Content – List of courses

Study program: Metallurgical Engineering, Mining Engineering and Technological Engineering

Level of study: Doctoral Academic Studies

Course: TRANSPORT PHENOMENA2

Lecturer: Vesna Grekulović, PhD, assistant professor

Status of the course: Elective course for the study programs Metallurgical Engineering and Technological Engineering, and Compulsory course for the study program Mining Engineering.

ECTS: 8

Prerequisites: Knowledge in mathematics, physical chemistry and Transport Phenomena 1 is required.

Course goals: Providing students the knowledge momentum, mass and heat transfer, as well as mathematical interpretation of the transport ways, so that they can explain and interpret a phenomenon under they consideration.

Learning outcomes: Students gain a certain level of knowledge from the basic transport phenomena that would help them to identify, solve problems in the subject area and manage processes that are limited by the transport rate of a specific phenomenon.

Course description: Physical and mathematical basics of transport phenomena: transport mechanisms, fluid flow modes, boundary layer; differential equations of mass and energy conservation and transport; partial solutions of differential equations of transport -theory of similarity. Transport in one's own field: diffusion, diffusion in own field, own field and flux. Convective transport. Transport models. Transport analogues. Equations of convective transfer - some partial solutions for natural and forced convection. Transport across phases interface: contact of phases, transfer rate and resistance through phases interface, contactors. Transfer of heat and mass with a chemical reaction.

Literature:

Recommended:

1. S.D. Cvijović, N.M. Bošković-Vragolović; Transport Phenomena; TMF Belgrade, 2001.
2. J. M. Coulson & J. F. Richardson, Chemical Engineering vol. 1 and 2, Butterworth-Heinemann; 2002.
3. J. Szekely & N.J. Themelis; Rate Phenomena in Process Metallurgy; John Wiley & Sons; New York;1971.
4. G.H. Geiger & D.R. Poirier; Transport Phenomena in Metallurgy; Addison-Wesley publ. Co. MA USA; 1973.
5. V. Stanković, Transport phenomena and unitoperations in metallurgy 1 and 2, University of Belgrade, Technical Faculty in Bor,1998. *(in Serbian)*
6. M. Sovilj; Diffusion operations; Faculty of Technology, University of Novi Sad; 2004.
7. F. Zdanski; Mechanics of fluid; Faculty of Technology and Metallurgy, University of Belgrade; 1995.

Number of classes per week:	Lectures: 6	Study research work: 4

Methods of teaching: traditional lectures, consultations and experimental work.

Grading system (max. number of points 100)

Oral exam 40% + term paper preparation + 40% + term paper defense 20%;

Study program: Technological Engineering

Level of study: Doctoral Academic Studies

Course: CHEMICAL THERMODYNAMICS - SELECTED TOPICS

Lecturers: Snežana M. Šerbula, PhD, full professor; Jelena M. Djoković, Phd, full professor; Vesna Krstić, PhD, research associate

Status of the course: Elective course

ECTS: 15

Prerequisites: None

Course goals: The main course goal is for students to master the knowledge and skills referring to chemical thermodynamics of processes and phenomena of the material systems.

Learning outcomes: Students are capable for independent and creative solving of the specific and concrete practical problems and assignments such as estimation of the equilibrium composition, analysis and using of phase diagrams, prediction and calculations of thermodynamic parameters of interest for designing technological processes, establishing and determining the energy and mass balance.

Course description: Students are introduced to basic thermodynamic properties, fundamental equations and Maxwell relations for systems subjected to constant or variable external field (electrical, magnetic and gravitational) taking into account surface effects. They gain knowledge about ideal solution model and nonideal solutions-thermodynamic potentials. Students are also introduced to: phenomena appearing at surfaces and interfaces; conditions of equilibrium and general criteria for stability; equilibrium in chemical reacting systems; determination of the equilibrium composition for homogeneous and heterogeneous systems with competing reactions-method by Kandiner and Brinkley and Gibbs Energy Minimization Method; monovariant equilibrium in non-reactive and reactive systems, basics of phase diagram theory with the application to binary and multicomponent systems.

