Attachement no. 1 to Programme of Education

LEARNING OUTCOMES FOR THE FIELD OF STUDY

(Assumed educational effects)

Faculty: Mechanical and Power Engineering
Field of study: Power Engineering (ENG)
Level of study: II (post-graduate)

The area of study:

Field of study Power Engineering belongs to the domain of technical sciences and is related to such majors as *Mechanical Engineering and Machine Building, Environmental Engineering, Electrical Engineering, Process Engineering and Chemical Technology*.

An applicant for the admission to the Master's degree in Power Engineering must have undergraduate degree and possess competencies to continue education at post-graduate level in this field of study. The candidate should have in particular the following abilities:

- knowledge of physics and mathematics that enables understanding of the fundamentals of physical phenomena used in the power engineering sector and to formulate and solve simple design tasks in the field of power engineering,
- knowledge and skills in the field of mechanics, electronics, electrical engineering, materials science, metrology, fluid mechanics, thermodynamics and the basics of machine design, enabling the measurement, analysis and design of simple components and power systems,
- ability to use, to formulate and solve engineering tasks, experimental and design methods,
- knowledge and skills in methodology and design techniques, enabling the formulation of a simple engineering problem and develop the solution using appropriate information tools,
- skills of interpretation, presentation and documentation of the experiment results, and the presentation and documentation of the project tasks.

The candidate who on completion of first stage of study and other forms of education did not receive the above-mention competences, may take a second stage of study at the field of Power Engineering, if the deficiency of competences can be achieved by the completion of classes in dimension not more than 30 ECTS credits.

The reference to the learning outcomes for second stage of study in the area corresponding to an area of technical sciences

In view of the fact that a person who studies a second stage of study in Power Engineering gained on completion of first stage of study necessary competence to take it or - in the absence of some of the skills required - can be supplemented as a result of activities in dimension not more than 30 ECTS credits, description learning outcomes for the second stage of study does not necessarily refer to all the learning outcomes listed in the description of the qualifications of the second stage of study in the field of education corresponding to an area of technical sciences (second stage of study description includes the combined effects of education achieved at the undergraduate and postgraduate education).

Description of learning outcomes for the study of a second stage of study in Power Engineering does not apply to the following learning outcomes listed in the description of the qualifications of the second stage of study in the field of education corresponding to an area of technical sciences: T2A_W10.
A graduate of the second stage of study must have the competences defined by learning outcomes listed below. This does not mean, however, that all of these effects must be achieved from the implementation of the second stage of study, the part can be achieved at the undergraduate level, and - to a limited extent - as a result of non-formal and informal learning.

Explanation of symbols:

K – learning outcomes for the field of study
S – learning outcomes for specialization
W – category of knowledge
U – category of skill
K (after the underscore) – category of social competencies
T – the area of study in the field of technical sciences
2 – post-graduate studies,
A – general profile

Learning outcome for post-graduate studies in the field of study: ENG	**DESCRIPTION OF THE MAIN LEARNING OUTCOMES** **After completion of the post-graduate studies in the field of Power Engineering, the graduate:**	**Reference to learning outcomes for the area of technical sciences (T)**
KNOWLEDGE		
K2ENG_W01	has ordered knowledge of probabilistics useful to formulate and solve power engineering problems	T2A_W01
K2ENG_W02	has ordered knowledge of numerical methods suitable to solve simple engineering problems	T2A_W01
K2ENG_W03	has ordered knowledge of quantum physics needed to understand the processes used in the power engineering and cryogenics	T2A_W01 T2A_W03
K2ENG_W04	has knowledge of the development trends and the most important achievements of the latest technologies used in the power industry, the development trends and problems in their implementation	T2A_W05 T2A_W08
K2ENG_W05	knows the basic tools for the formulation of mathematical models describing the properties of power systems, their identification and optimization	T2A_W07
K2ENG_W06	has knowledge necessary to understand the social, economic, legal and other non-technical considerations engineering activities, including the management and conduct of business, including in the area of individual entrepreneurship	T2A_W08 T2A_W09 T2A_W11
K2ENG_W07	knows methods of planning of energy systems at the local and regional scale; knows diagnostic systems and network control systems; knows the technical and economic issues associated with the production and distribution of electricity	T2A_W03 T2A_W09

