoring.

Laboratory and Practical project.

Air pollution monitoring and measuring stations.

Literature

*Recommended***:**

1. S. Šerbula, Ž. Grbavčić, Zagađenje i zaštita vazduha, Tehnički fakultet, Bor, 2011.
2. S. Šerbula, Zagađivanje i zaštita vazduha, Zavod za udžbenike, Beograd, 2009.

*Supplementary***:**

1. R.W. Boubel, D. L. Fox, D.B. Turner, A. C. Stern, Fundamentals of Air Pollution, Academic Press, San Diego, 1994.
2. J. Đuković, Hemija atmosfere, Rudarski institut, Beograd, 2001.

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

Methods of teaching: Lectures with interactive discussions, laboratory and practical project and Programming for solving problems (term paper).

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Practicals		Oral exam	30
Preliminary exams	20		
Term paper	50		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: CORROSION AND PROTECTION

Lecturer: PhD Mile Dimitrijević, full professor

Status of the Course: Compulsory course

ECTS: 6

Prerequisites: Necessary knowledge from physical chemistry

Goal of the Course: Introducing students with different forms of corrosion of materials and mechanisms of corrosion processes and basic methods of protection against corrosion.

Learning outcomes: Theoretical and experimental knowledge will enable students to better understand the role of corrosion in technological processes and to apply different methods of corrosion protection.

Course description:

Theory teaching:

Corrosion of structural materials and consequences. Electrochemical corrosion of metals and alloys. Thermodynamics. E-pH diagrams. Causes of electrochemical corrosion. Basic characteristics of electrochemical corrosion. Kinetics of electrochemical corrosion of metals. Passivity of metal. Types of electrochemical corrosion. Gas and chemical corrosion. Corrosion of non-metals. Corrosion of organic materials. Protection against corrosion. Electrochemical protection. Cathodic and anodic protection. Protectors. Protecting metals by treating corrosion environment. Corrosion inhibitors. Protecting metals with coatings, refinement and design modification.

Practical teaching: Practicals, Other forms of teaching, Study research work

Laboratory Practicals.

Literature

Recommended:

1. S. Mladenović, Korozija i zaštita materijala, TMF, Beograd, 1995.
2. M. G. Pavlović, D. Stanojević, S. Mladenović, Korozija i zaštita materijala, Tehnološki fakultet, Zvornik , 2012.
3. Z. Gulišija, Č. Lačnjevac, Korozija i zaštita materijala, ITNMS, IDK, Beograd, 2012.
4. V. Vujučić, Korozija i tehnologija zaštite metala, VIZ, Vojna akademija, Beograd, 2002.

Supplementary:

1. V. Mišković-Stanković, Metalne i nemetalne prevlake, Praktikum za vežbe, TMF, Beograd, 2001.
2. S. Mladenović, M. Petrović, G. Rikovski, Korozija i zaštita materijala, Rad, Beograd, 1985.
3. N. Radošević, ur., O. Tatić-Janjić, red., Hemijsko-tehnološki priručnik VI – korozija i zaštita materijala, Rad, Beograd, 1985.
4. D. Seferijan, Metalurgija zavarivanja, Građevinska knjiga, Beograd, 1969.
5. S. Đorđević, Metalne prevlake, Savremena administracija, Beograd, 1970.

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

Methods of teaching: Classical lectures with interactive discussions, laboratory Practicals, consultations and colloquia.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	**5**	Written exam	
Practical classes	**15**	Oral exam	**40**
Preliminary exams	**20 + 20**		
Independent work			

Study Program: Mining Engineering, Metallurgical Engineering, Technological Engineering

Level of study: Undergraduate Academic Studies

Course: ECONOMICS AND ORGANIZATION OF BUSINESS

Lecturer: PhD Dejan Riznić, full proffesor

Status of the course: Compulsory subject

ECTS: 6

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

Goal of the course:

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.

Learning outcomes:

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

Course description:

Introduction - the 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

Supplementary:

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

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

Methods of teaching

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

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**

Attendance and active class participation	20	Written exam	15
Practical classes		Oral exam	35
Preliminary exams	30		
Independent work			

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: WATER TECHNOLOGY

Lecturer: PhD Snežana Šerbula, Full professor

Status of the Course: Compulsory course

ECTS: 6

Prerequisites: Basic knowledge in Transport phenomena

Goal of the Course: Consideration of methods for water purification in order to obtain drinking water.

