Course Descriptions for the Joint Study Programme
"International Master of Science in Engineering, Entrepreneurship and Resources (MSc. ENTER)

Version 07.2024

Courses at **Technical University of Kosice**
with the Specialization "**Mineral Processing and Environmental Technologies**"

Module Name	**Revitalization and Recultivation of Landscape**
Code	2122151
ECTS Credits	**6**
Responsible	prof. Ing. Jiří Škvarla, CSc.
Institute(s)	Institute of Earth Resources
Terms of study	WT, ST
Learning Outcome (Competencies)	Negative human activity on the environment causes deterioration; deterioration of the quality of the components of the environment (degradation) to devastation; degradation. of the components of the environment and the ecosystems, when the country is deprived of its original natural properties. In consequence, negative soil degradation occurs. By recognizing the type of degradation and degree of soil degradation, revitalization measures can be selected. Devastation is most evident in areas with surface or deep mining, where not only soil degradation but also the extinction of ecosystems occurs. Using technical and biological ways to revitalize devastated areas, dump soils, dredges after ore and coal mining stabilizes the ecosystems. Water revitalization deals with processes of eutrophication, self-purification, biochemical processes.
Contents	Degradative impacts, soil degradation, revitalization possibilities. Soil contamination, soil hyg. limits, principles of revitalization. Effect of mining on ecosystems. and components of the environment, ecologist. motives for ecosystem revitalization, reclamation. Impacts of surface mining and environmental devastation. Mining of coal, ores and non-irons, land devastation and reclamation principles.
Teaching Methods	P,S,CN,CL,PP,A,ST,E,OP
Assessment Methods	Credit test and examination Continuous evaluation: Credit test Final evaluation: Examination
Workload	L-2 LE-2 per week (Weekly: 2,0,0,2,0,0,0,0,0)

Module Name	**Mineralurgy**
Code	2115811
ECTS Credits	**6**
Responsible	prof. Ing. Martin Sisol, PhD.
Institute(s)	Institute of Earth Resources
Term of study	WT, ST
Learning Outcome (Competencies)	The subject deals with basic processes of mineral processing technologies.
Contents	Milling and crushing: Grain characterization of materials. Geometric and physical characterization of grains. Characterization of grain mixtures. Grain-size curve. Index of operation. Grinding- stage of grinding and total stage of grinding. Types of grinders and their attributes. Capacitive calculation of grinders. Type characteristics of grinders. Milling. Types of mills and their attributes and capacitive calculation. Separation. Screening. Capacitive calculation of mechanical separators. Hydraulic separation. Mechanical, flow, centrifugal, hydraulic and pneumatic separation. Pneumatic separators. Physical separation: Gravity separation (heavy liquids, suspensions, jigging, shaking tables, etc.). Magnetic separation and filtration (LIMS, HIMS, HGMS). Magnetohydrostatic separation. Electrostatic separation. Optical and electronic separation. Special separation methods.
Assessment Methods	Credit test and examination Continuous evaluation: Credit test Final evaluation: Examination
Materials/literature	1.Špaldon, F., Úprava nerastných surovín, ALFA, Bratislava, 1986 (vysokoškolská učebnica) 2.Lukáč, J., Fyzikálne metódy rozdružovania, TU Košice, 1993 (skriptá) 3.Cagaš, Z., Fyzikální způsoby úpravy I. a II., VŠB Ostrava, 1982 (skriptá) 4. Lukáč, J., Základy úpravy nerastných surovín, ALFA, Bratislava, 1983 (skriptá)
Workload	L-3 NE-2 per week (Weekly: 2,0,2,0,0,0,0,0,0)

Module Name	**Mathematics I**
Code	2126761
ECTS Credits	**6**
Responsible	prof. RNDr. Igor Podlubný, DrSc.
Institute(s)	Institute of Control and Informatization of Production Processes
Term of study	WT, ST
Teaching Language	Slovak
Learning Outcome (Competencies)	After completion of the course a student should acquire basic knowledge, skills and abilities needed to resolve problems from vector and matrix operations, linear algebra, various methods of solution of systems of linear algebraic equations, sequences and numerical series, infinitesimal calculus, limits, functions of one variable, investigation of their properties and behavior, definite and indefinite integration, standard methods of evaluation of indefinite and definite integrals, basic idea of numerical evaluation of derivatives and integrals. These basic knowledge, skills and abilities should be actively used by the student in order to solve various applied problems.