	achieves results in the category KNOWLEDGE for one of the following specializations: • Refrigerating, Heating and Air Conditioning (CCK) - Appendix 1 • Power Engineering and Air Protection (ENA) - Appendix 2 • Nuclear Power Engineering (ENJ) - Appendix 3 • Renewable Sources of Energy (OZE) - Appendix 4	
SKILLS		
K2ENG_U01	can obtain information from the literature and other sources; can suggest improvements to existing solutions; can design energy systems	T2A_U01 T2A_U16 T2A_U19
K2ENG_U02	is able to communicate using a variety of techniques in a professional environment in the range of field study; can predict the directions of self-study in connection with realization of the thesis	T2A_U02 T2A_U04
K2ENG_U03	is able to obtain information from various sources, can make a preliminary economic analysis, is able to prepare a study on the results of their own research	T2A_U03 T2A_U05
K2ENG_U04	has language skills in the fields of science and scientific disciplines relevant to the Power engineering in accordance with the requirements for level B2 + European Framework of Reference for Languages	T2A_U06
K2ENG_U05	is able to - in formulating and solving engineering tasks - integrate knowledge of power engineering and probability	T2A_U09 T2A_U10
K2ENG_U06	is able to - in formulating and solving engineering tasks - integrate knowledge of power engineering and numerical methods	T2A_U08 T2A_U10
K2ENG_U07	is able to plan and carry out computer modeling of energy installations	T2A_U08 T2A_U09 T2A_U11 T2A_U17 T2A_U18
K2ENG_U08	is able to plan energy systems on a local scale, and to identify diagnostic systems and network control systems, and the technical and economic issues associated with the production and distribution of electricity	T2A_U10 T2A_U13 T2A_U15
K2ENG_U09	has language skills in the discipline of Power engineering according to the requirements for level A1 or A2 European Framework of Reference for Languages	T2A_U02
	achieves results in the category SKILLS for one of the following specializations: • Refrigerating, Heating and Air Conditioning (CCK) - Appendix 1 • Power Engineering and Air Protection (ENA) - Appendix 2 • Nuclear Power Engineering (ENJ) - Appendix 3 • Renewable Sources of Energy (OZE) - Appendix 4	

SOCIAL COMPETENCIES		
K2ENG_K01	understands the need to improve professional, personal and social skills; identifies and resolves dilemmas associated with his profession	T1A_K01 T1A_K05
K2ENG_K02	is aware of the importance of non-technical aspects and impacts of social engineering and the role of university graduates	T1A_K02 T1A_K07
K2ENG_K03	is able to work in a group and assume different roles	T2A_K03
K2ENG_K04	can properly identify priorities for implementation of self-defined or appointed tasks	T2A_K04
K2ENG_K05	is able to think and act in entrepreneurial manner	T2A_K06

Appendix 1

LEARNING OUTCOMES FOR SPECIALIZATION

Faculty: Mechanical and Power Engineering
Field of study: Power Engineering (ENG)
Level of study: II (post-graduate)
Specialization: REFRIGERATING, HEATING AND AIR-CONDITIONING (CCK)

Learning outcome for post-graduate studies in specialization: CCK	**DESCRIPTION OF THE MAIN LEARNING OUTCOMES** **After completion of the post-graduate studies in the field of Power Engineering and specialization Refrigerating, Heating and Air-conditioning, the graduate:**	**Reference to learning outcomes for the area of technical sciences (T)**
	KNOWLEDGE	
S2CCK_W01	has ordered and theoretically founded detailed knowledge related to the issues of the phenomena, processes and systems used in refrigeration as well as the most important new developments and trends of development in this area	T2A_W01 T2A_W04 T2A_W09
S2CCK_W02	has ordered and detailed knowledge of energy management, heating and cooling production for needs of professional and municipal power engineering	T2A_W02 T2A_W04 T2A_W07
S2CCK_W03	has detailed knowledge of the issues associated with air-conditioning technology, construction of heating systems, air conditioning, also has knowledge necessary to understand the determinants of non-technical activities related to thermal comfort	T2A_W02 T2A_W05 T2A_W08
S2CCK_W04	has an in-depth, ordered knowledge of the legal requirements and methodology for periodic measuring and monitoring pollutant emissions	T2A_W04 T2A_W08
S2CCK_W05	has theoretically founded detailed knowledge of the systems implementing refrigeration thermodynamic cycles for heating - heat pumps and transformers	T2A_W02 T2A_W05
S2CCK_W06	has theoretically founded detailed knowledge related to issues of sorption energy systems	T2A_W04 T2A_W07 T2A_W09
S2CCK_W07	has ordered knowledge of ventilation and air conditioning	T2A_W08
S2CCK_W08	an expanded knowledge of the techniques of environmental protection	T2A_W02 T2A_W03 T2A_W06
S2CCK_W09	an expanded knowledge of energy systems using renewable sources of energy and waste energy	T2A_W02 T2A_W04
S2CCK_W10	has ordered knowledge of thermodynamics and fluid mechanics necessary to understand the processes used in heating, cooling and air conditioning	T2A_W01 T2A_W02 T2A_W08 T2A_W09

