SZKOŁA GŁÓWNA GOSPODARSTWA WIEJSKIEGO

Study programme

Environmental Engineering

Faculty:	Faculty of Civil and Environmental Engineering
Level of study:	second cycle (post-engineering degree)
Education profile:	General academic
Form of study:	full-time studies
Academic year:	2023/24

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Basic information

Faculty name:	Faculty of Civil and Environmental Engineering
Major name:	Environmental Engineering
Level of study:	second cycle (post-engineering degree)
Profile of study:	General academic
Form of study:	full-time studies
Duration of studies (number of semesters):	3
Number of ECTS required to complete the studies:	90
The number of ECTS points a student obtains during classes conducted with the direct participation of academic teachers or other persons conducting classes:	47
Professional title awarded to graduates:	magister inżynier
ISCED code:	0712
Language of study:	english

Assigning the major to the fields and disciplines to which the learning outcomes relate

Environmental engineering, mining and energy	100%

Major characteristics

Major characteristics

The educational program in the field of Environmental Engineering supports the creation of a didactic offer within the field of engineering, technical and natural sciences. Such offer of education enables students to gradually acquire knowledge, qualifications and competence in the professional work of a master of engineering. The study program includes basic subjects, such as chemistry or statistics, and a wide range of directional, major subjects. In the block of obligatory classes, they introduce the subject of environmental monitoring and air protection; water supply and sewage systems and technology of installation works; issues related to environmental geotechnics and landfills, alternative energy sources, or reliability of engineering systems and spatial planning. A group of subjects concerns issues in the field of river engineering, i.e. river restoration, flood hazards and retention reservoirs. Moreover, the students also participate in the Modern Engineering in Water Management specialization. The English-language specialization aims to develop international cooperation between students and academic staff. The subjects of that specialization extend the directional learning outcomes, related to the student's area of interest and the matter of the diploma thesis and have been planned for all relevant semesters. Their task is to expand the educational offer in accordance with the needs of the labor market. Projects and design work, independently performed by students, enables the acquisition of skills that are sought after on the labor market, e.g. knowledge of the basic principles of analysis, construction design, implementation and operation of selected engineering facilities, the ability to use computer programs supporting calculations and design. During their studies, students continue learning a foreign language at the B2+ proficiency level of the Common European Framework of Reference for Languages. An important element of the program is a two-semester diploma seminar helping students prepare their master's thesis. Second-cycle studies end with a diploma examination combined with the defense of a master's thesis.

Learning objectives

Education in the field of Environmental Engineering at the Warsaw University of Life Sciences is realized in the spirit of the University's strategy, which prioritizes the achievement of a high level of education of graduates and the promotion of staff for the economic, necessary social and intellectual development of the country. The studies end with obtaining the professional title of Master of Science, and the achieved learning outcomes enable the acquisition of competences specified in the requirements of the Polish Qualifications Framework in the field of technical sciences at level 7.

Education concept

The concept of education in the field of Environmental Engineering is based on the strategy of the Warsaw University of Life Sciences and the strategic goals included therein. The mission of the Warsaw University of Life Sciences is to serve the intellectual, social and economic development of Polish society and the international community, with particular emphasis on sustainable development of rural areas, food economy and the extensively understood natural environment (Strategy of the Warsaw University of Life Sciences until 2030) The vision of the Warsaw University of Life Sciences and the Faculty of Civil and Environmental Engineering in the field of education is focused on
- a high level of knowledge and practical skills of the graduates,
- developing competences useful on the labor market,
- high student mobility,
- providing laboratory, IT and library infrastructure respectful of the teaching needs.
- providing a friendly and non-discriminatory place to study.

Education in the field of Environmental Engineering enables students of first-grade studies to acquire the knowledge, skills and competences indispensable for the professional career of a master engineer, and the high level of this education allows to adapt to the requirements of the labor market. The study program provides the learning outcomes necessary to continue education at third-cycle studies in the discipline of Environmental Engineering, Mining and Energy or in related disciplines.

Description of work placement (if provided for in the study programme)

Graduate profile

The graduate has knowledge and skills in the field of planning, design, construction and operation of sanitary engineering facilities (water supply, sewage systems, water treatment plants and sewage treatment plants), hydrotechnical and hydraulic structures, water engineering, landfills and water management systems. Graduates can take a job as a designer, contractor and executor of investments in the field of sanitary structures, networks and installations, waste management, development and reclamation of the environment, as well as within their own business activity related to the design and execution, distribution of materials and installations in the field of environmental engineering . Studies in the field of Environmental Engineering give the opportunity to obtain education on engineering issues related to the natural environment utilization for human needs.
A graduate of the course can find a job in design offices, contractor companies, construction supervision, municipal economy enterprises, state and local government administration units as well as in scientific and research institutes. After the graduation from the second-cycle studies are also prepared to continue education at Ph.D. studies, and have the ability to acquire, integrate, interpret and critically evaluate information, also in a foreign language. It should be stressed they are also ready to responsibly and reliably analyze and evaluate the results of their own and third-party work, formulate conclusions and opinions in the field of environmental engineering, able to convey knowledge and information to the public in a comprehensible way.

Learning outcomes

Knowledge

Code	Content	PRK
EE_K4_W01_inz	The graduate knows and understands selected fields of mathematics, physics and chemistry, which form the basis for formulating and solving complex tasks in the field of environmental engineering	P7S_WG
EE_K4_W02_inz	The graduate knows and understands issues in the field of industry legal and environmental regulations; knows the standards and guidelines of design, including standards in force in EU countries, regarding the planning, design and operation of facilities in environmental engineering	P7S_WG
EE_K4_W03_inz	The graduate knows and understands the basic technologies of alternative energy sources and methods of their use	P7S_WG
EE_K4_W04_inz	The graduate knows and understands the principles of operation, design and application of devices and technologies protecting atmospheric air; knows the factors posing acoustic hazard and active and passive means of noise protection	P7S_WG
EE_K4_W05_inz	The graduate knows and understands the methods of research and assessment of the impact of human activities and facilities on the environment; knows the methods of forecasting the spread of pollutants in it; knows the principles of designing and implementing protections as well as methods of cleaning and directions of development of degraded areas	P7S_WG
EE_K4_W06_inz	The graduate knows and understands the origin and properties of natural and anthropogenic soils and their use in earth and hydrotechnical structures; knows the principles of determining and documenting soil and water conditions	P7S_WG
EE_K4_W07_inz	The graduate knows and understands in an extended degree issues in the field of sustainable development; knows the formal and legal basis, principles and basic methods and techniques used in spatial planning, engineering and environmental protection	P7S_WG
EE_K4_W08_inz	The graduate knows and understands the principles of design, implementation and operation of complex systems and water supply and sewage systems as well as selected elements of sanitary, gas, heating and air conditioning installations	P7S_WG
EE_K4_W09_inz	The graduate knows and understands the principles of planning, design, execution and operation of complex structures and objects in environmental engineering, including those implemented for the needs of use, protection, reclamation and restoration of the environment	P7S_WG
EE_K4_W10_inz	The graduate knows and understands selected international environmental monitoring programs and the legal basis of PMŚ in Poland; has knowledge of environmental databases and measuring instruments used in environmental monitoring	P7S_WG
EE_K4_W11_inz	The graduate knows and understands issues in the field of systemic quality management in relation to the product, environment and safety; has basic knowledge of the life cycle of products and systems and their eco-design	P7S_WG
EE_K4_W12_inz	The graduate knows and understands in an extended scope hydrological and fluvial processes; knows the principles of their modeling and determining characteristics for planning and design purposes, including those related to flood protection	P7S_WG
EE_K4_W13_inz	The graduate knows and understands the basic concepts of the theory of reliability of systems and technical systems as well as methods of risk analysis and management	P7S_WG

