



Lodz University
of Technology

Study programme

Faculty:	Faculty of Civil Engineering, Architecture and Environmental Engineering
Major:	Environmental Engineering in Civil Construction
Level of study:	second-cycle programme (magister inżynier)
Form of study:	part-time studies
Academic year:	2026/27

Table of contents

Basic information	3
Learning outcomes (in relation to the PQF)	4
Matrix of course modules in relation to learning outcomes and curriculum content	5
ECTS - subjects	8
ECTS indicators	10
Methods of verifying and assessing learning outcomes	11
Professional internships	12
Characteristics of the course	13
Education program	16

Basic information

Name of the field of study:	Environmental Engineering in Civil Construction
Level of study:	second-cycle programme (magister inżynier)
Study profile:	general academic
Form of studies:	part-time studies
Duration of studies (number of semesters):	4
The number of ECTS points required to complete studies:	90
Total number of hours of classes:	575
The number of ECTS points a student obtains as part of classes conducted with the direct participation of academic teachers or other persons conducting classes:	23
Professional title awarded to graduates:	magister inżynier
ISCED code:	0712
Language of study:	polish

Assigning the course to the disciplines to which the learning outcomes relate

Discipline	Percentage share
Civil engineering and transport	100%

Learning outcomes (in relation to the PQF)

No.	Learning outcome code	Learning Outcome Content	Reference to the universal characteristics of the first level of PRK	Reference to the second-level characteristics of the PRK, taking into account the second-level characteristics enabling the acquisition of engineering competences
1	2ISB1	Has a thorough understanding of key processes and phenomena in environmental engineering and construction. Student is familiar with the main development trends in environmental engineering.	P7U_W	P7S_WG, P7S_WG_inż
2	2ISB2	Has extensive knowledge necessary to design, construct and operate networks and installations as well as facilities and equipment used in environmental engineering in accordance with applicable technical requirements and legal regulations, taking into account environmental aspects.	P7U_W, P7U_U	P7S_WG, P7S_WK_inż, P7S_UW_inż
3	2ISB3	Nows and understands the complex relationships in the area of non-technical conditions and effects of engineering activities, including basic concepts and principles of life cycle analysis of devices, facilities, installations and systems, industrial property protection and copyright, construction law and environmental protection.	P7U_W, P7U_U	P7S_WK, P7S_WK_inż, P7S_UW_inż
4	2ISB4	Is able to identify and solve complex and non-standard technical problems as well as perform, under unpredictable conditions, tasks related to the design and execution of technical infrastructure in urbanized areas, including sanitary networks and installations. Is able to prepare and interpret the required technical documentation using appropriate sources of information as well as information and communication methods and tools.	P7U_U	P7S_UW, P7S_UW_inż
5	2ISB5	Is able to communicate with a diverse audience and conduct debates on environmental engineering issues. Communicates using specialized terminology to a higher degree in Polish and a foreign language at B2+ level.	P7U_U	P7S_UW, P7S_UK
6	2ISB6	Is able to plan and organize work on assigned tasks (both independently and in a team) during the preparation and implementation of environmental engineering projects in construction. Student takes a leading role in teams, documents the division of tasks, and verifies the quality of results.	P7U_U	P7S_UW, P7S_UO, P7S_UU, P7S_UW_inż
7	2ISB7	Is ready to critically evaluate the correctness and quality of solutions in environmental engineering, taking into account non-technical aspects, formal-legal issues, sustainable development, and innovation. Is ready to consciously plan and implement a strategy for continuous improvement of engineering skills and to encourage others to do so.	P7U_K, P7U_U	P7S_KK, P7S_UW_inż
8	2ISB8	Is aware of professional responsibility arising from the role of an engineer and the need to uphold the ethos of the profession. Is ready to consider the interests of stakeholders in investment projects, subjecting them to critical evaluation. Appreciates the importance of interdisciplinary expertise. Is ready to initiate actions for the benefit of the social environment as well as to manage engineering projects.	P7U_K	P7S_KK, P7S_KO, P7S_KR