S2CCK_W11	has ordered knowledge of heat carriers, refrigerants and heat accumulation	T2A_W05
S2CCK_W12	has theoretically founded detailed knowledge of cryogenic installations for power engineering	T2A_W04 T2A_W05
SKILLS		
S2CCK_U01	is able to plan and carry out experimental tests, including measurements of basic performance parameters; interprets the results and draws conclusions regarding the operation of refrigerating systems	T2A_U08 T2A_U11
S2CCK_U02	is able to obtain data, formulate and execute tasks thermal balance in the field of energy management and heating and cooling for thermal and professional power engineering	T2A_U01 T2A_U09
S2CCK_U03	is able to carry out calculations related to the production of heating and cooling for the power engineering industry and municipal sorption systems and to interpret the results and draw conclusions	T2A_U01 T2A_U09 T2A_U10 T2A_U12
S2CCK_U04	is able to obtain and present in compact way reports and information on heating and air conditioning systems; presents an oral presentation on the detailed thermal issues - air conditioning; is able to assess and formulate proposals to be submitted for an opinion on the construction and operation of thermal devices and air-conditioning	T2A_U01 T2A_U02 T2A_U03 T2A_U04
S2CCK_U05	is able to formulate the measuring specifications of the elements periodic measurement and pollutant emissions monitoring system	T2A_U04 T2A_U07
S2CCK_U06	is able to develop a conceptual technological design for power system utilizing waste and law-parameter heat, to provide the thermodynamic, energetic technical and economic analysis for local technical conditions	T2A_U08 T2A_U12 T2A_U14
S2CCK_U07	is able to formulate design specifications sorption components of the energy system	T2A_U03 T2A_U05 T2A_U08 T2A_U11
S2CCK_U08	is able to perform calculations of thermal and flow components of the cooling system	T2A_U07 T2A_U09
S2CCK_U09	is able to obtain and present in compact way study and information on systems for environmental protection and to present an oral presentation on detailed environmental issues, to evaluate and formulate proposals to be submitted for an opinion on the design and operation of equipment used in the environment protection installation	T2A_U01 T2A_U02 T2A_U03 T2A_U04
S2CCK_U10	is able to design a system using heat pumps in the power engineering	T2A_U17 T2A_U19
S2CCK_U11	is able to formulate design specification and carry out a project of air conditioning systems	T2A_U09 T2A_U10 T2A_U11
S2CCK_U12	is able to formulate design specifications and carry out project of cryogenic systems	T2A_U17 T2A_U19

Appendix 2

LEARNING OUTCOMES FOR SPECIALIZATION

Faculty: Mechanical and Power Engineering
Field of study: Power Engineering (ENG)
Level of study: II (post-graduate)
Specialization: POWER ENGINEERING AND AIR PROTECTION (ENA)