Contents	Vectors. Notion of a vector space. Linear dependence and independence of vectors. Dot product of two vectors. Orthogonality of vectors. Cross product of two vectors. Scalar triple product of three vectors. Geometric interpretations, applications of vector products. Matrices, basic operations with matrices. Matrix products (Caley, Hadamard, Kronecker). Rank of a matrix. Equivalent matrices. Determinants and their properties. Determinants and matrix inversion. Systems of linear algebraic equations. Existence, uniqueness, number of solutions. Gauss's elimination method. Matrix form of a systems of linear algebraic equations. Cramer's method. Number sets: integer numbers, whole numbers, rational numbers, real numbers. Functions of one real variable. Basic notions and properties. Classification of functions of one real variable (even, odd, increasing, decaying, monotonic, etc.). Sequences. Limit of a sequence. Important limits of some sequences. Sequences and numerical series. Sum of infinite geometric series. Limit of a function (proper, improper, at improper points, left-sided, right-sided). Basic properties of limits. Direct evaluation of limits. Continuous functions. Some properties of continuous functions. Some important limits. Derivative of a function. Geometric and physical interpretation of derivatives. Direct evaluation of some functions. Derivative of a sum, product, ration of two functions. Derivative of a composite function. Derivative of an inverse function. Basic table of derivatives. Evaluation of limits using the L'Hospital rule. First-order derivative and intervals of monotonicity. Local extremes (local maximum and local minimum). The largest and the smallest value of a function in a closed interval. Second-order derivative, intervals of convexness and concaveness of a function. Points of inflection. Asymptotes. Vertical and horizontal asymptotes. Investigation of the behaviour of a function, function plotting based on such investigation. Primitive function (anti-derivative). Indefinite integral. Basic table of indefinite integrals. Properties of indefinite integrals. Basic rules of integration. Some typical methods for evaluating indefinite integrals. Integration by parts, integration by substitution of variables. Partial fraction decomposition. Definite integral, definition and properties. Geometric and physical interpretation. Newton-Leibniz formula. Applications of definite integrals (area, volume, distance, concentration, etc.)
Assessment Methods	Credit test and examination Continuous evaluation: 100% participation on the practical exercise and active participation on the lecture. A student passes through the course and obtain the course-credit, provided he/she attains at least 16% of 30%. During the semester two written tests will appear, each of them for 15 points at most. Final evaluation: A student passes through the exam, if he/she attains at least 36% from 70%. During the final written exam, at most 70 points can be obtained.

	The credits will be not assigned to a student, which obtains fewer than 16 points during the semester tests or fewer than 36 points from the final written exam. The course has a standardized grading system which is identified below: A (91–100%): Outstanding, excellent work, B (81–90 %): Good, competent work, C (71–80%): Adequate, reasonably satisfactory work, D (61–70%): Less acceptable work, E (60–51%): Minimally acceptable work, FX (under 50%): Inadequate work
Materials/literature	[1. Bermant A.F.: Mathematical Analysis. Abrief Course for Engineering Students. Mir Publishers, Moscow, 1st edition, 1975, or any later edition. 2. Barnett, R.A., Ziegler M.R.: Applied Mathematics. 3rd edition, Macmillan Publishers, 1986, or any later edition. 3. Zeldovich Y.B., Yaglom, I.M.: Higher Math for Beginning Physicists and Engineers, Prentice Hall, August 1988,. 4.Stroud, K.: Advanced Engineering Mathematics, 5th edition, Industrial Press, 2011.
Workload	L-2 NE-2 per Week (Weekly: 2,0,2,0,0,0,0,0,0)

Module Name	**Environmental Sampling**
Code	Not mentioned
ECTS Credits	**1**
Responsible	doc. Ing. Ľubica Kozáková, PhD.
Institute(s)	Institute of Earth Resources
Term of study	WT
Learning Outcome (Competencies)	The subject provides a brief summary on the problem of sampling of solid, liquid and gaseous materials before their analyses concerned with various problems of the environment. According to elementary mathematical and statistical theories, all aspects of sampling are overviewed.
Contents	Relation between sampling and analysis. Sampling stages. Sampling aims. Sampling documentation. Basic methods of sampling. Sampling of solid materials. Sampling of water. Sampling of air. Sampling of soils.
Teaching Methods	P,S,CN,CL,PP,A,ST,E,OP
Assessment Methods	Graded credit test Continuous evaluation: test Final evaluation: test
Materials/literature	L. H. Keith : Principles of Environmental Sampling, ACS Professional Reference Book,Washington, 1988Kozáková, L.: Environmentálne vzorkovanie / 1. vyd. - Košice : TU - 90 s.. - ISBN 978-80-553-1087-9, 2012
Workload	LE-2 per Week

Module Name	**Semestral Project**
Code	21000408
ECTS Credits	**1**
Responsible	prof. Ing. Martin Sisol, PhD.
Institute(s)	Institute of Earth Resources
Term of study	WT, ST

Learning Outcome (Competencies)	Not mentioned
Contents	Not mentioned
Teaching Methods	P,S,CN,CL,PP,A,ST,E,OP
Assessment Methods	Graded credit test
Workload	S-2 per Week

Elective courses: Students choose at least 10 ECTS points (CP) from the elective course list.