Matrix of course modules in relation to learning outcomes and curriculum content

No.	Course name	Program content	2ISB1	2ISB2	2ISB3	2ISB4	2ISB5	2ISB6	2ISB7	2ISB8
1	Alternative Energy Sources	Principles of operation of alternative energy sources; basis for selection and cooperation of sources. Principles of design, implementation and security. Integration with conventional systems. Economic, environmental, social and legal aspects of the development of alternative energy sources in Poland.		x	x	x			x	
2	Water and Wastewater Treatment Technology Special Processes	Modern and advanced water treatment technologies; removal of specific pollutants; water stabilisation; reduction of secondary pollution. Advanced municipal and industrial wastewater treatment technologies; secondary treatment; wastewater recovery/recycling; directions for modernisation of water treatment plants and sewage treatment plants.		x		x		x	x	
3	Modern Technologies in Underground Infrastructure	Modern methods of planning, designing, constructing and modernizing underground infrastructure, in particular water, sewage, gas and heating networks.		x		x			x	x
4	Monitoring of Air, Water and Wastewater Quality	State Environmental Monitoring, Integrated Environmental Monitoring. Air pollution: dispersion and spread; measurement methods, including altitude-dependent methods. Pollution maps: principles of compiling and presenting spatial changes in air quality. Measurements in time and space (location/emission sources); reports; compilation of sample maps. Interpretation of results in relation to standards and legal acts; statistical analysis of monitoring data. Analysis of the organisation of a selected type of monitoring station; presentations and discussion.	x		x			x	x	
5	Modern Ventilation and Air Conditioning Systems	Discussion of modern solutions for heating and ventilation systems. Classification and construction of heat sources and air handling units, design and installation requirements. Design of a heating and ventilation system in a building.		x		x			x	
6	Energy-saving Air Conditioning Systems	Overview of energy-efficient air conditioning systems. Design and installation considerations. Air conditioning systems (Split, MultiSplit, VRV). Cooling systems. Design of a building's air conditioning system.		x		x			x	
7	Control and Optimisation in Installations	Classification of control systems in sanitary installations. Definitions of continuous and discontinuous control systems. Principles of control and regulation in sanitary installations. Construction of pumps and fans. Methods of pump regulation. Impact of pump regulation on the operation of sanitary installations.		x		x				
8	Audit of Building Installations and Energy Certification	Energy balance of the building. Analysis of the technical condition of internal installations and heat sources in the building. Measurement of installation operating parameters and the impact of the results on its condition. Improvement of functionality and reduction of operating costs. Audit and energy performance certificate for the building.			x	x			x	
9	Biotechnology and Environmental Management	The role of biotechnology in environmental protection. Mechanisms of biological pollution removal. Structure and types of bioreactors. Fundamentals of environmental chemistry. Fundamentals of Management. Integrated environmental management, management strategies. Indicators of a company's environmental performance; verification of pro-environmental technologies. Sustainable development as a framework for engineering decisions. Environmental impact assessment of projects.	x		x		x		x	