Learning outcomes: Knowledge is obtained to involvement in the technologies of drinking water.

Course description:
Atmospheric water. Surface water. Underground waters. Drinking water. Drinking water preparation. Aeration. Coagulation and flocculation. Filtration. Water purification by cleansing and filtration. Disinfection of drinking water, ozonization and chlorination. Ionic exchange. Desalinisation of seawater. Water for industrial purposes. Water preparation for industrial purposes. Softening water. Thermal procedures. Chemical methods. Wastewater. Water protection legislation. Biological purification of water.

Practical teaching: laboratory and practical project, Other forms of teaching, Term paper
Designing and processing an individual project.

Literature
*Recommended***:**
1. M. Bogner, M. Stanojević, O vodama (teorija, propisi i primeri iz prakse), ETA, Beograd, 2006.
*Supplementary***:**
1. Lj. Mojović, Biološka obrada otpadnih voda (zbirka rešenih zadataka sa teorijskim osnovama), TMF, Beograd, 2004.
2. M. Stanojević, S. Simić, D. Radić, A. Jovović, Aeracija otpadnih voda (teorija i proračuni), ETA, Beograd, 2006.
3. Nicholas P. Cheremisinoff, Handbook of water and wastewater treatment technologies, Butterworth-Heinemann, 2002.

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

Methods of teaching: Lectures with interactive discussions, laboratory and practical project, computer Programming for solving problems, term paper.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Practical classes		Oral exam	30
Preliminary exams	20		
Term paper	50		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: CORROSION OF MATERIALS

Lecturer: PhD Milan M. Antonijević, full proffesor

Status of the course: Elective course

ECTS: 6

Prerequisites: Acquired knowledge from the field of Physical chemistry

Goal of the Course:
Students are introduced to test methods for studying corrosion processes, corrosion of basic metal and non-metallic materials, as well as the protection measures for these materials.

Learning outcomes:
Students are trained to work on the analysis of corrosion processes and protection of certain materials which are present in technological processes.

Course description:
Theoretical lecture:
Investigation of corrosion processes. Laboratory, field and exploitation investigation. Optical, gravimetric, mechanical, electrical and electrochemical test methods. Other methods of testing. Corrosion of iron and steel. Corrosion of copper and brass. Corrosion of aluminum and others important technical materials based on metals and alloys. Inhibitors of metal corrosion. Corrosion of non-metallic materials. Corrosion of materials under exploitation conditions. Analyses of technology processes from the aspect of materials corrosion. Selecting construction materials and protection measures.
Practical lectures: Practicals, Other forms of teaching, Study research work
Laboratory Practicals, seminar work.

Literature
*Recommended***:**

1. M.G. Fontana, N.D. Greene, Corrosion Engineering, McGraw-Hill, New York 1984.
2. Radošević, ur., O. Tatić-Janjić, red., Hemijsko-tehnološki priručnik VI – korozija i zaštita materijala, Rad, Beograd, 1985.
3. S. Mladenović, M. Pavlović, D. Stanojević, Korozija i zaštita betona i armiranog betona, SISZAM, Beograd, 2008.
4. M. G. Pavlović, D. Stanojević, S. Mladenović, Korozija i zaštita materijala, Tehnološki fakultet, Zvornik, 2012.
5. Z. Gulišija, Č. Lačnjevac, Korozija i zaštita materijala, ITNMS, IDK, Beograd, 2012.

*Supplementary***:**

1. L. L. Shreir, R. A. Jarman, Corrosion – Metal/Environmental reactions, Butterworth-Heinemann, Oxford, 2000.
2. S. Đorđević, Metalne prevlake, Savremena administracija, Beograd, 1970.
3. V. Mišković-Stanković, Metalne i nemetalne prevlake, Praktikum za vežbe, TMF, 2001.
4. V. Mišković-Stanković, Organske zaštitne prevlake, SITZAMS, Beograd, 2001.

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

Methods of teaching
Classical lectures with interactive discussions, laboratory Practicals, consultation and seminar work.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation		Written exam	
Practical classes	20	Oral exam	30
Preliminary exams			
Independent work	50		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: TECHNOLOGY OF CERAMICS

Lecturer: PhD Snežana Milić, associate professor

Status of the Course: Elective course

ECTS: 6

Prerequisites: Acquired knowledge from General Chemical Technology

Goal of the Course:
Students are introduced to technology of building material production.