Literature:

Recommended:

1. C.B. Alcock, Thermochemical Processes Principles and Models, Butterworth and Heinemann, Oxford, 2001,
2. N. Petranović, Hemijska termodinamika, FHZ, Beograd, 1996.
3. E.N. Yeremin, Fundamentals of Chemical Thermodynamics, Mir Publishers, Moscow, 1981,
4. K. Denbigh, Chemical thermodiynamics, Cambridge University Press, 1971.
5. S.I. Sandler, Chemical and Engineering Thermodynamics, John Wiley and Sons, 1989.
6. C.H.P. Lupis, Chemical Thermodynamics of Materials, North Holland, 1989.

Using literature from available databases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE PROQUEST, COMPENDEX, etc.).

Number of classes per week:	Lectures: 6	Study research work: 4

Methods of teaching: Lectures with interactive discussions, consultations and experimental work.

Grading system (max. number of points 100)

Oral exam 30% + term paper preparation 50% + term paper defense 20%

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: CHEMICAL KINETICS – SELECTED TOPICS		
Lecturers: Milan M. Antonijević, PhD, full professor; Snežana Milić, PhD, associate professor; Mile D. Dimitrijević, PhD, full professor.		
Status of the course: Elective course		
ECTS: 15		
Prerequisites: Necessary knowledge in the field of kinetics.		
Course goals: The course goal is to introduce PhD students to kinetics of chemical reactions in some technological process parameters and methods of controlling them.		
Learning outcomes: Finishing this course students will be able to research kinetics of chemical reactions which will provide them better management of technological processes.		
Course description: Application of kinetic law on simple chemical reactions. Basics of kinetic theory of gases. Theory of reaction kinetics. Parameters that define reaction mechanism and speed (concentration of reactants and products, temperature, reaction surface, presence of other substances, hydrodynamic conditions). Determining the mechanism of chemical reactions. Kinetics of heterogeneous reactions. Chain reactions. Photochemical reactions. Radiochemistry. Choice of models in heterogeneous systems. Examples topochemical reactions. Non-isothermal kinetics. Isothermal kinetics. Experimental and analytical methods for determining kinetical parameters. Femtosecond spectroscopy. Kinetics of homogenous and heterogeneous catalytically reactions. Autocatalysis. Kinetics of electrochemical reactions – Electrodics.		
Literature: *Recommended:* 1. G. Hammes, Principles of chemical kinetics, Academic press, London, 1996. 2. E. Koch, Non-isothermal reaction analysis, Academic press, London, 1977. 3. S.W. Benson, Thermochemical kinetics, Second edition, John Wiley Sons, New York, 1976. 4. F. Habashi, Kinetics of Metallurgical Processes, Laval University, Quebec, 1999. 5. E.N. Eremin, The foundations of chemical kinetics, Mir Publishers, Moscow, 1979. 6. R.F. Speyer, Thermal Analysis of Materials, Marcel Dekker, Inc, 1994. 7. J.O`M. Bockris, J.K.N. Reddy, Modern Electrochemistry, John Wiley Sons, New York, 1981. Use of literature in available databases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.)		
Number of classes per week:	Lectures: 6	Study research work: 4
Methods of teaching: Lectures with interactive discussions, consultations and experimental work.		
Grading system(max. number of points 100)		
Oral exam 30% + term paper preparation 50% + term paper defense 20%		

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: CERAMIC TECHNOLOGY – SELECTED TOPICS		
Lecturers: Snežana M. Milić, PhD, associate professor; Milan Radovanović, PhD, assistant professor; Olivera B. Milošević, PhD, principal research fellow		
Status of the course: Elective subject		
ECTS: 15		
Prerequsites: Necessary knowledge in the field of ceramics.		
Course goals: Introducing students with the latest achievements in the field of ceramics and technologies of obtaining them.		
Learning outcomes: Provides students with quality studies of ceramic materials and their application in production technologies.		
Course description: traditional and new ceramic materials. Structure of new cemamic materials. Defects in structure. Expansion and elastic deformation of grain. Anisotropy of structure. Isostatic pressing. Condensing and size change of particles. Strength and elastic modulus. Thickening curve. Sintering, glassening and crystalisation. Surface energy phenomenon. Recrystallization. Classification of precursors classic and contemporary ceramics.		
Literature: *Recommended:* 1. N.P. Bansal, Handbook of Ceramic Composites, Boston Kluwer Academic Publishers, 2005. 2. I. Yoshihiko, Multilayered Low Temperature Cofired Ceramics (LTCC) Technology, New York, Kluwer Academic Publishers, 2005. 3. B. Hans, K. Dieter, Low Thermal Expansion Glass Ceramics, Berlin Springer Science & Business Media, 2005. 4. Use of literature in available database (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).		
Number of classes per week:	Lectures: 6	Study research work: 4
Methods of teaching: Method of oral report and written work (term paper)		
Grading system (max. number of points 100)		
Oral exam 30% + term paper 70%		