No.	Course name	Program content	2ISB1	2ISB2	2ISB3	2ISB4	2ISB5	2ISB6	2ISB7	2ISB8
10	Foreign Language for Specialist Purposes	Analysis of scientific texts; critical reading of authentic materials. Synthesis of information from various sources. Rules for creating scientific texts and scientific presentations. Describing concepts, phenomena and processes; interpreting research results/statistical data. Scientific presentations: forms, signposting/signalling/call for action, body language and presentation techniques. Reflection, self-assessment and lifelong learning in a scientific and industry context.					x			
11	Application of Building Information Modeling in Design	Characteristics of BIM programmes for modelling building installations. Principles of data exchange between platforms; working in a multi-tool environment. Modelling sample installations; creating drawing documentation with the required level of detail. Detection, analysis and removal of collisions; interdisciplinary coordination.		x		x			x	
12	Water and Wastewater Systems Modelling and Optimization	Model classification. Data preparation. Modelling error assessment. Modelling as a tool for research and analysis of phenomena; system operation scenarios. Optimisation: objective function, constraints, decision variables; optimisation criteria; economic indicators. Optimisation of water supply and sewage networks (agglomerated costs); multi-criteria tasks.		x		x				
13	Sustainable Stormwater Management	Legal and organisational basis for rainwater management in cities. Characteristics of precipitation. Surface runoff in urban areas. Infiltration and retention: selection of local devices; dimensioning rules. Pre-treatment of runoff; impact of rainwater on the receiving water body and mitigation of impact. Green infrastructure as a tool for sustainable drainage systems. Relief of traditional sewerage systems. Adaptation strategies to climate change.	x		x	x				x
14	Waste Recovery and Disposal	Legal framework for waste treatment. Types and role of treatment plants. Waste composting. Biogas plants. Thermal waste conversion. Natural use of waste and sewage sludge; land reclamation. Social and environmental aspects of plant operation; hazardous waste and methods of handling.		x	x	x				x
15	Fire Protection Installations	Fire protection installations as part of the technical-legal building safety system. Fire development, hazards, smoke impact on evacuation, and mitigation measures. Fire ventilation, firefighting equipment, water supply, system integration, calculations, and maintenance principles.		x	x	x				x
16	Safety and Organization of Installation Works	Requirements for construction products in sanitary installations: standards and regulations. Development of BIOZ Information and BIOZ Plan for installation works. Identification of hazards in sanitary networks and risk minimisation. Safe installation of fittings, instruments and installation equipment. Installation quality control: hazards, tools and stage monitoring. Designing tests and technical acceptance of sanitary networks with documentation. Designing BIOZ documentation with justification of solutions.		x	x	x				x
17	Heating, Ventilation, Air Conditioning	Classification of HVAC installations and operating principles. Development trends in HVAC systems; solutions for buildings of the future and energy-efficient buildings. HVAC design principles; equipment selection. System concept for heating, air conditioning or ventilation; justification of the adopted solution. Principles of preparing documentation in English.					x			
18	Advances in Wastewater Treatment Processes	Modern solutions in biological treatment of municipal and industrial wastewater. Advances in modelling and simulation of wastewater treatment processes; the role of numerical tools.					x			

No.	Course name	Program content	2ISB1	2ISB2	2ISB3	2ISB4	2ISB5	2ISB6	2ISB7	2ISB8
19	Managing the Investment Process. Social and Cultural Aspects.	Investment process management. Entrepreneurial thinking and action. Non-technical conditions of the investment process; investment-society-culture relations. Social participation. The role of stakeholders. Sustainable development in investment practice; tensions between economic and social goals. Cultural aspects of space perception; the impact of place value and identity on investment decisions. Urban issues.			x				x	
20	Entrepreneurship and Management in Civil Engineering	Entrepreneurship and enterprise: essence, definitions; role in the construction industry. Investment process management. Human needs as the context for organisational decisions and actions. The business environment and its impact. Basics of running a business, legal framework; costs. Organisational and legal forms of enterprises; accounting principles; employer and employee obligations. Corporate social responsibility; entrepreneurial thinking and action.			x				x	
21	Diploma Seminar	Working with printed literature and databases; verifying sources; synthesising and interpreting information. Clarifying the thesis topic and its elements. Discussing possible solutions; justifying the choice of methods and approaches. Presentations: progress in thesis work + selected issues (competency exam). Professional and scientific work ethics; plagiarism. Commercialisation of research results. Copyright and patent protection.					x	x	x	
22	Final Project	Formulation of theoretical and empirical problems; objectives and assumptions of the work. Selection of methods and tools (analytical, numerical or experimental) appropriate to the level of education. Review of professional literature; acquisition, verification and synthesis of information; development of the thesis and concept of the work. Performing calculations/experimental research; development, analysis and interpretation of results. Drawing conclusions with regard to responsibility for decisions and solutions; presentation of results. Writing and editing the work; preparation of a presentation illustrating the diploma.	x			x	x	x	x	

