Environmental-Engineering-ERASMUS-2024/2025-COURSE-CATALOGUE - Syllabus

1. Biology and ecology

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
Basic issues in biology and ecology. Application of biomonitoring species and methods. Ecological processes in the environment.				
Number of hours of classes in each form of study according to the study programme:	full-time studies: lecture – 10 h, project classes – 15 h part-time studies: lecture – 5 h, project classes – 10 h			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference*[1]	Form of classes	Means of verification and assessment of the learning outcomes
B10_W01	know basic biological concepts and theories	K_W02	lecture	test
B10_W02	discuss the most important groups of biomonitoring species	K_W02, K_W08	lecture	test
B10_W03	describe the basic ecological processes in the environment	K_W08	lecture	test
B10_U01	apply biomonitoring methods	K_U09	pract.	task completion
B10_U02	select and justify the choice of appropriate research methods for measurements used in biology and ecology	K_U09, K_U10, K_U22	pract.	task completion, drawing up a report on the exercise
B10_U03	is able to analyse nature documentation	K_U01, K_U22	pract.	task completion, drawing up a report on the exercise
B10_K01	is able to define priorities for the completion of a specific task	K_K03	pract.	discussion, observation

Additional elements

Specific learning content of each form of the course:	**Lectures:** Fundamentals of natural science methodology in the fields of biology and ecology. Levels of life organization. Ecological units. Ecological succession.

[1] Reference to the learning outcomes for the course of study (Pol. KEU)

	Indicator species of plants and animals. Biomonitoring. Local and global threats to the biosphere. Fundamentals of nature protection. **Project classes:** Studying the age and spatial structure of selected plant and animal populations – fieldwork. Characteristics of habitat conditions as a function of the ecological requirements of a biocenosis. Studying the similarity of biocenoses – similarity coefficients. Analysis of the course of ecological succession. Field methods for studying the course of ecological succession – permanent study plots, transect. Air biomonitoring studies (lichen scale) – fieldwork. Landscape monitoring – assessment using the straight line method. Operation of wastewater treatment plants, operation of equipment, analysis of individual treatment stages. Analysis of basic documentation of Natura2000 sites.

2. Protection of aquatic ecosystems

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
The specificity of aquatic habitats. Diversification of water-dependent ecosystems. Natural and economic importance of water ecosystems. Anthropogenic threats to aquatic ecosystems. Protection of water-dependent ecosystems.				
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture 15 hours; project classes: 15 hours Part-time studies: lecture: 5 hours; project classes: 10 hours			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference*	Form of classes	Means of verification and assessment of the learning outcomes
D1-5_W01	the natural and economic importance of aquatic ecosystems	K_W11 K_W15	L	test
D1-5_W02	the variability of ecosystems in relation to the aquatic environment	K_W11 K_W15	L	test
D1-5_U01	juxtapose and evaluate the natural and anthropogenic importance of aquatic ecosystems	K_U09 K_U17 K_U20	Pr	project evaluation
D1-5_U02	carry out a project on anthropogenic threats to aquatic ecosystems, and propose measures to protect these ecosystems	K_U09 K_U10	Pr	project evaluation
D1-5_K01	are ready to and understands the need to communicate to the public about threats and protection of aquatic ecosystems.	K_K02 K_K06	L	test

3. Waste management

Programme content ensuring the achievement of the learning outcomes for the course				
Topics related to the management of different types of waste and the ways of their recovery and disposal.				
Number of hours of classes in each form of study according to the study programme:	full-time studies: lecture – 15 h, project classes – 15 h part-time studies: lecture – 5 h, project classes – 10 h			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference*	Form of classes	Means of verification and assessment of the learning outcomes
C8_W01	define terms relevant to waste management in accordance with the Act	K_W07, K_W16	lecture	exam
C8_W02	have knowledge of waste management in a municipality and a company	K_W07, K_W18	lecture	exam
C8_W03	are able to determine the impact of waste on the environment	K_W07	lecture	exam
C8_W04	know the recovery and disposal technology for municipal waste and industrial waste recovery technologies	K_W07, K_W11	lecture	exam
C8_U01	prepare a waste management project for a given company	K_U01, K_U11, K_U20	pract.	task completion
C8_U02	identify the responsibilities of an entrepreneur in the field of waste management and are able to estimate the amount of municipal waste produced	K_U01, K_U04, K_U09	pract.	task completion
C8_U03	develop a waste management concept for the municipality in accordance with the given specifications	K_U01, K_U03, K_U11, K_U18, K_U22	pract.	task completion
C8_K01	are aware of the effects of waste management on society	K_K02, K_K06	lecture, pract.	discussion
C8_K02	identify, evaluate and resolve dilemmas related to the performed profession	K_K04	lecture, pract.	discussion