Learning outcomes:
Students are trained for work in a building material factory as well as for proper testing of such materials.

Course description:
Theoretical lectures:
Throughout the corse processes which are an integral part of technological diagram of traditional and contemporary ceramics production are studied. Topics covered: types and preparation of starting material for traditional ceramics, chemical production routes of starting material for contemporary ceramics, methods of shaping in ceramics technology, powder press forming, shaping of plastic dough, shaping by casting in traditional and contemporary ceramics, curing in ceramics technology, sintering of traditional and contemporary ceramics matierial, dryers and furnaces in ceramics technology, glazing, pigment application in ceramics technology.
Practical lectures: Practicals and other types of lectures. Study research.
Laboratory Practicals and writing seminar papers.

Literature
Recommended:
1. V. Srdić, Procesiranje novih keramičkih materjala, Tehnolohki fakultet, Univerzitet u Novom Sadu, Novi Sad, 2004.
2. M. Tecilazić – Stevanović, Osnovi tehnologije keramike, Tehnološko – metaluršku fakultet, Beograd, 1990.
3. Lj. Kostić – Bogdanović, M. Todorović, R. Petrović, Praktikum iz tehnologije keramike, Tehnološko – metalurški fakultet, Beograd, 2000.
Supplementary:
1. J. Hlavać, The Technology of Glass and Ceramics, An Introduction, Elsevire Scientific Publishing company, Amsterdam-Oxford-New York, 1983.

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

Methods of teaching
Classical lecture with interactive discussions, calculation and laboratory Practicals, consultation and seminar work

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	/	Written exam	
Practical classes	20	Oral exam	30
Preliminary exams			
Independent work	50		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: GLASS TECHNOLOGY

Lecturer: PhD Snežana M.Milić, associate professor

Status of the Course: Elective course of the study Program Technological Engineering

ECTS: 6

Prerequisites: Acquired knowledge from the field of General chemical technology

Goal of the Course: Introducing students with the properties and physical and chemical principles of glass synthesis

Learning outcomes: Training students to work in glass production plants

Course description:

Theoretical teaching:

Glass classification. Glass state. Glass structure. Glass properties. Physical-chemical basis synthesis of glass. Raw materials. Melting processes. Designing processes. Cooling processes. Finishing processes. Flaws in glass. Technological processes. Calculations.

Practical teaching: Practicals, other forms of teaching, study research work.

Laboratory practicals and term paper work.

Literature

Recommended:

1. V. Srdić, Procesiranje novih keramičkih materijala, Tehnološki fakultet, Univerzitet u Novom Sadu, Novi Sad, 2004.
2. M. Tecilazić-Stevanović, Osnovi tehnologije keramike, Tehnološko-metalurški fakultet, Beograd, 1990.
3. Lj. Kostić-Gvozdenović, M. Todorović, R. Petrović, Praktikum iz tehnologije keramike, Tehnološko-metalurški fakultet, Beograd, 2000.

Supplementary:

1. J.Hlaváč, The Technology of Glass and Ceramics, An Introduction, Elsevire Scientific Publishing company, Amsterdam-Oxford-New York, 1983.

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

Methods of teaching: Classical lectures with interactive discussions, calculations and laboratory Practicals, consultations and seminar work.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	/	Written exam	
Practical classes	20	Oral exam	30
Preliminary exams			
Independent work	50		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: TECHNOLOGY OF SOLID WASTE TREATMENT AND DISPOSAL

Lecturer: PhD Mile D. Dimitrijević, full professor

Status of the Course: Elective course

ECTS: 6

Prerequisites: The basic knowledge from ecology and environmental protection

Goal of the Course: This course is designed to provide students a basic knowledge of the solid waste classes, negative influence of the solid waste on the environment (different degradation processes), as well as major disposal and processing technologies for the solid waste.

Learning outcomes: The proper treatment of the solid waste, as well as the use of solid waste as secondary raw materials.

Course description:

Theoretical lectures:

The main sources and characteristics of the solid waste; Legislation; Composition of waste; Physical, chemical and biological characteristics of the solid waste; Solid waste management at source of origin; Collection and transport of the waste; Methods of treatment (physical, chemical and biological); Energy utilization and obtaining useful products by transformation of waste; Reuse and recycling; Integrated solid waste management.