ECTS - subjects

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
1	Alternative Energy Sources	5			5	
2	Water and Wastewater Treatment Technology Special Processes	7			7	
3	Modern Technologies in Underground Infrastructure	5				
4	Monitoring of Air, Water and Wastewater Quality	6			6	
5	Modern Ventilation and Air Conditioning Systems	4		4	4	
6	Energy-saving Air Conditioning Systems	4		4	4	
7	Control and Optimisation in Installations	4				
8	Audit of Building Installations and Energy Certification	5				
9	Biotechnology and Environmental Management	4	4			
10	Foreign Language for Specialist Purposes	2				
11	Application of Building Information Modeling in Design	4				
12	Water and Wastewater Systems Modelling and Optimization	5			5	
13	Sustainable Stormwater Management	2			2	
14	Waste Recovery and Disposal	4			4	
15	Fire Protection Installations	2			2	
16	Safety and Organization of Installation Works	2				
17	Heating, Ventilation, Air Conditioning	2				2
18	Advances in Wastewater Treatment Processes	2				2
19	Managing the Investment Process. Social and Cultural Aspects.	3	3	3		
20	Entrepreneurship and Management in Civil Engineering	3	3	3		
21	Diploma Seminar	2				

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
22	Final Project	20		20		

ECTS indicators

Name	Value
The total number of ECTS credits that a student must obtain through elective courses (amounting to no less than 30% of the total ECTS credits required to obtain the qualification corresponding to the given level of study)	27/90 (30%)
The total number of ECTS credits to be earned by a student through courses in the fields of humanities or social sciences	4
The total number of ECTS credits that a student must obtain from courses related to research conducted at the university, amounting to more than 50% of the total ECTS credits required to graduate from a given level of study	35/90 (38.89%)

Methods of verifying and assessing learning outcomes

The verification of achieved learning outcomes requires the use of diverse assessment methods appropriate to the categories of knowledge, skills, and social competencies to which these outcomes pertain. The selection of suitable tools also depends on the specific nature of the subject and the format of the classes and is described in detail in the course syllabi. The achievement of the required learning outcomes is assessed through:

1. written assignments (exams, quizzes, reports, essays, projects, posters, thesis, etc.);
2. oral assessments (oral exams, public speaking, e.g., delivering a paper, presentation, etc.);
3. practical and/or project-based tasks (both individual and group work);
4. observation and evaluation of students' participation and activity during classes;
5. self-assessment and peer evaluation (especially in the case of group projects);
6. competency exams and final diploma examinations.

Verification can be formative (partial, conducted multiple times during the course) and/or summative (final grade assessment). The final verification result is given according to the currently applicable grading scale.

The course coordinator or instructor is required to present the course syllabus during the first class and to clearly define and formally communicate the assessment methods and conditions for verifying learning outcomes.

Professional internships

Non applicable.

Characteristics of the course

Graduate profile

A graduate of the Master's programme Environmental Engineering in Civil Construction possesses advanced, integrated knowledge and skills that enable independent and creative solving of complex design and research problems in the field of environmental engineering installations and systems operating within buildings and their surroundings.

The graduate is capable of applying advanced modelling and optimisation methods, sensitivity analyses, as well as methods for assessing risk, reliability and installation safety.

They are prepared to conduct development work, validate solutions, perform audits, and take on leadership roles within interdisciplinary teams.

In the area of building installations and external networks, the graduate is able to design innovative, low-emission and energy-efficient solutions, integrate them with existing infrastructure, prepare documentation in accordance with regulations, and carry out energy and environmental audits.

The graduate should be able to adapt flexibly to labour market needs and demonstrate a habit of continuous professional development, particularly because, after completing the required professional practice, graduates of this programme may apply for licences to perform independent technical functions in construction. For this reason, the curriculum content is consulted with the Łódź Regional Chamber of Civil Engineers, as a representative of the professional community.

The relationship between the field of study and the university's strategy

The guiding theme of the TUL Strategy is cooperation (COOPERATION). The Environmental Engineering in Civil Construction study programme naturally aligns with this approach, as it integrates installation and network engineering with environmental protection, water management, waste management, energy and construction - areas that inherently require collaboration among multiple stakeholders: public administration, industry, designers, contractors, infrastructure operators and local communities.

