



Poznan University of Technology

Faculty of Civil and Environmental Engineering

Learning outcomes

for first-cycle studies, Bachelor of Science Engineering, general academic profile National Qualifications Framework level 6 qualifications

1. Name of the field of study

ENVIRONMENTAL ENGINEERING

2. Placing the field within the area

Environmental Engineering as a field of study belongs to the area of technical studies. Environmental Engineering as a field of study is linked especially with the following fields of study: *Civil Engineering, Architecture and Urban Planning, Management, Power Engineering, Electrical Engineering, Materials Engineering*. Relationships with them, even if they are not explicitly defined in the learning outcomes or Directional Studies Program field of Environmental Engineering are essential complements the description of study.

Of the two regulatory profiles of study, the general academic one and the practical one, training is provided on the general academic one, as a long university tradition of construction faculty at Poznań University of Technology, created from the very beginning of technical higher education, which since 1950 has been teaching on specialties related to sanitary engineering, and since 1972 it has been Environmental Engineering.

3. Reference to international standards

The preparation of these descriptions of learning outcomes was based on international standards formulated by the following organizations: American ABET (Accreditation Board for Engineering and Technology), Japanese JABEE (Japan Accreditation Board for Engineering Education), IEA (International Engineering Alliance), FEANI (Fédération Internationale d'Associations Nationales d'Ingénieurs), EUR-ACE (European Accredited Engineer Project) and CDIO (Conceive Operate Implemented Design Initiative). Most attention was given to the requirements of FEANI, through accreditation requirements formulated by the EUR-ACE.

4. Area descriptors taken into account in the field of study description

The description takes into account the learning outcomes for the general academic profile for education in the area of technical sciences, originating from Annex No. 5 to

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the Regulation of the Minister of Science and Higher Education dated 2 November 2011 on the National Qualifications Framework for Higher Education (Dziennik Ustaw No. 253, Item . 1520), and conditions for conducting studies in a certain fields and levels of education, the Regulation of the Minister of Science and Higher Education dated 5 October 2011 (Journal of Laws No. 243, item. 1445).

5. Educational effects

The objectives of education for the first-cycle studies in the field of Environmental Engineering, general academic profile are the following:

- 1) to provide basic engineering knowledge in the field of Environmental Engineering, design systems, technical equipment of buildings and municipal infrastructure related to environmental engineering and working in this field and preparing to perform the works,
- 2) to develop the ability to identify and solve basic tasks for Environmental Engineering,
- 3) to prepare the graduate for independent and team work in positions related to designing, implementing and operating the equipment and technical systems related to environmental engineering and related professional fields.

6. Learning outcomes

On completing first-cycle studies, general academic profile, the graduate of Environmental Engineering with the knowledge acquired while studying is prepared to take decisions for the proper application of installation materials, equipment engineering design of buildings, water supply, sewage, gas, heating and water treatment systems, wastewater treatment, air and soil protection and management of construction works in this field.

The graduate can create and read technical drawings and recognize cartographic and land surveying documentation.

The graduate has a theoretical background in the field of technical thermodynamics, heat and mass transfer, fluid mechanics and environmental biology and chemistry. The graduate is able to formulate and solve engineering tasks of a practical nature typical of environmental engineering systems associated with selected technical equipment of buildings and technical infrastructure. The graduate develops simple devices in the field of technical equipment for buildings and technical infrastructure systems related to environmental engineering and selects typical devices based on their technical and technological characteristics. The graduate also designs technical equipment for buildings, develops systems installation and simple infrastructure systems together with technological devices in the field of energy, water supply and sewage disposal.

The graduate knows current trends in the execution of construction works in the field of Environmental Engineering and is able to work in a team. The graduate can develop a report on the progress of the work and design. The graduate can choose

arguments critically to support decisions regarding the implementation of tasks in construction. The graduate knows and applies the provisions of construction law and applies the principles of safety and health at work. The graduate is responsible for his or her own safety and security as well as his or her colleagues. The graduate is aware of the need to raise professional and personal competences and acts in accordance with the rules of ethics.

The graduate is prepared to start second-cycle studies in the field of Environmental Engineering.

6. Detailed learning outcomes for the field of Environmental Engineering and their reference to the effects for the area of technical sciences

Explanation of signs used in symbols:

K - directional learning outcomes,

W - category of knowledge,

U - category of skills,

K_ - category of personal and social competence

T1A - area learning outcomes for technical sciences for the first-cycle studies, general academic profile

| Learning outcomes for the field of Environmental Engineering | DESCRIPTION OF FIELD LEARNING OUTCOMES What the graduate can do upon completion of first-cycle studies in the field of Environmental Engineering: | Reference to learning outcomes for the area of technical sciences |
|--|---|---|
| KNOWLEDGE | | |
| K_W01 | The graduate has a knowledge of mathematics, physics, chemistry, environmental biology and other areas useful in formulating and solving simple problems in the field of environmental engineering. | T1A_W01 |
| K_W02 | The graduate has a basic knowledge of architecture, technical mechanics, building and construction, structures of buildings, ways of shaping construction components as far as their properties are concerned, namely heat and moisture properties, airtightness, foundations for buildings and constructions as well as placing heat and sanitary installations underground, installation materials and ways of connecting pipes and networks into systems, electrical power engineering, control engineering, information technology as well as meteorology and ecology, which are useful in formulating and solving simple problems in the field of environmental engineering. | T1A_W02 |