Practical classes: Practicals; Other forms of teaching; Study research work

Laboratory and fieldwork. Preparation and presentation of seminary paper.

Literature:

Recommended:

1. M. Ristić, M. Vuković, Upravljanje čvrstim otpadom, Grafomed-trade, Bor, 2006.
2. M. Ilić, R. Miletić, Osnovi upravljanja čvrstim otpadom, Institut za ispitivanje materijala, Beograd, 1998.

Supplementary:

1. G. Tchobanoglous, H. Theisen, S.A. Vigil, Integrated Solid Waste Management, McGraw-Hill Companies, London, 1993.
2. S. Gaćeša, Lj. Vrbaški, J. Baras, L. Knežić, M. Klašnja, F. Zdanski, Biogas - production and application, The Faculty of Technology, Novi Sad, 1985.

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

Methods of teaching: Classical lectures with interactive discussions, laboratory Practicals, consultations with teachers and assistants, independent work of students related to writing of seminary paper.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	/	Written exam	
Practical classes	**10**	Oral exam	**40**
Preliminary exams			
Independent work	**50**		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: PURIFICATION OF WASTE GASES

Lecturer: PhD Snežana M. Šerbula, full professor

Status of the Course: Elective course

ECTS: 6

Prerequisites: The basic knowledge in the field of air pollution and protection.

Goal of the Course: Mastering the main methods for the purification of waste gases from various industries to the extent that is safe to be emitted into the atmosphere.

Learning outcomes: Using the gas purification methods in order to protect the environment.

Course description:
Introductory part: classification of industrial gases by the type of industry, composition, quantities. Properties of gases. Gas flow models. Fundamentals of the two-phase system (gas-aerosol) mechanics. Fundamentals of the three-phase system mechanics. Methods for gases purification. Purification of gases from the particles dispersed in gas. Separation of solid phase particles dispersed in gas under the influence of external force - in the gravitational field of force, in the centrifugal field of force, in the electrostatic field of force, filtration of gases, purification of condensed systems. Gases purification devices which work under the influence of external force. Removing of gas/steam components from the industrial gases. Absorption. Equilibrium in the gas-liquid system; differential and degraded absorption systems. Absorbers. Adsorption. Equilibrium in the gas-solid system. Adsorbents. Molecular sieves. Removing of moisture from the industrial gases; condensation and condensers; draying of gases. Ion exchange.
Practical teaching: *laboratory and practical project, Other forms of teaching, Term paper*
Designing and processing an individual project.

Literature:
Recommended:
1. M. Bogner, M. Stanojević, L. Livo, Prečišćavanje i filtriranje gasova i tečnosti – teorija i računski primeri iz prakse, ETA, Beograd, 2006.
Supplementary:
1. M. Bogner, M. Isailović, Tehnički i medicinski gasovi, ETA, Beograd, 2005.
2. A. Kohl, R. Nielsen, Gas Purification, Gulf publishing company, Houston, Texas, 1997.

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

Methods of teaching: Lectures with interactive discussions, laboratory and practical project, computer programming for solving problems, term paper.

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Independent work (project)	**20**	Oral exam	**30**
Term paper	**50**		

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: HAZARDOUS ORGANIC SUBSTANCES

Lecturer: PhD Slađana Alagić, associate professor

Status of the Course: Elective course

ECTS: 6

Prerequisites: Fundamental knowledge on basic classes of organic compounds.

Goal of the Course: Introduction into the field of hazardous organic substances, which are commonly emitted into the environment, especially regarding their eco-toxicological characteristics (reactivity, flammability, toxicity, and explosion potential).

Learning outcomes: Students will be able to analyze and identify organic pollutants as well as to suggest adequate environmental protective procedures.

Course description:

Theoretical:

The sources of pollution and the classification of organic pollutants. Persistent organic pollutants: pesticides and their metabolites, polychlorinated biphenyls and phthalates, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, polybrominated organic compounds, organic solvents and detergents, aliphatic and aromatic hydrocarbons, polycyclic aromatic hydrocarbons. The influence of organic pollutants on plant and animal life; the influence on humans (systemic, acute, and chronic effects). The pollution of air, ground and underground water, soil and protection treatments. Remediation methods. Physical, chemical, and microbiological methods for organic pollutants identification and evaluation, with special accent on the utilization of modern instrumental methods in their environmental monitoring.