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: MATERIALS SCIENCE		
Lecturers: Snežana M. Milić, PhD, associate professor; Marija Petrović Mihajlović, PhD, associate professor; Olivera B. Milošević, PhD, principal research fellow		
Status of the subject: Elective subject		
ECTS: 15		
Prerequisites: Necessary knowledge in the field of chemical technology		
Course goal: Introducing students to the newest achievment s in the field of new materials and technology of obtaining them.		
Learning outcomes: After finishing the exam from Material Science, PhD students will have a good foundation for studying properties and application of new materials. Also they will be capable of synthesizing these materials from various precursor by utilizing modern synthesis methods		
Course description: Crystallization, nucleation and grain growth. Liquid crystals. Amorphous state. Solid solutions. Semiconductors and superconductors. High purity materials. Special and super alloys. Silicate melts and glass. Polymers and biomaterials. Synthesis of new materials. Chemothermal and chemical deposition from gas phase. Plasma thermal methods with use of lasers. Methods of obtaining ultra dispersed and metallic amorphous powders. Obtaining composite materials.		
Literature: *Recommended:* 1. R.W. Cahn, The Coming of Material Science, Pergamon – Elsevier, Amsterdam, 2001. 2. M.F. Ashby, D.R.H. Jones, Engineering Materials, Vol 1, Oxford Butterworth–Heinemann, 2002. 3. M. F. Ashby, D.R.H. Jones, Engineering Materials, Vol 1, Oxford Butterworth–Heinemann, 1999. 4. L.H. Van Vlack, Elements of materials science and engineering, Addison Wesley Publishing Co. 1989, New York. 5. P. Knauth, J. Schoonman, Nanocrystalline Metals and Oxides: Selected Properties and Applications, Boston Kluwer Academic Publishers, 2002. 6. Use of literature in available databases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.)		
Number of classes per week:	Lectures: 6	Study research work: 4
Methods of teaching: Method of oral report and written work (term paper).		
Grading system (max. number of points 100)		
Oral exam 30% + term paper 70%		

Study program: Technological Engineering

Level of study: Doctoral Academic Studies

Course: ELECTROCHEMICAL TECHNOLOGY

Lecturers: Mile D. Dimitrijević, PhD, full professor; Jasmina S. Stevanović, PhD, principal research fellow; Miomir G. Pavlović, PhD, principal research fellow.

Status of the course: Elective course

ECTS: 15

Prerequisites: Required knowledge in the field of electrochemistry.

Course goals: Students will acquire the necessary knowledge to understand fundamental electrochemical processes as well as their application.

Learning outcomes: Students will be able to apply electrochemical methods in technological processes using different electrolytes and electrode materials in order to obtain inorganic and organic compounds. They will use the acquired knowledge to better understand the operation of galvanic sources of power and the application of various components for anodes or cathodes in these processes.

Course description: Theoretical basis of electrochemical processes. Processes on electrodes. Materials for anodes and cathodes. Insoluble and soluble electrodes. Electrolytes. Solvents. Mediators. Diaphragms and membranes. Electrochemical reactors. Electrochemical synthesis of inorganic and organic compounds. Galvanic sources of electricity.