Code	Content	PRK
EE_K4_W14_inz	The graduate knows and understands the basic concepts and principles of industrial property protection and copyright; can use patent information resources	P7S_WK
EE_K4_W15_inz	The graduate knows and understands issues related to organization and management, including quality management and conducting business in the field of environmental engineering; has knowledge of the application of labor norms and norms as well as the organization and management of construction	P7S_WK
EE_K4_W16_inz	The graduate knows and understands the basic microeconomic concepts used in business activity and methods and techniques for solving typical economic issues in the field of environmental engineering	P7S_WK

Skills

Code	Content	PRK
EE_K4_U01_inz	The graduate is able to use analytical, experimental and simulation methods, including the use of computer programs, to solve engineering tasks and simple research problems in the field of environmental engineering; is able to interpret and critically evaluate the results obtained	P7S_UW
EE_K4_U02_inz	The graduate is able to develop a program of environmental research, conduct their analysis and assess the state of the environment, select appropriate methods and techniques of protection, reclamation and restoration of the environment, and design appropriate devices and protections	P7S_UW
EE_K4_U03_inz	The graduate is able to choose the location of selected buildings and environmental engineering objects, assess their impact on the environment, choose a construction solution, control the conditions of execution, operation and reclamation	P7S_UW
EE_K4_U04_inz	The graduate is able to design, manufacture and operate devices and elements of water supply and sewage systems as well as selected elements of sanitary, gas, heating and air conditioning installations	P7S_UW
EE_K4_U05_inz	The graduate is able to combine engineering tasks at the level of design, implementation and operation with environmental issues	P7S_UW
EE_K4_U06_inz	The graduate is able to organize work on the construction site in accordance with the principles of technology and organization of construction, draw up schedules of construction works taking into account the elements of risk	P7S_UW
EE_K4_U07_inz	The graduate is able to collect and analyze data on the existing conditions for the development of a given area and use them as a basis for developing their own land development concept	P7S_UW
EE_K4_U08_inz	The graduate is able to conduct a simple microeconomic and macroeconomic analysis of environmental engineering projects	P7S_UW
EE_K4_U09_inz	The graduate is able to assess the degree of security of engineering systems	P7S_UW
EE_K4_U10	The graduate is able to obtain information in the field of environmental engineering from literature, databases and other sources, including in a foreign language; is able to integrate the information obtained, interpret and critically evaluate it, draw conclusions and formulate and substantiated opinions	P7S_UK
EE_K4_U11	The graduate is able to prepare in Polish and English a well-documented engineering study and has the ability to present orally detailed issues in the field of environmental engineering	P7S_UK
EE_K4_U12	The graduate is able to communicate in a foreign language, including knowledge of technical language elements in the field of environmental engineering	P7S_UK

Code	Content	PRK
EE_K4_U13	The graduate is able to work independently and cooperate in a team on the assigned task; takes care of the safety of own and the team's work	P7S_UO
EE_K4_U14	The graduate is able to determine the directions of further learning and implement the process of self-education in the field of environmental engineering; can inspire and organize the learning process of others	P7S_UU

Social competence

Code	Content	PRK
EE_K4_K01	The graduate is ready for a responsible and reliable analysis and evaluation of the obtained results of his own and external works	P7S_KK
EE_K4_K02	The graduate is ready to take into account non-technical aspects and effects of engineering activity, including its impact on the environment	P7S_KK
EE_K4_K03	The graduate is ready to describe the results of his own work, formulate conclusions and opinions on issues in the field of environmental engineering; providing the public with knowledge and information in the field of environmental engineering in a communicative and universally understandable way	P7S_KO
EE_K4_K04	The graduate is ready to create and develop forms of individual professional activity, is ready to act in an entrepreneurial way	P7S_KO
EE_K4_K05	The graduate is ready to act in accordance with the principles of ethics	P7S_KR

Study plan

Semester 1

In semester 1, students complete library training and a health and safety course on a platform available at https://szkolenia.sggw.pl

Subject	Number of hours	ECTS points	Form of verification	
OHS training	OHS training: 4	0	Pass	O
Environmental monitoring	Lecture: 15 Auditorium exercises: 5 Field exercises: 10	2	Exam	O
Spatial planning	Lecture: 15 Project exercises: 15	2	Pass with grade	O
Engineering of air pollution control	Lecture: 15 Auditorium exercises: 6 Project exercises: 7 Field exercises: 2	3	Exam	O
Statistics	Lecture: 20 Auditorium exercises: 20	3	Exam	O
Waterworks and sewage systems	Lecture: 20 Project exercises: 20	4	Exam	O
Water reservoirs	Lecture: 20 Project exercises: 20	4	Exam	O
Renewable energy resources	Lecture: 20	1	Pass with grade	O
Reliability and safety of engineering systems	Lecture: 15 Laboratory exercises: 15	3	Pass with grade	O
Foreign language I	Auditorium exercises: 30	2	Pass with grade	G
Foreign language I	Auditorium exercises: 30	2	Pass with grade	F
Diploma seminar I of specialization modern engineering in water management	Auditorium exercises: 15	2	Pass with grade	O
Remote Sensing Environment	Lecture: 10 Laboratory exercises: 10	2	Pass with grade	O
Modern engineering in water management	Contact hours: 20	2	Pass with grade	G
UAV/UAS environmental application	Lecture: 10 Laboratory exercises: 5 Field exercises: 5	2	Pass with grade	F
Water footprint and virtual water trade	Lecture: 10 Project exercises: 10	2	Pass with grade	F

Subject	Number of hours	ECTS points	Form of verification	
Water structures in environment	Lecture: 10 Laboratory exercises: 10	2	Pass with grade	F
Sum	**349**	**30**		