Module Name	**Material Evaluation of Technological Processes**
Code	2129171
ECTS Credits	**5**
Responsible	prof. Ing. Martin Sisol, PhD.
Institute(s)	Institute of Earth Resources
Term of study	WT
Learning Outcome (Competencies)	The aim of the subject is to teach students: technological parameters and evaluation of the distribution process, technological analysis of raw materials to evaluate the possibilities of processing, analyze the technological system.
Contents	Technological system - technological operations and their basic graphic and mathematical expression. Fundamentals of the balancing of technological processes. Basic technological parameters of the distribution operations. Measurement errors and their calculation. Bug Transmission Laws. Optimization of measurement in terms of errors. Calibration of measured data. Analysis of technological raw materials. Analysis of technological systems. Mathematical decomposition of the technological system. Transmission characteristics of the distribution system. Single factor and multifactor analysis of variance.
Teaching Methods	P,S,CN,CL,PP,A,ST,E,OP
Assessment Methods	Credit test and examination Continuous evaluation: Credit test Final evaluation: Examination
Materials/literature	1. Leško, M.: Úpravnícka technologická analýza. ES VŠT v Košiciach, 1985 2. Leško, M.: Úpravnícka technologická analýza. (Príklady) ES VŠT v Košiciach, 1988 3. Páznam, A. a kol.: Riešenie situácie a navrhovania experimentov, ALFA Bratislava, 1986 4. Pechoč, V.: Vyhodnocování měření a početní metodiky v chemickem inženýrství, SNTL Praha, 1981
Workload	L-2 NE-2 per Week (Weekly: 2,0,2,0,0,0,0,0,0)
Note	Obligatory elective courses

Module Name	Gas Cleaning Technologies
Code	2116791
ECTS Credits	5
Responsible	prof. Ing. Martin Sisol, PhD.
Institute(s)	Institute of Earth Resources
Term of study	WT, ST
Contents	Origin and properties of gas pollutants. Physical chemical phenomena and principles used for the separation of gaseous pollutants. Technical principles and technologies limiting gas pollutants, designing separation. Measurement of emissions and immissions. Spread of polluting substances in the air.
Teaching Methods	P,S,CN,CL,PP,A,ST,E,OP
Assessment Methods	Credit test and examination Continuous evaluation: Credit test Final evaluation: Examination
Materials/literature	Všeobecné záväzné predpisy v ochrane ozdušia. MŽP SR Bratislava, 2002 Tolgyessi, J. : Chémia, biológia a toxikológia vody a ovzdušia. Veda Bratislava, 1984 Bretschneider, B. Kurfurst, J. : Technika ochrany ovzdušia, SNTL Praha, 1978 Hostin, S. a kol.: Environmentálne inžinierstvo I. STU Bratislava, 2004 Odvetvové technické normy ochrany ovzdušia. MŽP SR, 1996
Workload	L-2 NE-2 per Week (Weekly: 3,0,2,0,0,0,0,0,0)
Note	Obligatory elective courses

Module Name	Technical Mineralogy
Code	2129181
ECTS Credits	5
Responsible	doc. Mgr. Julián Kondela, PhD.
Lecturer(s)	doc. Mgr. Julián Kondela, PhD., Ing. Diana Dirnerová, PhD.
Institute(s)	Institute of Geo-sciences
Term of Study	WT
Learning Outcome (Competencies)	The absolvent of the course will have knowledge about the mineral processing methods as well as about the main characteristics (related to processing) of the most important minerals with higher response to Slovakia. Absolvent should also be able to analyze the polymineral samples and suggest the main processes for individual mineral segregation.
Contents	The course of Technical (industrial) mineralogy is a continual to courses of Mineralogy and Mineral deposits. It concerns about the general methods of the mineral processing and useable technical properties of important ore and none-metallic raw materials of Slovakia. The course is also focused on description of the parameters important for the evaluation of the analyzed materials.
Teaching Methods	P,S,CN,CL,PP,A,ST,E,OP
Assessment Methods	Credit test and examination **Continuous evaluation:** For the successful completion of the course is needed: - Doing 2 tasks on required level. The maximal credits for the tasks is 30 points