Literature:

Recommended:

1. A. Despić, Osnovi elektrohemije, Zavod za udžbenike i nastavna sredstva, Beograd, 2002.
2. J.O'M. Bockris; A.K.N. Reddy; M. Gamboa-Aldeco, Modern Electrochemistry. Volume 1, Ionics , New York Kluwer Academic Publishers, 2002.
3. J.O'M. Bockris; A.K.N. Reddy; M. Gamboa-Aldeco, Modern Electrochemistry. Volume 2B, Electrodics in Chemistry, Engineering, Biology and Evironmental Science, New York Kluwer Academic Publishers, 2000.
4. P.A . Christensen; A. Hamnett, Techniques and Mechanisms in Electrochemistry, New York Kluwer Academic Publishers, 1994.
5. K.I. Popov; S.S. Djokic; Grgur, Branimir N., Fundamental Aspects of Electrometallurgy, New York Kluwer Academic Publishers, 2002.
6. M. Alexander, Electrocrystallization: Fundamentals of Nucleation and Growth, Boston, Mass. Kluwer Academic Publishers, 2002.

Using literature from available databases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).

Number of classes per week:	Lectures: 3	Study research work: 4

Methods of teaching: Method of oral presentation and discussion, method of written work (term paper).

Grading system (max. number of points 100)

Oral exam 30% + term paper preparation50% + term paper defense 20%

Study program: Technological Engineering

Level of study: Doctoral Academic Studies

Course: FUNDAMENTALS OF CORROSION

Lecturers: Milan M. Antonijević, PhD, full professor; Mile D. Dimitrijević, PhD, full professor; Miomir G. Pavlović, PhD, principal research fellow.

Status of the course: Elective course

ECTS: 15

Prerequisites: Basic knowledge in the field of material corrosion.

Course goals: Introducing students with the mechanism of corrosion and the application of appropriate protection measures. Upgrading basic theoretical knowledge of corrosion phenomena in the light of recent knowledge in this field.

Learning outcomes: Students who choose this course will acquire the necessary knowledge to study the phenomenon of corrosion of various materials in different environments, and in particular will acquire knowledge about the methods used for this kind of testing.

Course description: Corrosion of materials. Thermodynamic aspect of corrosion. Corrosion rate. Electrode kinetics. Passivity. Mechanism of unraveling corrosion processes. Types of corrosion. Corrosion in different environments. Corrosion inhibitors. Corrosion tests, monitoring and analysis. Methods of corrosion testing. Protection of materials against corrosion.

Literature:

Recommended:

1. Scully, J.C., The Fundamentals of Corrosion, Pergamon Press, 1990.
2. Fontana, M.G., Corrosion Engineering, McGraw-Hill, New York, 1986.
3. Corrosion Science, Vodeći međunarodni časopis u ovoj oblasti.
4. Bardal Einar, Corrosion and Protection, London, New York Springer-Verlag New York, 2004,
5. Perez Nestor, Electrochemistry and Corrosion Science, Boston Kluwer Academic Publishers, 2004.

Using literature from available databases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).

Number of classes per week:	Lectures: 6	Study research work: 4

Methods of teaching: Method of oral presentation and discussion, method of written work (term paper).

Grading system (max. number of points 100)

Oral exam 30% + term paper preparation50% + term paper defense20%

Study program: Technological Engineering

Level of study: Doctoral Academic Studies

Course: ENVIRONMENTAL PROTECTION

Lecturers: Milan M. Antonijević, PhD, full professor; Snežana M. Šerbula, PhD full professor; Slađana Č. Alagić, PhD, associate professor.

Status of the course: Elective course

ECTS: 15

Prerequisites: Basic knowledge regarding environmental protection.

Course goals: Training students for independent examination of pollution problems in the environment as well as for finding appropriate methods of protection

Learning outcomes: The theoretical foundations that are gained by passing this exam will enable PhD students to be successful in the field of environmental protection from the scientific point of view. In addition, PhD students will be trained for monitoring of environmental pollution levels, as well as for the application of remediation technologies.

Course description: Sources of pollution in the environment. Hazardous substances and their toxicity. State of the areas of interest. Monitoring. Remediation technologies. Natural and anthropogenic polluters. Air quality and methods for air treatment. Water quality and enhanced methods of water treatment. Drinking and waste water. Technologies for soil remediation. Plant uptake of toxic substances. Life cycles of hazardous substances and its degradation.