Additional elements

Specific learning content of each form of the course:	**Lectures:** Concepts and definitions based on the wording of the Act. Division of waste. History of waste management. Law in waste management, EU directives, laws, regulations. General principles in waste management, hierarchy of operations. Product life cycle. Waste in quantitative terms. Waste records – The Polish Waste Database. Obligations of the municipality and the entrepreneur in waste

	management. Waste management plans. Municipal waste, collection, accumulation, and transport systems. Methods of recovery and disposal, recycling, properties of waste. Municipal waste as a source of secondary raw materials. Automatic waste segregation – construction of modern sorting lines. Landfill gas and leachate management, monitoring, closure, reclamation of landfills. Biological recovery methods, composting, biogas. Thermal waste treatment. Bulky waste, household appliance waste, electronic waste, car wrecks. **Project classes:** Projects on waste management obligations based on study tours to companies (waste recovery and disposal facilities). Determination of waste streams in selected households.

4. Hydraulic engineering structures

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
Basic concepts related to hydraulic engineering structures. Division and discussion of hydraulic engineering structures. Design of selected hydraulic engineering structures.				
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture: 15 hours; project classes: 30 hours; Part-time studies: lecture: 5 hours; project classes: 10 hours			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference *	Form of classes	Means of verification and assessment of the learning outcomes
C10_W01	know the principles of hydraulic engineering structures design.	K_ W05, K_W06, K_W10, K_W16	lecture	test exam
C10_W02	know the principles of designing damming structures	K_ W05, K_W06, K_W10, K_W16	lecture	test exam
C10_W03	subdivide the various types of hydraulic engineering structures	K_ W05, K_W06, K_W10, K_W16	lecture	test exam

C10_U01	can calculate the parameters necessary for the correct design of selected hydraulic engineering structures	K_U03, K_U08, K_U18, K_U20	pract.	task completion
C10_U02	can design simple selected hydraulic engineering structures and regulating structures in river channels with flood protection	K_U03, K_U08, K_U18, K_U20	pract.	task completion
C10_K01	are aware of the technical developments in the field of hydraulic engineering structures and flood control aspects and are able to communicate these to the public	K_K06	lecture, pract.	discussion

Additional elements

Specific learning content of each form of the course:	**Lectures:** Basic concepts related to hydraulic engineering structures. Division of structures. Damming structures and their division. Earth dams. Stone, concrete and reinforced concrete dams. Weirs and their classification. Embankments, division of embankments and flood control structures. Regulatory structures on rivers and streams. Water reservoirs. Aqueducts, siphons, adits and lifts. Diaphragm walls. Water filtration in the ground. Drainage structures. **Project classes:** Design calculations of the lumen of openings of hydraulic structures. Filtration of water in different soils. Dike design. Calculation of water filtration under a damming hydraulic engineering structure. Drainage design.

5. Sewerage systems

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
Tasks and division of sewers, construction and design of sewerage systems				
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture 15 hours; project classes 30 hours Part-time studies: lecture 10 hours; project classes 15 hours			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference*	Form of classes	Means of verification and assessment of the learning outcomes
C11_W01	Know the classification of sewerage networks and the calculations and construction solutions for	K_W09, K_W10,	L	exam

	sewerage pipes, the execution of networks, materials used for the construction of networks	K_W12, K_W13, K_W14, K_W15		
C11_W02	Know the fittings of sewerage networks, sewage pumping stations	K_W10, K_W12, K_W13, K_W14, K_W15	L	exam
C11_W03	Are familiar with the regulations and guidelines for the design and construction of water supply systems	K_W10, K_W12, K_W13, K_W14, K_W15	L, Pr	exam, project execution
C11_U01	Are able to perform tasks related to the problems of design and execution of sewerage systems investments	K_U02, K_U03, K_U08, K_U09, K_U17, K_U18	Pr	project execution
C11_U02	Have skills and competences in the operation of sewerage networks and facilities on the network	K_U12, K_U13, K_U14	Pr	project execution
C11_U03	Can carry out calculations and design a simple sewage network	K_U03, K_U08, K_U09, K_U18, K_U20, K_U22	Pr	project execution
C11_K01	Critically evaluate the knowledge they have acquired	K_K01	L, Pr	discussion, project execution
C11_K02	Identify, evaluate and resolve dilemmas related to the performed profession	K_K04	Pr	project execution