Within the EDUCATION area of the TUL Strategy, emphasis is placed on developing a model of education that prepares graduates for the dynamically changing needs of the socio-economic environment, including through intensified practical experience and increased student participation in research activities. The Environmental Engineering in Civil Construction programme fulfils these objectives through a strong design and computational component, the presence of laboratory classes, and the use of digital tools applied in engineering practice.

The Strategy also highlights areas that build organisational culture, talent development and systemic student support (LEADERSHIP, TALENTS, STUDENTS). The study programme contributes to these goals by incorporating elements that develop teamwork, communication and professional responsibility.

In the INFRASTRUCTURE area, the TUL Strategy calls for the development and integration of information systems and the modernisation of infrastructure. The programme corresponds to this vision through modules focused on GIS, BIM, spatial analysis and data-driven work.

In summary, the Environmental Engineering in Civil Construction study programme is aligned with the logic of the TUL Strategy 2025-2030, because it:

- supports the mission of building a sustainable research university by educating specialists capable of implementing environmental solutions in construction and infrastructure,
- fulfils the EDUCATION objective through its emphasis on design, laboratory work, digital tools and practical engineering competences,
- strengthens SUSTAINABILITY through content related to water, wastewater, air, waste and energy, addressing environmental and climate challenges,
- builds IMPACT and INNOVATION by fostering implementation-oriented skills and preparing graduates to work in sectors of critical importance to regional and economic development,
- develops a culture of cooperation and talent through team-based projects and diploma modules.

The second-cycle programme is fully aligned with the university strategy, reinforcing the areas of EDUCATION, SCIENCE, INNOVATION and SUSTAINABILITY. At the master's level, emphasis is placed on students' research independence, the implementation of development projects in cooperation with socio-economic partners, innovation (including elements of commercialization), and advanced

digital competences.

The programme also includes modules focused on practical implementation and audits, which support the internationalisation of education, real IMPACT and cooperation with industry.

Educational objectives and employment and continuing education opportunities

The fundamental objective of the second-cycle programme Environmental Engineering in Civil Construction is to develop professional competences essential for undertaking conceptual, expert and research work, as well as for performing managerial, initiating and advisory functions in governmental and local administration units related to environmental protection, environmental engineering, construction and municipal services.

Completion of the second-cycle programme Environmental Engineering in Civil Construction allows students to advance their knowledge in the mathematical, natural and technical sciences and to acquire specialised skills related to building networks and installations in environmental engineering, in particular in the areas of:

- modernisation and ensuring the reliability of utility networks and site infrastructure,
- the use of renewable energy sources and alternative water supply systems,
- ensuring the safe operation of building networks and installations in the context of urban development, changing societal expectations and climate change,
- environmental monitoring, including technologies for air-quality control,
- modern systems for control, measurement and automation in building installations,
- energy audits, building energy assessments and certification,
- modelling and optimisation of systems used in environmental engineering with the support of specialised software.

Students develop practical skills through the implementation of a wide range of projects as well as engineering research and measurements conducted in laboratory and/or field conditions. They also complete design assignments using BIM (Building Information Modeling) technologies, which provides comprehensive preparation for undertaking design and investment tasks in their future professional practice.

The acquired qualifications enable graduates to work in design offices, construction and installation companies involved in the building, maintenance and operation of facilities, municipal service units, governmental and local administration bodies related to environmental protection, as well as production and research enterprises dealing with, among others, air protection, water supply, wastewater treatment, waste management and the reclamation of degraded areas.

The competencies developed during the studies also provide a strong foundation for shaping and developing individual entrepreneurship.

Completion of second-cycle studies and obtaining the professional title of magister inżynier entitles graduates to apply for full professional licensing, both in supervising construction works and in design activities.