Literature:

Recommended:

1. E. Lichtfouse, J. Schwarzbauer, R. Didier, Environmental Chemistry: Green Chemistry and Pollutants in Ecosystems, Berlin, New York Springer Science & Business Media, 2005.
2. Reviews of Environmental Contamination and Toxicology Volumes 180, 181, 184, New York Springer Verlag New York, 2004,
3. L. Richard; J-P. Waaub; Zaccour Georges, Energy and Environment, New York Springer Science & Business Media, 2005,
4. F.W. Ruth and R. Matthews, Environmental Engineering, Butterworth-Heinemann, 2003.

Ancillary:

Different data bases (SCOPUS, SCIENCE DIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX).

Number of classes per week:	Lectures: 6	Study research work: 4

Methods of teaching: Method of oral presentation and discussion, method of written work (term paper).

Grading system (max. number of points 100)

Oral exam 30% + term paper preparation 50% + term paper defense 20%

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: AEROSOLS IN THE ATMOSPHERE		
Lecturer: Snežana Šerbula, PhD, full professor		
Status of the course: Elective course		
ECTS: 15		
Prerequisites: Required knowledge of air pollution and waste gases treatment.		
Course goals : Fundamentals of aerosol science and engineering.		
Course description: Introduction, characterization of aerosols. Models of particulate transport. Brownian diffusion, inertia of aerosols. Pipe and cylinder flow. The action of the thermal, electrostatic and magnetic field forces. Visibility and light scattering. Aerosol dynamics: coagulation, nucleation, condensation, crystallization and particle growth. Aerosol sources: combustion of fossil fuels, industry, ambient atmosphere, synthesis of materials, etc.		
Literature: *Recommended:* 1. W.C. Hinds, Aerosol Technology, John Wiley & Sons, New York, 1999. 2. J.H. Seinfeld and Pandis, Atmospheric Chemistry and Physics of Air Pollution, J. Wiley & S., New York, 1997. 3. Use of literature from available databases (SCOPUS, SCIENCEDIRECT, WEB OF SCIENCE, PROQUEST, COMPENDEX, etc.).		
Number of classes per week:	Lectures: 6	Study research work: 4
Methods of teaching: Lectures with interactive discussions, programming for solving problems (term paper).		
Grading system (max. number of points 100)		
Oral exam 30% + term paper 50% + computer programming for solving problems 20%		

Study program: Technological Engineering

Level of study: Doctoral Academic Studies

Course: SOLID WASTE TREATMENT

Lecturer: Mile D. Dimitrijević, PhD, full professor

Status of the course: Elective course

ECTS: 15

Prerequisites: Basic knowledge in solid waste management.

Course goals: Upgrading existing knowledge in solid waste management, especially in the treatment segment of this waste.

Learning outcomes: Students will be able to deal with various types of solid waste treatment, especially recycling of this waste in order to obtain secondary raw materials and preserve the environment.

Course description: Source, types and composition of solid waste (SW). Physical, chemical and biological properties of SW. Hazardous Waste in SW. Basic operations in the management of the SW. Physical treatment of SW. Chemical treatment of SW. Biological treatment of SW. Recycling processes. Waste disposal. Control of landfill gas. Landfills and environmental protection.

Literature:

Recommended:

1. F. Woodard, Industrial Waste Treatment Handbook, Boston Butterworth–Heinemann, 2001.
2. R.J. Watts, Hazardous Wastes, John Wiley and Sons, 1980.
3. G. Tchobanoglous, H. Theisen, S.A. Vigil, Integrated Solid Waste Management – Engineering Principles and Management Issues, McGraw-Hill, New York, 1993.

Using literature from available databases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).

Number of classes per week:	Lectures: 6	Study research work: 4

Methods of teaching: Method of oral presentation and discussion, method of written work (term paper).

Grading system (max. number of points 100)

Oral exam 30% + term paper preparation 50% + term paper defense 20%

Study program: Technological Engineering

Level of study: Doctoral Academic Studies

Course: WASTEWATERS TREATMENT PROCESSES

Lecturers: PhD Grozdanka Bogdanović, full professor, PhD Vesna Krstić, research associate

Status of the course: Elective course

ECTS: 15

Prerequisites: Basic knowledge in technology and wastewater treatment.