Semester 2

Subject	Number of hours	ECTS points	Form of verification	
Economics of environmental engineering	Lecture: 15 Project exercises: 30	3	Exam	O
Chemistry in environmental engineering	Lecture: 20 Laboratory exercises: 10 Project exercises: 10	3	Exam	O
River restoration	Lecture: 15 Auditorium exercises: 4 Project exercises: 20 Field exercises: 6	3	Exam	O
Environmental geotechnics	Lecture: 15 Project exercises: 15	3	Exam	O
Waste landfills	Lecture: 15 Project exercises: 15	2	Pass with grade	O
Technology and organization of installation works	Lecture: 15 Laboratory exercises: 9 Project exercises: 6	2	Pass with grade	O
Environmental management	Lecture: 15 Project exercises: 20 Field exercises: 10	2	Pass with grade	O
Foreign language II	Auditorium exercises: 30	2	Pass with grade	G
Foreign language II	Auditorium exercises: 30	2	Pass with grade	F
Urban Hydrology	Lecture: 10 Laboratory exercises: 10 Project exercises: 10	2	Pass with grade	O
Programing and scripting	Lecture: 10 Laboratory exercises: 10 Project exercises: 10	2	Pass with grade	O
Urban Hydrological Modeling	Lecture: 10 Laboratory exercises: 5 Project exercises: 15	2	Pass with grade	O

Subject	Number of hours	ECTS points	Form of verification	
Modern engineering in water management	Contact hours: 60	4	Pass with grade	G
Numerical Modeling of Hydrosystems	Lecture: 10 Laboratory exercises: 5 Project exercises: 15	2	Pass with grade	F
Engineering Surveying and Geoinformatic Applications	Lecture: 10 Project exercises: 15 Field exercises: 5	2	Pass with grade	F
Agricultural catchment modeling	Lecture: 10 Laboratory exercises: 10 Project exercises: 10	2	Pass with grade	F
Water Resources Management and Modeling	Lecture: 10 Project exercises: 20	2	Pass with grade	F
Groundwater and Soil Protection	Lecture: 10 Project exercises: 20	2	Pass with grade	F
Sum	**445**	**30**		

Semester 3

Subject	Number of hours	ECTS points	Form of verification	
Flood risk assessment	Lecture: 15 Project exercises: 30	3	Exam	O
Intellectual property management	Lecture: 10	1	Pass with grade	O
Diploma seminar II of specialization modern engineering in water management	Auditorium exercises: 15	2	Pass with grade	O
Climate change and consequences	Lecture: 15 Auditorium exercises: 15	2	Pass with grade	O
Modern engineering in water management	Contact hours: 30	2	Pass with grade	G
Urban Greenery and Forestry	Lecture: 15 Auditorium exercises: 5 Laboratory exercises: 10	2	Pass with grade	F
Fluid mechanics	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	F
Hydromorphological river quality assessment	Lecture: 15 Project exercises: 15	2	Pass with grade	F
Ecosystem services	Lecture: 10 Laboratory exercises: 10 Field exercises: 10	2	Pass with grade	F

Subject	Number of hours	ECTS points	Form of verification	
Dissertation	Diploma thesis: 0	20	Exam	G
Dissertation	Diploma thesis: 0	20	Exam	F
Sum	**130**	**30**		

O - Obligatory subjects
G - Mandatory group
F - Elective subjects

Subject name:		Environmental monitoring	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	The objectives and scope of environmental monitoring at various scales, the range of activities, and regulations concerning environmental protection.	EE_K4_W10_inz
	W2	The main themes of conventions and protocols relating to air pollution control and their resulting obligations	EE_K4_W10_inz
	W3	The basic and most frequently used methods for measuring the quality and quantity of water, with particular emphasis on measurement methods using sensors	EE_K4_W05_inz, EE_K4_W10_inz
Skills: (In terms of skills, the graduate can)	U1	To select measurement methods based on the monitoring needs of specific air pollutants, with special consideration given to reference methods	EE_K4_U02_inz
	U2	To prepare a plan for a water quality and quantity monitoring system for a selected river, taking into account the system's costs	EE_K4_U01_inz, EE_K4_U10, EE_K4_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	To communicate information to society regarding the impact of environmental monitoring, particularly information systems on water quality and quantity and how they affect human life	EE_K4_K02, EE_K4_K04
Course content ensuring the achievement of learning outcomes:		Legal foundations of environmental monitoring, transboundary transfer of pollutants and waste, international environmental monitoring programs (GEMS, HELKOM, EMEP, EIONET, EUROAIRNET, INTEGAIRE, and others), Poland's commitments arising from ratified international agreements on emission reduction, and the organization of the State Environmental Monitoring. Monitoring of air quality, noise, ionizing radiation, quality of inland surface waters, quality of inland groundwater, quality of the Baltic Sea, soil and land quality. Measuring devices used in environmental monitoring. Methods for measuring different elements of the natural environment, and discussion of the quantitative characteristics of selected pollutants. Construction, operating principles, and maintenance of selected measuring instruments.	
Examination methods:		Written exam, Project, Assessment of activity during classes	

Subject name:		Spatial planning	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	legal, institutional and organizational conditions of spatial planning in Poland	EE_K4_W02_inz, EE_K4_W07_inz
	W2	selected methods of spatial analysis, the scope and structure of basic planning documents and the rules for using them	EE_K4_W02_inz, EE_K4_W07_inz
Skills: (In terms of skills, the graduate can)	U1	individually and collectively collect data and analyze supra-local and local development conditions (natural, socio-economic, infrastructural, cultural)	EE_K4_U07_inz, EE_K4_U13
	U2	draw conclusions from analyzes of development conditions and formulate indications for development useful in making planning decisions	EE_K4_U07_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	elaborate the results of spatial analyzes and conclusions regarding spatial planning and development in a clear, understandable and adequate to the scope and scale of the problem	EE_K4_K03
Course content ensuring the achievement of learning outcomes:		The practical examples, including functions for plan-oriented analysis of localization or consequences of plan implementation, are explained. The course will include basic geographical data and reference systems, cartography and cartographic methods relevant to the needs and scope of physical planning. It will also raise awareness of the complexity of the planning process and its interdisciplinary, developing students' ability to deal with complex phenomena, issues and situations and their potential for professional activities that demand considerable independence or for research and development. Students will elaborate on their research topic - globalization, urban planning and social justice in the context of a specific developing country through group and individual project work. Cases investigated will include Local and Regional Development Theory and Policy, main methods for analysing critical elements of regions' development trends and prospects in GIS, introduction to some socio-spatial and process ideas on how and why to develop spatial strategies, land use analyses in spatial planning – methods and tools (GIS-based), Case study - neighbourhood planning, the role of public participation, theoretical challenges in planning for globalisation and sustainable development – pluralism and assessment (concepts of sustainability and resilience in planning are introduced), the role of green spaces in city planning – analysis of spatial distribution, Planning for Flood risk management and sustainable development, introduction to socioeconomic equity issues - methods to identify inequality issues in an urban environment, basing on green areas available to residents.	
Examination methods:		Written credit, Project	