Additional elements

Specific learning content of each form of the course:	**Lectures:** Sewage management, characteristics of sewage systems. Types of wastewater. Classification of sewage systems. Unconventional sewer systems. Pressure sewerage systems. Vacuum sewerage systems. General principles of gravity sewer network design, design assumptions, documentation, design stages. Sewer routing, sewer sinking, hydraulic calculations. Construction of gravity sewer networks. Earthworks, installation works, costs, operation. Reinforcement of sewer networks. Pump stations and sewage pumping stations. Requirements and tests for acceptance of sewerage networks. Safety rules for work on sanitary sewers. Repair and sealing of old sewer networks.

	Project classes: Design assumptions for a selected type of sewerage system. Calculations and design solutions for sewer lines. Design of sewerage networks including fittings.

6. Environmental monitoring

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
Basic knowledge of legal acts related to environmental monitoring. Structure, objectives and tasks of the State Environmental Monitoring. Monitoring of air quality. Monitoring of water quality. Monitoring of soil and ground quality. Monitoring of nature. Monitoring of noise. Monitoring of electromagnetic fields. Monitoring of ionising radiation. Monitoring of waste.				
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture: 15 hours; project classes 15 hours. Part-time studies: lecture: 5 hours; project classes 10 hours.			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference*	Form of classes	Means of verification and assessment of the learning outcomes
C12_W01	define monitoring objectives for individual environmental elements	K_W07	L	test
C12_W02	perform tasks related to the assessment of the state of the environmental elements	K_W07	L	test
C12_U01	prepare assessments of the condition of an environmental element	K_U01, K_U04, K_U11 K_U20 K_U15	Pr	task completion
C12_U02	choose the legal basis and recognise environmental monitoring techniques	K_U01, K_U04, K_U11 K_U20 K_U15	Pr	task completion
C12_U03	recognise threats to the environment and to human health and life	K_U01, K_U04, K_U11 K_U20 K_U15	Pr	task completion
C12_K01	are ready to carry out the tasks assigned to them in cooperation with team members	K_K03	L, Pr	Discussion

Additional elements

Specific learning content of each form of the course:	**Lectures:** Structure, objectives and tasks of the State Environmental Monitoring (Pol. PMŚ), Integrated Environmental Monitoring. Monitoring of air quality. Monitoring of water quality (surface, groundwater, Baltic Sea). Monitoring of soil and ground quality. Nature monitoring (species and natural habitats; birds of Poland). Monitoring of noise. Monitoring of electromagnetic fields. Monitoring of ionising radiation. Monitoring of waste (landfill sites). Use of technical and project documentation, data sheets, standards and instructions for carrying out environmental surveys. Analysis of results, compilation and recording of studies performed. **Project classes:** Surveys of the state of the environment based on the structure of seven subsystems: subsystem for monitoring air quality, water quality, soil and ground quality, nature, noise, electromagnetic fields, and ionising radiation. Reporting to the District Starosty, to the Marshal's Office, under the Voivodeship Environmental Protection Inspector. The National Centre for Emissions Management (KOBIZE). Polish Waste Database (BDO) system (computerised). Cost accounting – environmental charges. Environmental permit obtaining cycle.