Course goals: The aim of the course is to provide students with modern knowledge in the field of wastewater treatment and introduces them to advanced techniques of industrial wastewater treatment processes

Learning outcomes: PhD students will be trained to study wastewater treatment methods using various procedures. They will use theoretical knowledge to development new procedures in the goal environmental protection.

Course description: Classification of industrial wastewater - by species, by composition, by way of formation; Wastewater treatment - access to the problem. Advanced techniques of industrial wastewater treatment processes:
Physical, chemical, physico-chemical methods of industrial wastewater treatment: adsorption / ion exchange, solvent extraction, flotation processes, membrane processes, electrochemical processes (reduction of metal ion, anode oxidation of organic compounds, electrodialysis), biochemical methods, hybrid and combined processes. Removal suspended particles from wastewater – clarification. Treatment and disposal of sludges from processing industrial waste waters.

Literature:

Recommended:

1. F. Habashi; A Textbook of Hydrometallurgy; MetallurgieExtective Quebec, Enr. 1992. (Selected chapters).
2. N.P. Cheremisinoff; Handbook of Water and Wastewaters Treatment Technologies; N&P Ltd Butterworth and Heinemann; Boston USA 2002. (Selected chapters).
3. Ch. Comninelis; TechnologieChimique et Biologie de L'environement (Selected chapters); SB, EPFL, Swiss 2004.
4. S. Judd and B. Jeffersoon; Membranes for Industrial Wastewaters Recovery and Reuse; Elsevier 2003.
5. Using literature from available databases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).

Number of classes per week:	Lectures: 6	Study research work: 4

Methods of teaching: Method of oral presentation and discussion, method of term paper.

Grading system (max. number of points 100)

Oral exam 30% + Independent work 30% + Term paper 50%

Study program: Technological Engineering

Level of study: Doctoral Academic Studies

Course: FUNDAMENTALS OF SOIL REMEDIATION

Lecturers: Milan M. Antonijević, PhD, full professor; Grozdanka Bogdanović, PhD, associate professor; Ana Simonović, PhD, assistant professor

Status of the course: Elective course

ECTS: 15

Prerequistes: Background knowledge in the field of pollution and soil protection.

Course goals: Introducing students with chemistry of solutions, interaction of pollutants with soil components and methods of remediation of polluted soil. The program will allow students to independently examine the soil and propose appropriate methods for the elimination of pollutants.

Learning outcomes: Students will be trained for independent scientific and professional work in this field.

Course description: Chemistry of soil. Soil analysis. Solvability of soil components. Carbonate balance. Reactions of ion exchange in the soil. Adsorption processes. Acid-base equilibrium. Redox processes in the soil. Inorganic and organic pollutants. Interaction of polutants with soil components. Remediation Technologies. Bioremediation. Chemical oxidation. Thermal desorption. Electrokinetic remediation of soil. Soil washing. Extraction methods of soil remediation. Soil calcification and reduction of salinity. Fitoremediation. Separation of heavy metals. Other remediation techniques.

Literature:

Recommended:

1. R.G. Buran and R.J. Zasoski, Soil and water shemistry, U.C. Davis, 2002.
2. R. Burt, Soil Survey Laboratory Methods Manual, NRCS, USA 2004.
3. M. Rosa, S. Franz, Manual for Soil Analysis: Monitoring and Assessing Soil Bioremediation, Berlin, New York Springer Science & Business Media, 2005.
4. Lavelle, P. Spain, Alister V., Soil Ecology, Boston Kluwer Academic Publishers, 2001.
5. Calabrese Edward J.; Kostecki Paul T.; Dragun James, Contaminated Soils, Sediments and Water: Science in the Real World, New York Kluwer Academic Publishers, 2005.
6. Breemen N. van.; Buurman P, Soil Formation, Boston Kluwer Academic Publishers, 2002.
7. Using literature from available databases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc).

Number of active classes:	Lectures: 6	Study research work: 4

Methods of teaching: Method of oral presentation and discussion, method of written work (term paper).