Subject name:		Engineering of air pollution control	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	selected processes and devices for dedusting industrial and flue gases	EE_K4_W04_inz
	W2	selected processes and equipment that are used to clean gases from gaseous pollutants	EE_K4_W04_inz, EE_K4_W05_inz
	W3	sound propagation in the environment	EE_K4_W04_inz
Skills: (In terms of skills, the graduate can)	U1	perform measurements of basic parameters characterizing noise in the environment	EE_K4_U01_inz, EE_K4_U02_inz
	U2	provide examples of potential corrective actions related to the reduction of nuisance from different categories of emission sources	EE_K4_U02_inz, EE_K4_U03_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	acting in an entrepreneurial way, taking into account non-technical aspects and effects of engineering activities in the area of air protection	EE_K4_K02, EE_K4_K04
Course content ensuring the achievement of learning outcomes:		Methods of reducing pollutant emissions to the atmosphere. Modernization of the technological process, fuel change, and purification installations. Methods of dedusting flue gas and industrial gases. Methods and systems for removing acid-forming gases; industrial gas desulfurization methods and systems; methods of catalytic purification of industrial gases and car exhaust gases. Fundamentals of acoustics. Noise criteria. Sources of mechanical and acoustic vibrations. The impact of noise on the human body: the impact of noise on the hearing organ; non-auditory effects of noise. Methods of reducing the noise level in the environment. Noise level monitoring: systems for measuring and analyzing noise parameters; environmental noise measurements; acoustic climate concept. Field noise level measurements: measurements within the campus of the Warsaw University of Life Sciences, elaboration and interpretation of measurement results. Principles of designing acoustic screens, calculations of leakage of acoustic partitions. Principles of drawing up remedial air protection programs (POP) in zones.	
Examination methods:		Written exam, Assessment of activity during classes, Project, Report	

Subject name:		Statistics	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the basics of probability theory	EE_K4_W01_inz
	W2	the basics of statistical inference	EE_K4_W01_inz
Skills: (In terms of skills, the graduate can)	U1	analyze simple data in a statistical program	EE_K4_U01_inz, EE_K4_U14
	U2	draw conclusions from statistical analyses	EE_K4_U09_inz, EE_K4_U10
Social competences: (Within the scope of competence, the graduate is ready to)	K1	perform simple data analysis and evaluate its results	EE_K4_K01
	K2	apply the statistical methods in risk assessment estimation	EE_K4_K01
Course content ensuring the achievement of learning outcomes:		Basics of probability calculus, the concept of a random variable, probability distributions (binomial, Poisson, normal, log-normal, exponential), issues of linear and non-linear regression, methods for estimating distribution parameters, confidence intervals, testing hypotheses (significance and agreement tests). Elements of data analysis and introduction to the statistical package R.	
Examination methods:		Written credit, Test (written or computer based), Assessment of activity during classes	

Subject name:		Waterworks and sewage systems	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	construction and principles of operation for surface water intakes, devices used for surface water treatment, storm overflow, sewage pumping stations, sewage pumping stations, as well as the principles of designing bank-chamber intakes, radial wells, rapid filters for water treatment, peripheral water supply network, storm overflow, sewage pumping stations	EE_K4_W08_inz
	W2	construction and principles of operation of gravity small–diameter sewage system	EE_K4_W08_inz
	W3	requirements and research for the acceptance of sewage and water networks	EE_K4_W08_inz, EE_K4_W13_inz
Skills: (In terms of skills, the graduate can)	U1	design bank-chamber intake, radiant well, rapid filter for surface water treatment, and sewage pumping station	EE_K4_U04_inz
	U2	perform necessary hydraulic calculations for the peripheral sewage system and gravity small–diameter sewage system. Is able to design a storm overflow on a gravity-combined sewage system	EE_K4_U04_inz, EE_K4_U11
Social competences: (Within the scope of competence, the graduate is ready to)	K1	act in an entrepreneurial way and act in accordance with the principles of ethics in the field of calculations of water and sewage networks	EE_K4_K04, EE_K4_K05
Course content ensuring the achievement of learning outcomes:		Edge-ventricular approach. The radiant well. Waterworks station for surface water treatment. Perimeter water supply network. Small-diameter gravitational sewage network. Sewage pumping station. Storm overflow on the gravitational combined sewage network.	
Examination methods:		Written exam, Written credit, Project	

Subject name:		Water reservoirs	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	Construction and operation of reservoir spillway and outlet works, their purpose and operating conditions, principles of their design and operation	EE_K4_W03_inz, EE_K4_W09_inz
	W2	Principles of the design and operation of earth dams, their construction, purpose and working conditions	EE_K4_W06_inz, EE_K4_W09_inz
Skills: (In terms of skills, the graduate can)	U1	Design the dam and reservoir spillway, determine the environmental impacts of the reservoir and develop a list of impacts	EE_K4_U01_inz, EE_K4_U02_inz
	U2	Use Internet resources and selected computer programs, make drawings of structures damming water reservoirs, prepare a well-documented engineering study in Polish	EE_K4_U09_inz, EE_K4_U10, EE_K4_U11
Social competences: (Within the scope of competence, the graduate is ready to)	K1	To take into account non-technical aspects and impacts of engineering activities, including their impact on the environment, and to act in accordance with the principles of ethics	EE_K4_K02, EE_K4_K05
Course content ensuring the achievement of learning outcomes:		Classification of water reservoirs, basic structures and facilities. Location criteria, (topography, hydrology, geology and geotechnical conditions). Water management on reservoirs, water requirements, capacity, area and storage volume characteristics. Reservoir site inspection and investigation, site selection for dam construction. Selection of type of dam (classification of types, factors governing selection of type). Foundation and construction materials. Earthfill dams (design data and criteria, seepage flow through the embankment, foundation and abutments, drainages, cutoff trenches, grouting, upstream and downstream slope protection). Stress state, settlements and slope stability analyses. Spillways (selection of inflow design flood, spillway size, types and components, spillway layout, hydraulics of spillways). Outlet works (functions, arrangements and location, components, hydraulic design). Dam operation, maintenance and safety (monitoring equipment, periodic dam safety evaluation). Influence of the reservoirs on the site (ecological and environmental considerations). Project of the reservoir with embankment dam, other structures and facilities: general description; reservoir – site selection, assumption of normal water level characteristic curves of the reservoir, shallow and deep water waves; hydrology; dam – foundation, material for embankment, dam cross-section selection and embankment design, seepage and stability analyses; spillway and outlet works; the influence of the reservoirs on the site.	
Examination methods:		Written exam, Project	