Practical:

Identification of hazardous potential on the basis of physical, physic-chemical, and toxicological characteristics. GC/MS analysis of persistent organic pollutants. Source of pollution identification. Formulation of planes for statistical analyses. Independent work.

Literature

Recommended:

1. Power-Point presentation of the lecturer
2. O. Stojanović, N. Stojanović, Đ. Kosanović, Opasne i štetne materije, Rad, Beograd, 1986.
3. S.M. Milosavljević, Strukturne instrumentalne metode, Univerzitet u Beogradu, Hemijski fakultet, Beograd, 1994.

Supplementary:

1. N.I. Sax, Dangerous Properties of Industrial Materials, 4th Ed., New York, 1987.
2. F. Carson, C. Mumford, Hazardous chemicals handbook, Butterworth-Heinemann, Oxford, 2002.

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

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

Grading system (max. number of points 100)

Pre-examination obligations	**Number of points**	**Final examination**	**Number of points**
Attendance and active class participation	10	Written exam	
Practical classes	10	Oral exam	30
Preliminary exams			
Independent work	50		

Study Program: Metallurgical Engineering, Mining Engineering and Technological Engineering

Level of study: Undergraduate Academic Studies

Course: METALLURGY OF THE SECONDARY RAW MATERIALS

Lecturer: PhD Nada Štrbac, full professor

Status of the Course: Elective course for study Program Metallurgical Engineering (Modul: Extractive metallurgy), Compulsory course for study Program Mining Engineering (Modules: PMS and RTiOR) and Elective course for study Program Technological Engineering (Module: Environmental protection engineering)

ECTS: 6

Prerequisites: Knowledge in general technological disciplines is required.

Goal of the Course:
The goal of the course is transfering the knowledge to students in the field that deals with the problem of the formation and processing of secondary raw materials of ferrous and non-ferrous metallurgy.

Learning outcomes:
After studying the subject and calculation and experimental exercises, students have the necessary knowledge to calculate the material and thermal balance of metallurgical processes, which are applied in metallurgy of secondary raw materials, as well as theoretical knowledge that enable them to choose the right technology for the processing of secondary raw materials.

Course description:
Lectures:
Raw materials in secondary metallurgy and their usage. Sources of production of secondary raw materials. Classification of secondary raw materials. Determination of resources of secondary raw metal materials. Organization of collection and preparation of metal scrap and waste. Primary treatment: sorting, magnetic separation, separation, cutting, crushing and grinding, degreasing and drying, packing and briquetting, electrostatic separation, etc. Processing of metal waste. Production of secondary copper and copper alloys. Nickel based scrap and waste processing. Processing of secondary lead and alloys. Obtaining tin from secondary raw materials. Collecting, preparation and metallurgical processing of iron scrap. Processing of secondary raw materials containing zinc. Processing of secondary aluminum. Collection, primary treatment of scrap and waste and metallurgical processing of other non-ferrous metals and alloys (Sb, Hg, Co, etc.). Non-metallic waste processing. Hydrometallurgical processing of raw materials containing zinc. Obtaining precious metals from scrap and waste. Ecological bases for processing secondary raw materials. The economic effects of complex processing of secondary raw materials. Perspectives of the development of secondary metallurgy.

Practical classes: Practicals, Other forms of teaching, Study research work
Laboratory and calculation Practicals follow lectures related to raw materials in secondary metallurgy.

Literature
Recommended:
1. N. Štrbac, Authorized lectures, Bor, 2010. *(in Serbian)*
2. I.Ilić, Z.Gulišija, M.Sokić, Recycling of the metal raw materials, ITNMS, Belgrade, 2010. *(in Serbian)*
Supplementary:
1.I. Ilić et.al., Resources and recycling of the secondary non-ferrous raw materials, Copper institute Bor, Bor, 2002. *(in Serbian)*
2.R.Vračar, LJ.Jakšić, Secondary metallurgy of lead, Faculty of technical sciences Kosovska Mitrovica, 2001. *(in Serbian)*
4.. A. Čavić et.al., Steel scrap, Business school Megatrend, Belgrade, 1998. *(in Serbian)*
5. I. Hajdukov, Metallurgy of the secondary non-ferrous metals, Moskva, Metalurgija, 1987. *(in Russian)*