Grading system (max. number of points 100)

Oral exam 30% + preparation of term paper 50% + defense of term paper 20%

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: THEORETICAL FOUNDATIONS FOR THEME DEFINING		
Lecturer: All lecturers engaged in the study program who can be mentors.		
Status of the course: Obligatory subject of Technological engineering study program.		
ECTS: 15		
Prerequisites: All the exams within the doctoral studies curriculum passed.		
Course goals: Application of basic, theoretical-methodological, scientific-professional and expert-applied knowledge, methods and the latest knowledge from the journals from the SCI list in solving specific problems from the courses of doctoral studies.		
Learning outcomes: Training students to independently perform analysis and synthesis of materials from doctoral studies, apply previously acquired knowledge in structuring the research problem and defining the possible directions for its resolution. Autonomous use of literary sources from available databases in order to perform a comprehensive overview of the defined research problem.		
Course description: It is formed individually for each student in accordance with the needs of further work in the specific case. The student surveys the professional literature for defining possible solutions to the given problem through the development of: a) the research methodology to be applied in the preparation of the doctoral dissertation, b) clear definition of the basic scientific contributions expected during the doctoral dissertation. As a result of this work, the elaboration of the study, with the explanation of the topic for the preparation of the doctoral dissertation, is prepared and defended in front of the three-member Commission appointed by the Teaching-Scientific Council at the proposal of the department.		
Literature: Literature from the available data bases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).		
Number of classes per week:	Lectures:	Study research work: 10
Methods of teaching: The mentor gives a doctoral student an assignment to elaborate the explanation of the scientific basis of the topic for the preparation of a doctoral degree dissertation. The initial literature is defined by the mentor, and after that the candidate performs independent research using available databases and other available literature. The mentor can provide additional guidance and direct the candidates during the preparation of the dissertation proposal that presents explanation of the topic for doctoral thesis preparation. During the preparation of the proposal, the candidate performs the necessary measurements, analyses and other research for the purpose of better defining a research problem. After defending the proposal, the mentor starts the procedure for the official approval of the theme for the preparation of the doctoral dissertation.		
Grading system (max. number of points 100)		

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: DOCTORAL DISSERTATION – STUDY RESEARCH WORK 1		
Lecturer: All lecturers engaged in study program who can be mentors.		
Status of the course: Compulsory course		
ECTS: 30		
Prerequisites: All the exams within the doctoral studies curriculum passed .		
Course goals: Application of basic, theoretical-methodological, scientific-professional and expert-applied knowledge, methods and the latest knowledge from the journals from the SCI list in solving specific problems within the topic of doctoral dissertation. Within the defined topic for preparation of doctoral dissertation student studies the problem, its structure and complexity, performs analysis and synthesis and defines possible solutions. The goal of student activity at this level of studies is to obtain the necessary experience for independent structuring and solving of problems.		
Learning outcomes: Training students to independently apply previously acquired knowledge from various fields for concrete problem resolution. Through the autonomous use of literary sources students broaden their knowledge in the specific field and acquire experience in use of contemporary tools and techniques for the solution of practical problems.		
Course description: It is formed individually for each student in accordance with the requirements for doctoral dissertation preparation. Student surveys the professional literature and performs the necessary research related to the topic of doctoral dissertation (laboratory work, field work and similar).		
Literature: Literature from the available data bases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).		
Number of classes per week:	Lectures:	Study research work: 20
Methods of teaching: The mentor proposes an assignment to the candidate by defining the basic courses of research in accordance with the proposal that student previously defended in the course of defining of the topic of doctoral dissertation. The mentor can provide additional guidance and direct the candidates during the preparation of a doctoral dissertation in order to reach a successful problem solution and prepare a high-quality doctoral dissertation.		
Grading system (max. number of points 100)		