Subject name:		Renewable energy resources	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	about power installations of renewable energy sources including their construction, purpose and operating conditions	EE_K4_W02_inz, EE_K4_W03_inz, EE_K4_W09_inz
	W2	about legal aspects of renewable energy sources, understands their influence on environment, is able to identify the use of local renewable energy sources	EE_K4_W02_inz, EE_K4_W07_inz
	W3	the local renewable energy sources utility routine basing on science and technology achievements and communicate opinions about them	EE_K4_W03_inz
Skills: (In terms of skills, the graduate can)	U1	develop hydropower curves and can make technological drawings of hydropower plants	EE_K4_U01_inz, EE_K4_U03_inz, EE_K4_U07_inz
	U2	determine basic parameters of solar, wind, geothermal and biomass energy installations	EE_K4_U07_inz, EE_K4_U10
Social competences: (Within the scope of competence, the graduate is ready to)	K1	formulate conclusions on the benefits and limitations of using alternative energy sources, take into account non-technical aspects and effects of engineering activities, including their impact on the environment	EE_K4_K03
Course content ensuring the achievement of learning outcomes:		Energy sources and resources. Restrictions on renewable energy resources development. Legal basis of renewable energy investments. The role of renewable energy in the total energy system. Solar energy. Wind energy. Geothermal energy. Biomass energy. The energy of water. Basic concepts used in calculating the power of hydropower plants. Installation parameters, turbines of small hydropower plants selection. Turbine operating parameters and characteristics. Calculation of energy production in hydropower plants. The design of a small hydropower plant based on local conditions.	
Examination methods:		Written credit, Project	

Subject name:		Reliability and safety of engineering systems	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the basics of risk analysis theory and safety	EE_K4_W13_inz
	W2	the basics of reliability theory	EE_K4_W13_inz
Skills: (In terms of skills, the graduate can)	U1	apply the logic tree method in risk analysis	EE_K4_U01_inz, EE_K4_U09_inz
	U2	calculate the reliability indices of a technical facility	EE_K4_U01_inz, EE_K4_U09_inz
	U3	analyse reliability using the fault tree method	EE_K4_U01_inz, EE_K4_U09_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	participate in thematic discussions and argue his/her views on the reliability and safety of engineering systems	EE_K4_K03
Course content ensuring the achievement of learning outcomes:		Basic concepts of reliability theory. Reliability metrics. Reliability structure of technical systems. Reliability indicators - their selection in the assessment of the performance of engineering systems in environmental engineering. Criteria for reliability assessment of systems. Reliability analysis of technical objects and systems. Basic concepts in risk and safety analysis. Risk measures. Risk analysis methods - fault trees. Calculation of selected reliability indicators. Analysis of the reliability structure of selected engineering objects. The use of the fault tree method in reliability analysis. Application of the event tree method for hazard and risk analysis. Risk analysis project using the method of logical trees (event trees and fault trees) for technical objects selected by students.	
Examination methods:		Test (written or computer based), Project, Presentation	

Subject name:		Diploma seminar I of specialization modern engineering in water management	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	master's thesis in accordance with the provisions of intellectual property law	EE_K4_W14_inz
Skills: (In terms of skills, the graduate can)	U1	outline of the master's thesis based on their own research and literature sources and other sources of information and have the ability to make an oral presentation	EE_K4_U10, EE_K4_U11
	U2	software to collect, manage and cite bibliographic materials in accordance with the rules of copyright law	EE_K4_U10, EE_K4_U11
	U3	plan and implement their self-development in a selected area of environmental engineering related to the subject of the diploma thesis	EE_K4_U12, EE_K4_U14
Social competences: (Within the scope of competence, the graduate is ready to)	K1	ethical use of reliable bibliographic sources and their in-depth analysis	EE_K4_K01, EE_K4_K05
Course content ensuring the achievement of learning outcomes:		Characteristics of the diploma thesis. The role of the promoter. Requirements for the preparation of the diploma thesis. Formulating the topic and purpose of the work. Principles of completing literature, content analysis and taking notes. Copyright and plagiarism. Principles of citing literature and preparing a bibliography. Rules for the use of software for collecting, managing and citing bibliographic materials. Structure and methodology of work. Preparation of the outline of the master's thesis.	
Examination methods:		Presentation, Assessment of activity during classes	

Subject name:		Remote Sensing Environment	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	fundamental concepts of remote sensing and its applications	EE_K4_W01_inz, EE_K4_W07_inz
	W2	methods and techniques of GIS and remote sensing in environmental research	EE_K4_W01_inz, EE_K4_W07_inz, EE_K4_W12_inz
Skills: (In terms of skills, the graduate can)	U1	apply remotely sensed imagery and other spatial data in in practical applications (e.g. environmental protection, water resources assessment)	EE_K4_U01_inz, EE_K4_U10, EE_K4_U11
Social competences: (Within the scope of competence, the graduate is ready to)	K1	synthesize information from a range of different spatial sources – in relation to environmental science	EE_K4_K03
Course content ensuring the achievement of learning outcomes:		The knowledge on basic remote sensing and their application in environmantal science (e.g. monitoring and and assessment of the environmental stress, natural vegetation condition, precise agriculture, surface water identification and flood assessment, evapotranspiration, hydromorphology. Students will be provided with comprehensive skills in digital processing of remotely sensed data application of most commonly used open source software QGIS.	
Examination methods:		Test (written or computer based), Report	

Subject name:		Economics of environmental engineering	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	basic microeconomic concepts used in business economic	EE_K4_W15_inz, EE_K4_W16_inz
	W2	methods and techniques for solving typical economic problems in the field of environmental engineering	EE_K4_W11_inz, EE_K4_W15_inz, EE_K4_W16_inz
Skills: (In terms of skills, the graduate can)	U1	communicate with an economist and accountant	EE_K4_U10, EE_K4_U14
	U2	conduct macro- and micro-economic evaluation of environmental engineering projects	EE_K4_U08_inz, EE_K4_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	independently make a macro- and micro-economic evaluation environmental engineering projects	EE_K4_K02, EE_K4_K04
Course content ensuring the achievement of learning outcomes:		Basic concepts related to the economics of the enterprise. Micro and macroeconomics. Legal forms of enterprises. Types of costs in the enterprise. External costs. Types of fees for using the environment. Fixed assets and depreciation. Interest. Discounting. Financial and economic analysis. Evaluation of the economic efficiency of the project. Economic effects of the project.	
Examination methods:		Written exam, Project	