7. Mechanics and strength of materials

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
Planar and spatial systems of forces. Point and rigid body kinematics and dynamics. Stress. Fatigue strength.				
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture 15 hours; laboratory classes 15 hours Part-time studies: lecture 5 hours; laboratory classes: 10 hours			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference*	Form of classes	Means of verification and assessment of the learning outcomes
B6_W01	Know the laws of mechanics needed to analyse static and dynamic systems and the principles of determining force equilibrium conditions including frictional forces.	K_W09	L	test
B6_W02	Recognise the effects of static forces on variable structures in mechanical engineering.	K_W09	L	test

B6_U01	Apply the laws of statics and dynamics to analyse loads on structures	K_U01, K_U09	L	task completion
B6_U02	Calculate loads on machine parts and determine the dimensions of these parts on the basis of strength and stiffness conditions.	K_U09	L	task completion
B6_U03	Are able to work in a team.	K_U22	L	observation
B6_K01	Determine priorities for the completion of a given task.	K_K03	L	observation

Additional elements

Specific learning content of each form of the course:	**Lectures:** Flat convergent force systems. Flat parallel force systems. Flat arbitrary force systems. Trusses. Spatial systems of forces. Friction. Point and rigid body kinematics. Principles of dynamics. Point and rigid body dynamics. Work, energy, power, efficiency. Normal and tangential stresses. Simple states of stress. Moments of inertia and strength ratios of bent and torsional sections. Bending and torsion. Complex states of stress. Fatigue strength. **Laboratory class:** Static tension test. Static compression test. Static shear test. Static bending test. Impact test. Hardness tests on metals. Stress measurements by strain gauging. Stress measurements under polarised light – elasto-optics.

8. Water management and protection

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
Water management and protection of water quantity and quality on a macro scale and in catchment areas; water management and regulation in Poland.				
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture: 15 hours.; project classes: 30 h Part-time studies: lecture: 5 hours; project classes: 10 h			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference *	Form of classes	Means of verification and assessment of the learning outcomes
C1_W01		K_W07	lecture	

C1_W02	describe extreme hydrological phenomena, the hydrological cycle, hydrological states and describe water flows	K_W07	lecture	Task evaluation
C1_W03	present the principles of water management, lists development directions and limitations	K_W07	lecture	Task evaluation
C1_W04	know the legal basis and significance of the water cadastre	K_W07	lecture	Task evaluation
C1_W05	identify and describe qualitative and quantitative threats to groundwater and surface water	K_W07	lecture	Task evaluation
	know the terms and definitions related to water management and water conservation			Task evaluation
C1_U01	carry out a complete and simplified water balance for a selected catchment area	K_U09, K_U11	pract.	Task evaluation
C1_U02	analyse water and wastewater management in different economic sectors	K_U01, K_U04, K_U11	pract.	Task evaluation
C1_U03	are able to apply the procedure of obtaining a water permit	K_U11, K_U17, K_U20	pract.	Task evaluation
C1_U04	interpret results of qualitative and quantitative analyses of groundwater and surface water	K_U01, K_U04, K_U11, K_U09	pract.	Task evaluation
C1_K01	understand the relationship between economic activities and the qualitative and quantitative risks to surface water and groundwater	K_K02	lecture, pract.	discussion

9. Water and wastewater technology

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course	
Purpose of wastewater treatment and water treatment. Legal requirements for the quality of wastewater discharged to a receiving body and the quality of water intended for human consumption. Basic processes, equipment and technological parameters of wastewater treatment and water purification processes.	
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture: 15 hours; project classes: 30 hours; laboratory classes: 15 hours Part-time studies: lecture: 10 hours; project classes: 20 hours

Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference*	Form of classes	Means of verification and assessment of the learning outcomes
C2_W01	technological systems of water purification, know the basic processes occurring during water purification; technological systems of sewage treatment plants, know the basic processes occurring during sewage treatment.	K_W11 K_W15	L, Pr, Lab	test evaluation of reports, evaluation of the project
C2_W02	types and application of wastewater pollution indicators and water quality parameters; methods of testing these parameter indicators.	K_W11 K_W16	L, Lab	test evaluation of reports
C2_U01	perform tasks related to water purification; apply appropriate processes in water purification; select relevant equipment in the process line of a water purification plant.	K_U09 K_U20	L	test
C2_U02	perform tasks related to wastewater treatment; apply relevant processes in wastewater treatment; select relevant equipment in the process line of a wastewater treatment plant.	K_U09 K_U20	L, Pr	test project evaluation
C2_U03	assess the quality of waste water and water on the basis of information on the value of waste water contamination indicators and water quality parameters; calculate and interpret values of technological parameters of activated sludge.	K_U09 K_U10 K_U20	L, Lab	test
C2_K01	carry out the tasks assigned to them in cooperation with other team members.	K_K03	P, L	project evaluation, evaluation of reports
C2_K02	communicate to the public the importance of maintaining proper surface water quality and the importance of water purification and wastewater treatment facilities.	K_K02 K_K06	L	test