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

Methods of teaching
Lectures, laboratory and calculation practicals

Grading system (max. number of points 100)			
Pre-examination	**Number of points**	**Final examination**	**Number of points**

obligations			
Attendance and active class participation	10	Written exam	
Practical classes	10	Oral exam	30
Preliminary exams			
Independent work	50		

Study Program: Technological Engineering	
Level of study: Undergraduate Academic Studies	
Course: PROFESSIONAL PRACTICE	
Lecturer: All lecturers engaged in the study Program	
Status of the Course: Compulsory course	
ECTS: 3	
Prerequisites: Enrolment in eighth semester	
Goal of the Course: Goal of professional practice is that students acquaint and obtain practical knowledge regarding technological processes involved in production of various products and technological operations. Practical experience helps them understand the effects of technological processes on environment.	
Learning outcomes: Enabling students to acknowledge and apply previously obtained theoretical knowledge in real industrial conditions. Sublimations of theoretical knowledge gathered by lecturing activities and practical knowledge obtained by professional practice realization students acquire new quality and competences for better understanding, efficient studying and individual work on final paper.	
Course description: Viewing and recording the exploitation characteristics of process equipment used in technological processes. Considering the characteristics of raw materials, energy consumption, technological procedures, product quality, and the impact of technological processes on the living and working environment. Getting acquainted with planning and organization procedures in order to optimize the performance of specific technological operations. Introduction to methods of quality control of the production systems work.	
Number of classes per week, if specified	Other classes: 0+0+0+4
Methods of teaching: Practical work or professional practice in an enterprise or institution is carried out according to a predefined Program - a task, that consists of data collection - measurement and analysis in consultation with experts from a company where students conduct professional practice and a teacher-coordinator of professional practice. Upon completing the professional practice, the student delivers to the professional practice coordinator a written diary with a description of the activities and work that were performed during professional practice. Teacher-coordinator of professional practice with the signature in the index confirms that the student has successfully completed the professional practice. This enables student, with the other signatures, to certify the semester.	

Grading system (max. number of points 100)	
Obligations	**Number of points**
Professional practice attendance	50
Professional practice defense	50

Study Program: Technological Engineering

Level of study: Undergraduate Academic Studies

Course: BACHELOR THESIS

Lecturer: All lecturers in study Program are potential mentors

Status of the Course: Compulsory course

ECTS: 3

Prerequisites: Collected at least 210 ECTS´s of 240 ECTS´s envisaged by the Program of basic academic studies of the study Program Technological Engineering and realized professional practice

Goal of the Course: In the Bachelor's thesis, students describe technologies or scientific and professional issues in the field of inorganic chemical technology, environmental protection and narrow professional subjects, using data obtained during professional practice. Students are searching for available scientific and expert databases or experiments, and complete information on the given topic and submit a final paper defending it in front of a commission of three members. Final paper is the final exam in the study Program.

Learning outcomes: The expected results of the Bachelor's thesis are acquainting with the subject matter and the way of solving it, along with the practical application of the acquired knowledge from the study Program, which enables the student to independently solve the engineering tasks within the framework of the study Program.

Course description:

The final paper is a research paper formulated for each individual student, in which he becomes acquainted with the methodology of research in the field of technological engineering. The mentor leads the candidate in his work and provides him with assistance in the entire process of: chosing the thematic of final paper, formulation of the thesis title, setting the goal of the thesis, engineering methods and ways of solving it, approach to the problem, the choice of solving problems, collection, data processing and verification with applying engineering methods, and final designing of final paper. After the research, the student prepares final work in the form that contains the following chapters: introduction (defining the goal of the task and the expected results); theoretical part (an overview of the most important theoretical bases, which are the basis for certain research); experimental, practical part (concrete processing of a given engineering problem), results and discussion (presentation of obtained results in the unfinished technical form, with necessary comments and conclusions given in order to solve the current problem), and literature review.

After completing of Bachelor's thesis, the student submits it to the mentor, and then having public defense of the thesis. This way, student qualifies for independent exibition and defense of acquired engineering knowledge and experience.

Methods of teaching: The methods of performing the final work consist of a theoretical introduction to the problem and independent laboratory work under the supervision of teachers. During the final work, all necessary research methods will be applied. Upon completion of his work and his positive assessment by the mentor, the candidate will orally defend the work before the three-member teacher commission.

Grading system (max. number of points 100)

Obligations	**Number of points**
Completed thesis	50
Presentation and defense of bachelor thesis	50