Subject name:		Chemistry in environmental engineering	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	chemical processes occurring in the environment and their importance in environmental engineering	EE_K4_W01_inz
	W2	methods of research and assessment of the impact of human activity and objects on the environment and the processes of pollutant dissemination in the environment	EE_K4_W05_inz, EE_K4_W10_inz
Skills: (In terms of skills, the graduate can)	U1	use analytical and experimental methods to solve engineering tasks and simple research problems in the field of environmental engineering; interpret and critically evaluate the obtained results; integrate the obtained information, interpret and critically evaluate it, draw conclusions and formulate reasoned opinions	EE_K4_U01_inz, EE_K4_U10
	U2	work together as a team on a given project task	EE_K4_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	calculate, analyze and interpret the results of laboratory tests	EE_K4_K01
Course content ensuring the achievement of learning outcomes:		Forms of occurrence of organic and inorganic substances in soil, water and air. Circulation of elements in the environment. Inorganic and organic chemical pollutants in the environment. The importance of knowing and understanding chemical processes in environmental engineering. Chemical reactions related to the process of self-purification of water. Chemical processes used in water and wastewater treatment. The role of geochemical processes in the assessment of pollutant migration. Chemical properties of elements and their occurrence in the soil environment. Chemical remediation of the soil and water environment. Air pollution and its environmental effects. The use of chemical processes in waste disposal. The use of chemical processes in the aspect of the circular economy.	
Examination methods:		Written exam, Project, Report	

Subject name:		River restoration	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the causes of the loss of naturalness and river ecosystem degradation	EE_K4_W09_inz
	W2	types of restoration works	EE_K4_W09_inz
Skills: (In terms of skills, the graduate can)	U1	conduct field studies and develop an inventory of the current state of the object (river, valley, water body)	EE_K4_U02_inz, EE_K4_U05_inz, EE_K4_U07_inz, EE_K4_U10
	U2	indicate the objectives of restoration and determine the desired effects of changes in the natural environment, propose a preliminary concept of the restoration of a degraded river, taking into account the existing barriers and limitations related to their economic functions	EE_K4_U02_inz, EE_K4_U11
Social competences: (Within the scope of competence, the graduate is ready to)	K1	responsible and reliable analysis and evaluation of the obtained results of their own and external works, to formulate conclusions and opinions on issues in the field of environmental engineering	EE_K4_K01, EE_K4_K02, EE_K4_K03
Course content ensuring the achievement of learning outcomes:		Morphology of natural and regulated rivers and valleys. Relationship of morphological characteristics of rivers and valleys and their biota. Needs, possibilities and scope of restoration. Objectives, scope and characteristics of restoration work. Restoration projects related to the morphodynamic activity. Restoration work in the bank zone, in the floodplain, in the tributaries and in the catchment area. Stages of the restoration process. Planning and preparation for the restoration work. Barriers and limitations of restoration. Legal aspects of the restoration of rivers. Identification and assessment of the current state of the river section and part of the valley. The concept of restoring a section of the river in a variant approach.	
Examination methods:		Written exam, Project	

Subject name:		Environmental geotechnics	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	methods of determining the local stability of landfills	EE_K4_W06_inz
	W2	principles of designing, conducting and analyzing environmental tests	EE_K4_W09_inz
Skills: (In terms of skills, the graduate can)	U1	assess the impact of the designed structure on the environment	EE_K4_U02_inz
	U2	design a treatment system for the soil-water environment	EE_K4_U03_inz
	U3	assess the impact of the environmental condition on the safety of the designed building	EE_K4_U03_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	taking into account non-technical aspects and effects of engineering activities, including their impact on the soil-water environment	EE_K4_K02
Course content ensuring the achievement of learning outcomes:		Definition of selected terms related to environmental geotechnics, sources of environmental pollution, characteristics of contaminated areas (examples); environmental principles in geotechnical design; assessment of the risk of contamination of the soil and water environment, rules for determining protection zones; methods of recognizing contaminated areas (e.g. geotechnical soundings, non-invasive methods); criteria for selecting the location of environmental engineering structures; engineering properties (physical and mechanical) of waste and their impact on the safety of landfills (stability of landfills and their deformability); technical requirements for structural elements protecting the environment (natural geological barriers, geomembranes, bentonite liners (GCL)); monitoring of environmental engineering structures; rules of conduct in cases of soil contaminated with chemicals; types of pollutants, the impact of their properties on the processes and degree of spreading in the ground, technical methods of their neutralization; definition of the MICP method, rules and conditions for stabilization of non-cohesive soils using microbiologically assisted precipitation of carbonates. Review of the methods of securing the ground environment in the vicinity of communication routes; selected issues related to the impact of pollutants on the geotechnical parameters of soils.	
Examination methods:		Written exam, Written credit, Project	

Subject name:		Waste landfills	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	solving complex issues in municipal construction; application of landfill legislation, standards and guidelines; landfill materials; the impact of landfills on the natural environment	EE_K4_W02_inz, EE_K4_W04_inz, EE_K4_W05_inz, EE_K4_W09_inz
Skills: (In terms of skills, the graduate can)	U1	assess complex impacts in the interaction: building structures - natural environment; design and dimension elements and structures in landfills; determine the geotechnical parameters of the substrate and waste; assess the risks to the structure and apply appropriate protections	EE_K4_U01_inz, EE_K4_U02_inz, EE_K4_U03_inz, EE_K4_U05_inz, EE_K4_U09_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	providing information on the environment, hazards and taking into account non-technical aspects and effects of engineering activities	EE_K4_K02
Course content ensuring the achievement of learning outcomes:		Amounts of generated waste in various sectors of the economy. Waste management strategy in EU regulations: COM-105 (97) and 99/31WE: - limiting landfilling of organic waste; - forms of recovery in waste management, - an adaptation of waste to storage; Landfill classifications. Principles of environmentally friendly storage of waste generated in various fields of activity. Regional installations. Legal, biological and technical methods of protection against the impact of landfills on the environment. Procedures on environmental impact assessments. Risk assessment for landfills. Migration routes of pollutants from landfills. Composition of leachate from landfills and assessment of groundwater contamination potential. Protection zones and restricted use areas. Selection criteria for the location of landfills include geological, hydrogeological, communication, economic and ecological criteria. Favourable and unfavourable conditions for the location of landfills. Restrictions on the location of landfills. Social acceptance. Properties of waste deposited in solid and wet waste landfills. Morphological composition of municipal waste. Properties and methods of testing waste properties and design recommendations for calculation parameters. Influence of waste properties on the stability of landfills and their deformability. Structural elements of landfills - technical requirements. Typical constructions of landfills and engineering systems in their bottom and cover: sealing, drainage, degassing, technical and biological reclamation, and communication system. Landfill seals. Subsoil as a natural geological barrier - requirements. Soil linings - principles of soil selection, construction and quality control. Geomembranes - types and properties, laying conditions, connections and tightness control, the influence of atmospheric and chemical factors on properties. Bentonite linings (GCL) - mechanism of action, types and properties, quality of bentonite and geosynthetics. Advantages and disadvantages of the seals used. Choice of the sealing method. Principles of safe operation of landfills. Equipment. Waste compaction and layer insulation. Degassing systems - types, body, operation control. Methods of landfill surface protection and reclamation. Vertical and horizontal barriers - types, materials, technologies. Drainage systems. Required structural elements of landfill cover - degassing layer, sealing, drainage, reclamation layer. Technical requirements and control tests of covering systems. Possibilities of developing the landfill area. Biological development of the surface and protection zone. Monitoring during the operation phase and after the closure of the landfill. Types of piezometers, principles of their installation in the ground and interpretation of observations. Sampling rules.	
Examination methods:		Oral credit, Project, Presentation	