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: DOCTORAL DISSERTATION – STUDY RESEARCH WORK 2		
Lecturer: All lecturers engaged in the study program who can be mentors.		
Status of the course: Compulsory course		
ECTS: 30		
Prerequisites: All the exams within doctoral studies curriculum passed		
Course goal: Application of basic, theoretical-methodological, scientific-professional and expert-applied knowledge, methods and the latest knowledge from the journals from the SCI list in solving specific problems within the topic of doctoral dissertation. Within the defined topic for preparation of doctoral dissertation student studies the problem, its structure and complexity, performs analysis and synthesis and defines possible solutions. The goal of student activity at this level of studies is to obtain the necessary experience for independent structuring and solving problems.		
Learning outcomes: Training students to independently apply previously acquired knowledge from various fields for concrete problem resolution. Through the autonomous use of literary sources students broaden their knowledge in specific field and acquire experience in use of contemporary tools and techniques for the solution of practical problems.		
Course description: It is formed individually for each student in accordance with the requirements of doctoral dissertation preparation. Student surveys the professional literature and performs the necessary research related to the topic of doctoral dissertation (laboratory work, field work and the similar).		
Literature: Literature from the available data bases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).		
Number of classes per week:	Lectures:	Study research work: 20
Methods of teaching: The mentor proposes an assignment to the candidate by defining the basic courses of research in accordance with the proposal that the student previously defended in the course of defining of the topic of doctoral dissertation. The mentor can provide additional guidance and direct the candidates during the preparation of a doctoral dissertation in order to reach a successful problem solution and prepare high-quality doctoral dissertation.		
Grading system (max. number of points 100)		

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: DOCTORAL DISSERTATION – STUDY RESEARCH WORK 3		
Lecturer: All lecturers engaged in study program who can be mentors.		
Status of the course: Compulsory course		
ECTS: 30		
prerequisites: All the exams within doctoral studies curriculum passed		
Goal of the subject: Application of basic, theoretical-methodological, scientific-professional and expert-applied knowledge, methods and the latest knowledge from the journals from the SCI list in solving specific problems within the topic of doctoral dissertation. Within the defined topic for preparation of doctoral dissertation student studies the problem, its structure and complexity, performs analysis and synthesis and defines possible solutions. The goal of student activity at this level of studies is to obtain the necessary experience for independent structuring and solving of problems.		
Learning outcomes: Training students to independently apply previously acquired knowledge from various fields for concrete problem resolution. Through the autonomous use of literary sources students broaden their knowledge in the specific field and acquire the experience in use of contemporary tools and techniques for the solution of practical problems.		
Course description: It is formed individually for each student in accordance with the requirements of doctoral dissertation preparation. Student surveys the professional literature and performs the necessary research related to the topic of doctoral dissertation (laboratory work, field work and the similar).		
Literature: Literature from the available data bases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).		
Number of classes per week:	Lectures:	Study research work: 20
Methods of teaching: The mentor proposes an assignment to the candidate by defining the basic courses of research in accordance with the proposal that student previously defended in the course of defining of the topic of doctoral dissertation. The mentor can provide additional guidance and direct the candidates during the preparation of doctoral dissertation in order to achieve successful problem solution and prepare high-quality doctoral dissertation.		
Grading system (max. number of points 100)		

Study program: Technological Engineering		
Level of study: Doctoral Academic Studies		
Course: DOCTORAL DISSERTATION – PREPARATION AND DEFENSE OF DOCTORAL DISSERTATION		
Lecturer: All lecturers engaged in the study program who can be mentors		
Status of the course: Compulsory course		
ECTS: 20		
Prerequisites: All the exams within the curriculum passed.		
Course goal: Defense of doctoral dissertation.		
Learning outcomes: Upon successfully and independently prepared and written doctoral dissertation within the field chosen at doctoral studies enrolment, candidate gets the right to proceed to defense of doctoral dissertation.		
Course description: Doctoral students choose the topic of doctoral dissertation within the area covered by the elective courses. Doctoral dissertation contains the usual chapters: Topic, Introduction, Literature survey, Work hypothesis and research goal, Materials and methods, Results, Discussion, Conclusion and Literature.		
Literature:Theoretical Foundations for Defining a Theme Literature from the available data bases (SCOPUS, SCIENCEDIRECT, WEB of SCIENCE, PROQUEST, COMPENDEX, etc.).		
Number of classes per week:	Lectures:	Study research work:
Methods of teaching: Analysis of experimental data gathered from the applied methods and data processing, writing of dissertation, consultations with the mentor and members of the Committee.		
Grading system (max. number of points 100)		