10. Environmental protection

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course	
Basic concepts and definitions in environmental protection. Formation of the environment in the geological history of the Earth. Legal, organisational-economic and technical instruments in environmental protection. Types, sources and environmental impact of pollutants emitted to land and soil, water and air.	
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture 15 h, recitation class 15 h, laboratory class 15h Part-time studies: lecture 15h, recitation class 15h

Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference*	Form of classes	Means of verification and assessment of the learning outcomes
B4_W01	Define the environment and its elements.	K_W08	L	exam
B4_W02	Have knowledge of natural and anthropogenic pollution of the environment.	K_W08	L	exam
B4_W03	Know the specific environmental problems occurring in their commune/municipality and the general ones occurring in the Podkarpackie voivodeship and the country.	K_W08	L	exam
B4_U01	Interpret the quantities characterising environmental pollution.	K_U01	R, L	task completion
B4_U02	Prepare a paper on environmental protection.	K_U01, K_U04	R	task completion
B4_U03	Can assess the environmental impact of a simple technology.	K_U01	R	task completion
B4_U04	On the basis of a given procedure/instruction, perform determinations of basic indicators of pollution of selected elements of the environment.	K_U09, K_U10	L	performance of an experiment
B4_U05	Use tools and laboratory equipment and chemical reagents used in the physical and chemical analysis of environmental samples in a safe manner.	K_U09, K_U10	L	performance of an experiment
B4_U06	Report the course of the analyses performed and the results obtained in accordance with the guidelines received in this respect.	K_U09, K_U04	L	preparing a report
B4_U07	Are able to work individually and in a group, taking on different roles in the group.	K_U22	L	assessment of a laboratory exercise
B4_K01	Understand the need to provide the public with information and opinions on environmental protection achievements.	K_K06	L, R, Lab	discussion

Additional elements

Specific learning content of each form of the course:	**Lectures:** Basic concepts defining the environment, its components, environmental protection, types of raw materials, sustainable development. The natural environment, the functioning of nature, the food chain, cycles of elements (compounds) in nature, contemporary trends in nature conservation. Earth as a 'global village.' Legal instruments in environmental protection. EU

	legislation, domestic law, local law. Impact assessments, environmental reports. Economic instruments in environmental protection. Sources of environmental pollution, effects of emissions. Atmospheric problems, greenhouse effect, acid rain, ozone hole, dioxin and furan pollution. Anthropogenic atmospheric pollution by solids, gases, and aerosols. Engineering methods to reduce pollution. Formation and functions of soil in the environment. Types of soil pollution. Effects of atmospheric pollution on soils. Impact of radiation, noise, and vibration on the environment. Water environment. Surface waters, their quality, effects of pollution on water quality. Groundwater pollution. The geological environment, mineral resources and their role in the economy. Impact of exploration and mining activities on the environment. **Recitation class:** The environment around me – discussion with presentation of examples of contemporary effects of environmental destruction and the use of measures to restore the environmental value. Discussion of the methodology of working on the papers. Assignment of topics. Environmental law as the basic legal regulation of activities in the environment, discussion. The role of spatial planning in environmental protection, discussion. Tasks of the municipality in environmental protection, using the example of a selected municipality, discussion. Presentation of reports: Sources of pollution in my town/village. State of the atmosphere and ways to protect it in my town/village, discussion. Water and sewage management in my town/village, discussion. Legal forms of nature protection in Podkarpackie voivodeship. Areas of 'Natura 2000' in Podkarpackie voivodeship. Functioning of environmental protection inspection services in the Podkarpackie voivodeship. Environmental impact assessment for a selected industrial plant. **Laboratory class:** Organisation of classes. Rules and regulations of the laboratory. Principles of occupational health and safety in the laboratory. Spectrophotometric determination of selected substances in water and sewage samples. Spectrophotometric determination of selected substances in water and sewage samples. Determination of dry weight of total suspended solids and activated sludge index. Coagulation and coagulants and organic flocculation and polyelectrolytes in environmental protection. Monitoring of areas of special noise nuisance – field classes. Determination of selected atmospheric air pollutants. Determination of selected heavy metals in soil or ground samples.