Subject name:		Technology and organization of installation works	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the basic principles of planning and organization of installation works and is able to organize them	EE_K4_W02_inz, EE_K4_W08_inz, EE_K4_W15_inz
	W2	the basic rights and obligations of participants in the investment process	EE_K4_W02_inz
Skills: (In terms of skills, the graduate can)	U1	prepare a cost estimate of selected installation works and design documentation	EE_K4_U06_inz, EE_K4_U13
	U2	use to computer program for costing	EE_K4_U05_inz, EE_K4_U13
Social competences: (Within the scope of competence, the graduate is ready to)	K1	responsible and more reliable analysis and evaluation of the obtained results of his own and external works in the field of technology and organization of installation works	EE_K4_K01
Course content ensuring the achievement of learning outcomes:		The technology of installation works - technological principles of water supply (passage through obstacles, trenchless laying). Methods of making sewage pipes and heating networks. Assembly of internal systems. Conditions for collection, transport and storage of materials used in the construction of water supply and sewage systems. Organization and safety of workers in the execution of earthworks and assembly work in installation works. Organization of the construction process - in general, types of processes (auxiliary, essential, etc.), investment process, types of investments. Independent technical functions in construction (rights, duties and powers). Participants in the investment process (investor, investor's supervision inspector, construction manager, construction supervision - duties and rights, with particular emphasis on directional powers). Types of construction documents. Basic principles of preparing construction cost estimates, with particular emphasis on the principles of the bill of quantities for installation works. Principles of making cost estimates for works in the area of Public Procurement and commercial works.	
Examination methods:		Test (written or computer based), Project	

Subject name:		Environmental management	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the topic of integrated environmental management	EE_K4_W11_inz
	W2	principles of sustainable management of natural resources	EE_K4_W07_inz
	W3	principles of functioning of legal and economic tools and quality management systems in environmental protection	EE_K4_W02_inz, EE_K4_W11_inz
Skills: (In terms of skills, the graduate can)	U1	use legal and economic tools in environmental protection	EE_K4_U02_inz, EE_K4_U10
	U2	issue environmental decisions and opinions	EE_K4_U05_inz
Course content ensuring the achievement of learning outcomes:		System balance criteria. Recycling capacity of the ecosystem as a criterion for environmental management, Eco-development indicators. Legal and economic tools for the implementation of environmental policy, and reactions of business entities. Dematerialization of production processes and services. Marginal costs of pollution reduction. Valuation of environmental resources as non-market goods, the role of ecosystem services, cost-benefit analysis, quality management systems in resource protection, and environmental management systems. Voluntary and complementary tools, corporate social responsibility, environmental audits, certification and accreditation in environmental protection.	
Examination methods:		Essay, Assessment of activity during classes, Presentation	

Subject name:		Urban Hydrology	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	effects of human-induced pressure on hydrology of urban ecosystems	EE_K4_W05_inz, EE_K4_W12_inz
	W2	role of natural ecosystems in shaping city's hydrological conditions	EE_K4_W05_inz, EE_K4_W12_inz
	W3	environmental and social impact of nature based solution	EE_K4_W05_inz, EE_K4_W09_inz
Skills: (In terms of skills, the graduate can)	U1	competence in applying remote sensing data and GIS for urban hydrology	EE_K4_U01_inz
	U2	ability to analyse various sources of data for sustainable water management	EE_K4_U05_inz, EE_K4_U10
Social competences: (Within the scope of competence, the graduate is ready to)	K1	Ability to critically review existing data for sustainable water management in cities	EE_K4_K01, EE_K4_K03
	K2	Critical thinking how to better allocate green infrastructure in catchment scale	EE_K4_K01, EE_K4_K02, EE_K4_K03
Course content ensuring the achievement of learning outcomes:		Understanding of hydrological processes for spatial development. Students will develop their knowledge on hydrological processes and theories related to modelling processes. Theoretical concepts will be presented supported with hydrological models and supported with remote-sensing data. Special attention will be given to hydrological prognosis, flood prevention and mitigation methods applied in urban settings. The role of green and blue infrastructure and nature-based solutions in flood control will be discussed. Principles of urban hydrology, theories related to modelling processes and computational methods, flood risk analysis, flood and drought assessment and mitigation using mathematical models dedicated for water balance in urban catchment, the role of green infrastructure and nature based solutions (NBS) in shaping city's hydrological conditions, the environmental and social impact of impact of green infrastructure for sustainable urban development	
Examination methods:		Presentation, Report	

Subject name:		Programing and scripting	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	type and structure of data in R and QGIS software	EE_K4_W01_inz, EE_K4_W10_inz
	W2	about R syntax	EE_K4_W01_inz
Skills: (In terms of skills, the graduate can)	U1	usage of R Studio and QGIS software	EE_K4_U01_inz, EE_K4_U05_inz, EE_K4_U13
	U2	graphical presentation of various types of data	EE_K4_U01_inz, EE_K4_U05_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	present results of scientific research	EE_K4_K01, EE_K4_K03
	K2	analysis and assess results of scientific research	EE_K4_K01, EE_K4_K03
Course content ensuring the achievement of learning outcomes:		introduction to programming in R, presentation of other languages, R and RStudio an integrated development environment (IDE) for the R language, general information about writing in R, internet platforms for programmers.	
Examination methods:		Presentation, Report	

Subject name:		Urban Hydrological Modeling	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	Including the effects of human-induced pressure on flood simulation and pressure in sewer system	EE_K4_W05_inz, EE_K4_W12_inz
	W2	flood prevention techniques and drought mitigation methods	EE_K4_W05_inz, EE_K4_W12_inz
Skills: (In terms of skills, the graduate can)	U1	competence in applying hydrological modelling for water balance and urban flood simulation	EE_K4_U01_inz
	U2	ability to analyse and describe various land management scenarios for modelling	EE_K4_U05_inz, EE_K4_U11
	U3	ability to link hydrological model with hydraulic model and coupling hydraulic model with urban flood model	EE_K4_U01_inz, EE_K4_U03_inz, EE_K4_U05_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	ability to critically review existing data and publications for development of flood risk and inundation scenarios in urbanised catchment	EE_K4_K03
	K2	Ability to provide solution for sustainable urban development	EE_K4_K01, EE_K4_K02, EE_K4_K03
Course content ensuring the achievement of learning outcomes:		Basic knowledge of Hydraulic and hydrological systems modelling in urban areas and understanding of hydrological processes. Students will develop their knowledge on hydrological and hydraulics modelling and they would practically learn how to use fundamental software for urban hydraulic and hydrological modelling e.g. SWMM. Special attention will be given to flood and inundation simulation using SWMM and BitaGreen Platform. Principles of urban hydrological modelling and simple empirical computational methods, Unit Hydrograph Instantaneous Theory, flood risk analysis using SWMM and BitaGreen platform. The Low Impact Development (LID) concept, modelling and role in urban water balance, porous pavements theory for flood and inundation control will be discussed and applied in computer training.	
Examination methods:		Presentation, Report	