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| K_W03 | The graduate has an organized knowledge with a theoretical background including key concepts of technical thermodynamics, heat and mass transfer, fluid mechanics including fluid flow machines, environmental biology and environmental chemistry. | T1A_W03 |
| K_W04 | The graduate has a detailed knowledge concerning energy balance, heat transfer in the transient state and in the steady state, convection, thermal radiation and conductivity, compressible and incompressible fluid dynamics in installations and machines, thermodynamic changes of ideal gas and moist air, clockwise and anticlockwise thermodynamic cycles, combustion including low-emission combustion, hydrology, sanitary biology, water evaluation, water protection and sanitary chemistry. | T1A_W04 |
| K_W05 | The graduate has a basic knowledge of development trends in the field of environmental engineering including the following: <ul style="list-style-type: none"> - technical systems for buildings - heat sources, networks, heating substations and heat exchangers - water and sewage networks - systems of water treatment and wastewater treatment - air protection - hydrology - the role of microbes in wastewater treatment and water treatment - air microbiology - global phenomena which determine and shape housing development | T1A_W05 |
| K_W06 | The graduate has a basic knowledge of technical systems, facilities and appliances in environmental engineering, their lifespan including the following: <ul style="list-style-type: none"> - technical systems and installations for buildings - heat distribution systems - heating, water and sewage networks - water treatment systems and wastewater systems - systems used for treating water and treating wastewater - systems used for protecting air - hydrology | T1A_W06 |
| K_W07 | The graduate knows basic methods, techniques, tools and materials used in solving simple engineering tasks in the field of environmental engineering, including: <ul style="list-style-type: none"> - technical systems and installations for buildings - selection of structures for heating, ventilation and air conditioning (HVAC) systems for buildings with different energy performance, - structures of control and regulation systems in the construction industry and municipal engineering | T1A_W07 |

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| | <ul style="list-style-type: none"> - heating networks, water supply and sewage - water treatment systems and wastewater treatment systems - air protection systems - municipal wastes and methods of their disposal and recycling, - hydrology and water protection, - disinfection of water and wastewater; | |
| K_W08 | The graduate has a basic knowledge necessary to understand social, economic, legal and other non-technical conditions in engineering business in the field of environmental engineering and ecology. | TA1_W08 |
| K_W09 | <p>The graduate has a basic knowledge of management, including quality management and business activity in the field of environmental engineering, including:</p> <ul style="list-style-type: none"> - technical systems and installations for buildings, - heat supply systems, - heating systems, water supply and sewage systems, - carrying out construction works for installing heating and sanitary systems, - water treatment systems and wastewater treatment, - air protection systems, - environmental management, - hydrology, - the organization of work in research laboratories. | T1A_W09 |
| K_W10 | The graduate knows and understands the basic concepts and principles of the protection of industrial property and copyright and is able to use the resources of patent information and Polish Standards. | T1A_W10 |
| K_W11 | The graduate knows the general principles of creation and development of forms of individual entrepreneurship, using the knowledge of environmental engineering. | T1A_W11 |

SKILLS

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| K_U01 | The graduate can get information from literature, databases and from other appropriately selected sources, also in English or in another foreign language recognized as a language of international communication in the field of environmental engineering. The graduate can integrate the information obtained, to make an interpretation, as well as draw conclusions and formulate and justify opinions; | T1A_U01 |
| K_U02 | The graduate can communicate using a variety of techniques in a professional environment of environmental engineering, architecture and construction, and in other ones related to environmental engineering. | T1A_U02 |
| K_U03 | The graduate can prepare a well-documented report concerning problems in the field of environmental engineering both in Polish and in a foreign language which is considered essential for environmental | T1A_U03 |