	and minimal is 16 points. - Presence at lectures and exercises. - The final examination by written form. The maximal credit is 70 points and minimal is 36 points. **Final evaluation:** For the successful completion of the course is needed: - Doing 2 tasks on required level. The maximal credits for the tasks is 30 points and minimal is 16 points. - Presence at lectures and exercises. - The final examination by written form. The maximal credit is 70 points and minimal is 36 points.
Grading	The final grade of the course consists of the points from tasks (max 30 points) and final examination (max 70 points) and it is expressed as A (91-100 points), B (81-90 points), C (71-80 points), D (61-70 points), E (51-60 points).
Materials/literature	Gilson, J.L., 1960: Industrial Minerals and Rocks (Nonmetallics other than Fuels). Aime, New York. Harben, P.W. and Kužvart, M., 1996: Industrial Minerals (A Global Geology). Industrial Minerals Information Ltd. London. Gasparrini, Claudia, 1993: Gold and other Precious Metals (From Ore to Market). Springer-Verlag, New York. Silver – Exploration, Mining and Treatment, Institution of Mining and Metallurgy, 1988, London. Pryor, E.J., 1965: Mineral Processing. Elsevier, 843 p. Perepelicin, V.A. : Osnovy techničeskoj mineralogii i petrografii. Nedra, Moskva 1987. Barskij, L.A. : Osnovy mineralurgii. Nauka, Moskva 1984. Eggert, E.G. : Metallic Mineral Exploration (an Economic Analysis). Resources for the Future, Washington 1987. Forman, J. a kol. : Základní anorganický průmysl. SNTL, Praha 1968. periodiká (čas. Industrial Minerals, Geologický průzkum, European Journal for Mineralogy)
Workload	L-2 NE-2 per Week (Weekly: 2,0,2,0,0,0,0,0,0)
Note	Obligatory elective courses

Legend

Course type:

C = Compulsory course, OE = Obligatory elective course, V = Voluntary course

Contact lessons:

S = Studio, LE = Laboratory exercise, NE = Numerical exercises, E = Excursion, SP = Specialistic practice, L = Lecture, PW = Project work, S = Seminar, I = Internship

Study schedule MSc. ENTER (from October 2024)

Modules	1st term L/E/S/P	2nd term L/E/S/P	3rd term L/E/S/P	4th term L/E/S/P	CP
Compulsory modules					
Revitalization and Recultivation of Landscape	2/2/0/0 TUKE				6
Mineralurgy	3/2/0/0 TUKE				6
Mathematics I	2/2/0/0 TUKE				6
Environmental Sampling	0/1/0/0 TUKE				1
Semestral Project	0/0/2/0 TUKE				1
Elective modules: Students must choose at least **10 CP** to achieve 30 CP in total.					
Material Evaluation of Technological Processes	2/2/0/0 TUKE				5
Gas Cleaning Technologies	2/2/0/0 TUKE				5
Technical Mineralogy	2/2/0/0 TUKE				5
Compulsory modules					
Current Issues in Enabling Technologies for Circular Economy		LUT Online Teaching			5
Knowledge Discovery and Process Data Analysis		LUT Online Teaching			5
Process Intensification		LUT Blended Teaching			5
Academic Entrepreneurship		LUT Blended Teaching			6
Start-ups and venture formation		LUT Blended Teaching			6
Elective modules: Students must choose at least **3 CP** to achieve 30 CP in total.					
Simulation, Laboratory Course		LUT Online Teaching			5
Advanced Course in Life Cycle Assessment		LUT Blended Teaching			8
Integration of Product's Design, Sustainable Production and Material Selection		LUT Blended Teaching			5
Bioeconomy		LUT Blended Teaching			5
Development of New Sustainable Products and Solutions		LUT Blended Teaching			5

Modules	1st term L/E/S/P	2nd term L/E/S/P	3rd term L/E/S/P	4th term L/E/S/P	CP
Power-to-X processes		LUT Online Teaching			5
Fluid Dynamics in Chemical Engineering		LUT Contact Teaching			5
Compulsory modules					
Training in Particle Technology			1/2/0/0 TUBAF		4
Training in Endurance and Design			1/2/0/1 TUBAF		6
Conception of Process Equipment			2/1/0/0 TUBAF		5
Sustainable Engineering			2/1/0/0 TUBAF		4
Project - Process Design Mineral Processing / Recycling			0/0/2/8 TUBAF		5
Elective modules: Students must choose at least **6 CP** to achieve 30 CP in total.					
Maintenance Engineering			2/1/0/0 TUBAF		4
Process Development in Mechanical Process Engineering			2/0/1/0 TUBAF		4
Recycling - Secondary Raw Materials			3/0/1/0 TUBAF		6
Master Thesis (Mechanical and Process Engineering)				22 Wo (TUKE/ *LUT / TUBAF*)	30

Legend - Teaching Methods:

In contact hours per week

L= Lecture
Ü= Exercise
S= Seminar
P= Practical application