Subject name:		Flood risk assessment	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	rules for drawing up flood hazard and flood risk maps	EE_K4_W02_inz, EE_K4_W12_inz
	W2	phenomena and processes causing flood hazards and the principles of their modelling, as well as the principles of applying measures to reduce the risk	EE_K4_W07_inz, EE_K4_W12_inz
Skills: (In terms of skills, the graduate can)	U1	estimate the impact of land use or climate changes on flood flows	EE_K4_U01_inz
	U2	determine the minimum capacity of the retention reservoir necessary to reduce flood risk, is able to assess the effectiveness of flood protection measures	EE_K4_U01_inz, EE_K4_U03_inz
Social competences: (Within the scope of competence, the graduate is ready to)	K1	works independently and in a team, analyzes and evaluates the results of own work and other team members concerning flood risk assessment	EE_K4_K01, EE_K4_K03
Course content ensuring the achievement of learning outcomes:		Types, sources and causes of flood risk. Parameterization of floods and flood characteristics as well as information and warning systems. Development of the catchment area and flood risk assessment. The reaction of the catchment to its intensive supply (through precipitation and/or snowmelt), maximum probable flows (WQp%) and maximum credible floods (MWW) and the safety of hydro-technical structures. Modelling the impact of urbanization and climate change on the size of floods. Threats in the valleys of small watercourses, including urbanized catchments, operation of small reservoirs during floods of various sizes, determination of flood risk assessment, flood zones, flood hazard zones and preparation of flood risk maps. Wave transformation through a reservoir with defined characteristics and known characteristics of discharge devices. Measures of flood wave reduction.	
Examination methods:		Written exam, Presentation, Project	

Subject name:		Intellectual property management	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the essence and role of intellectual property management	EE_K4_W14_inz
	W2	principles of organization of intellectual property protection in the enterprise	EE_K4_W02_inz
Skills: (In terms of skills, the graduate can)	U1	in advanced way, use knowledge to manage intellectual property in the enterprise, taking into account economic and legal aspects in the field of intellectual property protection	EE_K4_U10
Social competences: (Within the scope of competence, the graduate is ready to)	K1	self-expanding knowledge in the field of intellectual property management	EE_K4_K04
Course content ensuring the achievement of learning outcomes:		Intellectual property management strategies. Company secret. Protection of intellectual property at the international level. Internet domain protection. Database protection. Organizations for the collective management of copyright or related rights.	
Examination methods:		Test (written or computer based), Assignment	

Subject name:		Diploma seminar II of specialization modern engineering in water management	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	master's thesis in accordance with the provisions of intellectual property law	EE_K4_W14_inz
Skills: (In terms of skills, the graduate can)	U1	presentation in the field of the master's thesis based on their own work and review of literature sources	EE_K4_U10, EE_K4_U11, EE_K4_U12
	U2	plan and implement their self-development in a selected area of environmental engineering related to the subject of the diploma thesis	EE_K4_U14
Social competences: (Within the scope of competence, the graduate is ready to)	K1	using reliable sources and formulating opinions and conclusions in the field of the master's thesis	EE_K4_K01, EE_K4_K05
Course content ensuring the achievement of learning outcomes:		Rules for writing a master's thesis. Plagiarism and anti-plagiarism procedure. Analysis of source texts - language errors, graphic elements in the work. Rules for writing a literature review. Critical evaluation of the methodology, results and discussions as well as formulating conclusions. Rules for the preparation of a multimedia presentation and a synthetic presentation of the results of the master's thesis. Criteria for assessing the work - the role of the reviewer. The course of the diploma exam.	
Examination methods:		Presentation, Assessment of activity during classes	

Subject name:		Climate change and consequences	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	effects of anthropogenic activities on climate change and consequences	EE_K4_W02_inz, EE_K4_W16_inz
	W2	soil science area	EE_K4_W02_inz, EE_K4_W16_inz
Skills: (In terms of skills, the graduate can)	U1	interpret climate change models	EE_K4_U10
Social competences: (Within the scope of competence, the graduate is ready to)	K1	critically review existing data for Climate Change-Evidence, Causes, and Consequences, Climate Change	EE_K4_K03
Course content ensuring the achievement of learning outcomes:		The climate change system is one of the planet Earth internal systems. Interdependence, interaction, and co-operation of all systems within the planet Earth are making the planet Earth existence as reality. As we known, the planet earth is very unique among Universe. The climate change system is maker, provider, holder and guardian of the living conditions within the Biosphere of the planet Earth. With ceaseless interdependence, interaction and co-operation of all internal and external systems of the Earth is making present possible and observable as it is. Research and scientific observation of the Nature from requisitely holistic systemic viewpoint are opening new horizons for better tomorrow of humanity. Students will develop their knowledge on climate change and consequences, phenomenon, and theories related to modelling processes. Theoretical concepts will be presented supported with climate change models. Special attention will be given to Climate Change-Evidence, Causes, and Consequences, Climate Change and Land, Soil Degradation.	
Examination methods:		Presentation, Report	

Programme indicators

2023/24/S_D/4/BIS/EE/all

Name	Value
Potwierdzenie – na podstawie planu studiów, że student realizuje zajęcia z dziedziny nauk humanistycznych i/lub społecznych, którym przypisano nie mniej niż 5 punktów ECTS	6
Potwierdzenie – na podstawie planu studiów, że student ma możliwość wyboru zajęć, którym łącznie przypisano liczbę punktów ECTS nie niższą niż 30% ECTS określonych dla programu tych studiów	32/90 (35.56%)
Potwierdzenie, że program studiów o profilu ogólnoakademickim obejmuje zajęcia związane z prowadzoną w uczelni działalnością naukową, w wymiarze większym niż 50% liczby punktów ECTS, określonej dla programu tych studiów	49/90 (54.44%)
Potwierdzenie, że liczba punktów ECTS uzyskanych w programie studiów poprzez realizację zajęć z wykorzystaniem metod i technik kształcenia na odległość jest nie wyższa niż 75% ogólnej liczby punktów ECTS w programie studiów o profilu ogólnoakademickim	0/90 (0%)
Liczba godzin w programie	924