Description of the process and outcome of consultations on the proposed study program with the socio-economic environment

The Environmental Engineering in Civil Construction study programme has been consulted on multiple occasions with external industry stakeholders in relation to both core and specialised education. The current modifications arise primarily from the need to comply with internal regulations and do not affect the substantive scope of the programme. Consequently, the opinions and recommendations formulated during earlier consultation processes remain valid and applicable to the proposed version of the curriculum.

In parallel, internal consultations were carried out with students, doctoral candidates, and Faculty staff. A student representative actively participated in the meetings of the Programme Council, providing feedback on key changes. Comments concerning the content and quality of courses were collected through evaluation surveys.

An important additional source of information was the annual reports prepared by the Career Office of Lodz University of Technology, analysing the professional career paths of graduates of the programme.

Description of competencies expected from a candidate applying for admission to studies

According to the admission resolution for the relevant academic year.

The unit organizing education

Faculty of Civil Engineering, Architecture and Environmental Engineering

Education program

Semester 1

Course	Number of hours	ECTS points	Form of verification	Obligatory
Alternative Energy Sources	Tutorials: 10 Project work: 10 Lecture: 20	5	Exam	Obligatory
Water and Wastewater Treatment Technology Special Processes	Tutorials: 10 Laboratory classes: 20 Project work: 20 Lecture: 20	7	Exam	Obligatory
Modern Technologies in Underground Infrastructure	Tutorials: 10 Project work: 10 Lecture: 20	5	Graded assignment	Obligatory
Monitoring of Air, Water and Wastewater Quality	Seminar: 10 Laboratory classes: 20 Lecture: 20	6	Graded assignment	Obligatory
Sum	200	23		

Semester 2

Course	Number of hours	ECTS points	Form of verification	Obligatory
Elective Course 1		4	Graded assignment	Obligatory group
The student chooses 1 subject.				
Modern Ventilation and Air Conditioning Systems	Project work: 10 Lecture: 20	4	Graded assignment	Optional
Energy-saving Air Conditioning Systems	Project work: 10 Lecture: 20	4	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Control and Optimisation in Installations	Project work: 15 Lecture: 15	4	Graded assignment	Obligatory
Audit of Building Installations and Energy Certification	Project work: 20 Lecture: 20	5	Exam	Obligatory
Biotechnology and Environmental Management	Seminar: 20 Lecture: 30	4	Graded assignment	Obligatory
Foreign Language for Specialist Purposes	Tutorials: 45	2	Graded assignment	Obligatory
Sum	195	19		

Semester 3

Course	Number of hours	ECTS points	Form of verification	Obligatory
Application of Building Information Modeling in Design	Project work: 40 Lecture: 10	4	Graded assignment	Obligatory
Water and Wastewater Systems Modelling and Optimization	Laboratory classes: 40 Lecture: 20	5	Graded assignment	Obligatory
Sustainable Stormwater Management	Tutorials: 10 Lecture: 10	2	Graded assignment	Obligatory
Waste Recovery and Disposal	Laboratory classes: 20 Lecture: 10	4	Exam	Obligatory
Fire Protection Installations	Tutorials: 10 Lecture: 10	2	Graded assignment	Obligatory
Sum	180	17		

Semester 4

Course	Number of hours	ECTS points	Form of verification	Obligatory
Safety and Organization of Installation Works	Project work: 10 Lecture: 10	2	Graded assignment	Obligatory
Heating, Ventilation, Air Conditioning	Project work: 10 Lecture: 10	2	Graded assignment	Obligatory
Advances in Wastewater Treatment Processes	Seminar: 10 Lecture: 10	2	Graded assignment	Obligatory
Elective Courses 2		3	Graded assignment	Obligatory group
The student chooses 1 subject.				
Managing the Investment Process. Social and Cultural Aspects.	Lecture: 20	3	Graded assignment	Optional
Entrepreneurship and Management in Civil Engineering	Lecture: 20	3	Graded assignment	Optional
Diploma Seminar	Seminar: 20	2	Graded assignment + exam	Obligatory
Final Project	Diploma Thesis: 0	20	Pass	Obligatory subjects to choose from
Sum	100	31		