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| | <p>engineering. The report may concern the following:</p> <ul style="list-style-type: none"> - technical systems and installations for buildings, - heat supply systems, heat sources, heat exchangers, heating networks, - water supply and sewage systems, - the use of renewable sources of heat and heat recovery, - water treatment systems and wastewater treatment, - air protection systems, - hydrology, - environmental biology and ecology, - the protection of water against pollution; | |
| K_U04 | <p>The graduate can prepare and deliver an oral presentation on detailed problems concerning particular problems of environmental engineering in Polish and in a foreign language. The presentation may concern the following:</p> <ul style="list-style-type: none"> - technical systems and installations for buildings, - heat supply systems, heat sources, heat exchangers, heating networks, - water supply and sewage systems, - the use of renewable sources of heat and heat recovery, - water treatment systems and wastewater treatment systems, - air protection systems, - hydrology, - technical microbiology, protection and contamination of water | T1A_U04 |
| K_U05 | The graduate has an ability of learning unaided. | T1A_U05 |
| K_U06 | The graduate has basic linguistic skills in the area of science, particularly environmental engineering, which are compliant with requirements listed for level B2 of the Common European Framework of Reference. | T1A_U06 |
| K_U07 | The graduate has skills enabling him/her to use information technology and communication tools appropriate for doing tasks typical of the engineer's job. | T1A_U07 |
| K_U08 | <p>The graduate can perform experiments, including measurements and computer simulations in the following range:</p> <ul style="list-style-type: none"> - technical systems and installations for buildings, - selected construction components, - selected elements of technical systems and installations for buildings, - selected elements of heat supply systems, - selected elements of water treatment systems and wastewater treatment, - selected elements of sewage systems, - selected elements of air protection systems, - selected elements of microbiological contamination, | T1A_U08 |

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| | of the environment, The graduate can clearly present and interpret the results obtained and draw conclusions. | |
| K_U09 | The graduate can formulate and solve engineering tasks in the field of environmental engineering using analytical methods, simulation and experimental methods, including the following: - commercial numeric codes EPANET and engineering programs, for example AutoCAD, - measurement methods (pressure, temperature, fluid velocity, flow rate, heat flow, heat exchanger performance, thermography, ...); | T1A_U09 |
| K_U10 | While formulating and solving engineering tasks in the field of environmental engineering, the graduate can perceive their system and non-technical aspects. | T1A_U10 |
| K_U11 | The graduate has necessary background to work in an industrial environment, particularly in networks and installations, technical equipment of buildings, heat supply systems, water treatment systems, wastewater treatment and air protection devices, basic environmental monitoring, water, air and sewage quality control. The graduate knows the rules of safety for this job. | T1A_U11 |
| K_U12 | The graduate can make an initial analysis of the economic and ecological engineering activities undertaken in the following areas: - technical systems and installations for buildings, - heating, water and sewage networks, - water treatment systems and wastewater treatment systems, - air protection systems, - hydrology; | T1A_U12 |
| K_U13 | The graduate can make a critical analysis of the functioning and evaluate the existing technical solutions in the field of environmental engineering, in particular equipment, facilities, systems, processes, services related to: - technical systems and installations for buildings - central heating supply, - thermal networks, water supply and sewage, - treatment of water and wastewater treatment, - air protection, - biological wastewater treatment, - water quality control for the water produced; | T1A_U13 |
| K_U14 | The graduate can identify and formulate a specification of simple engineering tasks of a practical nature, typical of environmental engineering, including: - selected technical systems and installations for buildings - selected water treatment systems and wastewater treatment, | T1A_U14 |

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| K_U15 | <ul style="list-style-type: none"> - selected elements of sewage systems, - selected heat supply systems, - selected air protection systems, - selected water, air and sewage disinfection systems | T1A_U15 |
| | <p>The graduate can assess the usefulness of routine methods and tools to solve simple engineering tasks of a practical nature, typical of environmental engineering as well as choose and apply the right method and tools.</p> | |
| K_U16 | <p>The graduate can design and implement a simple device, object, system or process using appropriate methods, techniques and tools, choose equipment typical of environmental engineering, including the following areas:</p> <ul style="list-style-type: none"> - technical systems and installations for buildings, - heaters and heat exchangers, heating networks, - heat supply systems, - heating, water and sewage networks, - water treatment systems and wastewater treatment systems, - air protection systems, - hydrology, - water quality control and disinfection; | T1A_U16 |
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SOCIAL COMPETENCES

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| K_K01, | The graduate understands the need of lifelong learning and can inspire other people as well as organize the process of learning for other people. | T1A_K01 |
| K_K02 | The graduate is aware of the importance and understanding non-technical aspects and results of the engineer's job, including its environmental impact and the resulting responsibility for all decisions made. | T1A_K02 |
| K_K03 | The graduate can cooperate and work in a team accepting various positions. | T1A_K03 |
| K_K04 | The graduate can appropriately set priorities necessary to complete a task specified by other people or a self-prepared task. | T1A_K04 |
| K_K05, | The graduate correctly identifies and solves dilemmas related to doing the job. | T1A_K05 |
| K_K06 | The graduate can think and act in a businesslike way. | T1A_K06 |
| K_K07 | The graduate is aware of the social role of a technical university graduate. The graduate particularly understands the need to formulate information and opinions concerning technological advances and other aspects of the engineer's job and to inform the society about them using mass media. The graduate tries to convey such information and opinions in a way which is generally understandable. | T1A_K07 |