11. Environmental geophysics

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
Basic issues in general geophysics. Methodology of geophysical research and interpretation of the results obtained for the determination of physical and mechanical parameters of ground-rock media and environmental studies.				
Number of hours of classes in each form of study according to the study programme:	full-time studies: lecture – 15 h, laboratory classes – 30 h part-time studies: lecture – 10 h, laboratory classes – 15 h			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference *	Form of classes	Means of verification and assessment of the learning outcomes
C18_W01	define basic geophysical terms	K_W02	lecture	test
C18_W02	describe basic geophysical properties of soils and rocks	K_W02	lecture	test
C18_U01	perform geophysical measurements using equipment presented in class in accordance with the survey methodology	K_U09, K_U10, K_U11, K_U22	pract.	task completion
C18_U02	perform measurements in a safe and appropriate (equipment maintenance) manner using geophysical equipment	K_U10, K_U14, K_U16, K_U22	pract.	task completion
C18_U03	compile and present reports on geophysical surveys carried out	K_U04, K_U09, K_U11, K_U22	pract.	task completion
C18_K01	are willing to communicate to the public new developments in the application of geophysics to the search for environmental objects in the ground	K_K06	lecture, pract.	discussion

Additional elements

Specific learning content of each form of the course:	**Lectures:** Characteristics of applied geophysics. Advantages and disadvantages of geophysical surveys. Gravimetry – physical fundamentals; principles of measurement; processing of results; gravimetry in practical research. Seismics – physical fundamentals. Borehole acoustic profiling. Practical use of seismic and acoustic surveys. Geomagnetics – physical foundations; principles of measurement; development of test results; use of test results in practice. Geo-electrics – physical

	fundamentals. Surface geoelectric methods. Interpretation of survey results and their practical use. Radiometry – physical basis of radiometric surveys. Drilling radiometric methods. Geothermics – physical fundamentals. Drilling thermometry methods. Interpretation of test results in practical application. Use of geophysical surveys in ground investigation and environmental protection. Geo-radar method – physical fundamentals, application in soil mechanics. Geo-radar equipment. Results of geo-radar surveys – principles of interpretation. Advantages and disadvantages of the geo-radar method. **Laboratory class:** Charts of anomalies of two- and three-dimensional bodies in a rock medium. Mapping the distribution of gravity anomalies. Seismic surveying. Investigation of soil compaction using a light dynamic footing within the PANS site in Krosno. Location of underground infrastructure using a GPR within PANS premises in Krosno. Location of geological strata using GPR. Investigating the location of cables and metals on PANS premises in Krosno using cable and metal detectors. Electrical resistivity surveying of the subsoil. Summary of the class.

12. Drainage systems

Elements of the study programme

Programme content ensuring the achievement of the learning outcomes for the course				
Current requirements of drainage and irrigation drainage systems. Design of components of these systems.				
Number of hours of classes in each form of study according to the study programme:	Full-time studies: lecture 20 hours; project classes 40 hours Part-time studies: lecture 10 hours; project classes 15 hours			
Description of the learning outcomes for the course				
Course outcome code	Students who have successfully completed the course know and understand/are able to/are ready to:	KEU reference *	Form of classes	Means of verification and assessment of the learning outcomes
D1-1_W01	Know the types, principles and scope of land reclamation and drainage in rural and urban areas	K_W10, K_W13, K_W14	L	Exam
D1-1_W02	Define problems related to the necessity of drainage	K_W10, K_W14	L	Exam
D1-1_U01	Are able to assess the suitability of drainage solutions and identify the optimum solution	K_U01, K_U11, K_U20	L, Pr	Project execution
D1-1_U02	Are able to make drainage calculations	K_U08, K_U09,	L, Pr	Project execution

		K_U13, K_U18		
D1-1_U03	Can carry out drainage system design	K_U08, K_U09, K_U13, K_U18, K_U22	Pr	Project execution
D1-1_K01	Identify, evaluate and resolve dilemmas related to the performed profession	K_K04	Pr	Discussion, task performance

Additional elements

Specific learning content of each form of the course:	**Lectures** Types of land reclamation and drainage in rural and urban areas. Natural basis of drainage. Principles and scope of water drainage. Polders, floods. Interrelationship of land management and drainage infrastructure elements. Linking land reclamation with irrigation. **Project classes** Conceptual design of the drainage of a building plot for a building. Conceptual design for drainage of a selected area.