Learning outcome for post-graduate studies in specialization: ENA	**DESCRIPTION OF THE MAIN LEARNING OUTCOMES** **After completion of the post-graduate studies in the field of Power Engineering and specialization Power Engineering and Air Protection, the graduate:**	**Reference to learning outcomes for the area of technical sciences (T)**
	Wiedza	
S2ENA_W01	has ordered knowledge of the theoretical basis of the separation process of solid and gaseous phase, which is the starting point to draw conclusions about the utilitarian nature of the optimization of constructional and operating parameters of dedusting equipment	T2A_W02 T2A_W03 T2A_W07
S2ENA_W02	has knowledge of the technology to reduce gaseous pollutants resulting from selected industrial processes	T2A_W02 T2A_W07 T2A_W08
S2ENA_W03	has knowledge of control systems used in power engineering; has knowledge of the artificial neural networks and fuzzy controllers	T2A_W05 T2A_W07
S2ENA_W04	has ordered knowledge of the coal combustion technology; has knowledge about the current technologies for coal combustion facilities, its principles of design, operation and selection	T2A_W05 T2A_W07
S2ENA_W05	has ordered and detailed knowledge of production technology, methods of preparation, purification of hydrogen for professional power engineering	T2A_W02 T2A_W06 T2A_W07
S2ENA_W06	has ordered knowledge of the measurement and the control of fundamental gaseous pollutants generated in combustion processes, has knowledge of instrumental analytical methods	T2A_W03 T2A_W07
S2ENA_W07	has ordered knowledge of the measurement properties of the solid phase and the measurement and control of dust pollution	T2A_W04 T2A_W07
S2ENA_W08	has knowledge of the type of gaseous pollutants emitted from power stations, the mechanisms of their formation and reduction	T2A_W01 T2A_W04 T2A_W07
S2ENA_W09	has ordered knowledge of solid fuel gasification technology, knows properties of raw materials and products derived from gasification process, is able to assess the effects of the economic and ecological use of the major gasification technology	T2A_W01 T2A_W05 T2A_W07 T2A_W08

S2ENA_W10	has ordered knowledge in the use of biomass energy	T2A_W05 T2A_W07 T2A_W08
SKILLS		
S2ENA_U01	is able to use theoretical knowledge to solve design problems in the field of gas dedusting techniques	T2A_U07 T2A_U11 T2A_U15
S2ENA_U02	can make a technological and economical balance of installation for reduction of gas pollution	T2A_U11 T2A_U14 T2A_U15
S2ENA_U03	can analyze the structure of the control system of a power unit; knows criteria for the selection of individual elements of the automation of power unit	T2A_U08 T2A_U11 T2A_U19
S2ENA_U04	can do balance calculations of boiler; is familiar with design of burners	T2A_U11
K2ENA_U05	can assess the efficiency of hydrogen production from the gasification process, depending on the type of fuel and the process conditions, is able to assess the efficiency of the fuel cell	T2A_U09 T2A_U11 T2A_U12
S2ENA_U06	is able to perform fundamental measurements of gaseous pollutants generated in combustion processes; can do chromatographic analysis	T2A_U09
S2ENA_U07	is able to perform measurements of parameters describing the properties of the solid phase and the basic parameters of the dusty gas	T2A_U09
S2ENA_U08	is able to assess the impact of parameters such as fuel, the process temperature, excess of air, the type of burner on pollution emission; can evaluate the reactivity of the fuel mixture	T2A_U09 T2A_U11 T2A_U16
S2ENA_U09	is able to perform a preliminary project of installation for gasification of solid fuels	T2A_U11 T2A_U14 T2A_U19
S2ENA_U10	can perform calculations of devices for combustion and gasification of biomass	T2A_U11 T2A_U12 T2A_U16

Appendix 3

LEARNING OUTCOMES FOR SPECIALIZATION

Faculty: Mechanical and Power Engineering
Field of study: Power Engineering (ENG)
Level of study: II (post-graduate)
Specialization: NUCLEAR POWER ENGINEERING (ENJ)

Learning outcome for post-graduate studies in specialization: ENJ	**DESCRIPTION OF THE MAIN LEARNING OUTCOMES** **After completion of the post-graduate studies in the field of Power Engineering and specialization Nuclear Power Engineering , the graduate:**	**Reference to learning outcomes for the area of technical sciences (T)**
KNOWLEDGE		
S2ENJ_W01	has knowledge of the conduction and heat transfer in fuel elements and coolant in one-and two-phase flow conditions, knows the basic criteria for the selection of coolant and cooling systems of reactors	T2A_W01 T2A_W07
S2ENJ_W02	has knowledge of the nuclear processes occurring in the reactor core, and control the operation of the nuclear reactor	T2A_W01 T2A_W04 T2A_W05 T2A_W08
S2ENJ_W03	has knowledge of the synthesis reaction that occurs in the hot plasma and the prospects for the use of this process in fusion reactors	T2A_W01 T2A_W04 T2A_W05
S2ENJ_W04	has knowledge of the materials used in nuclear power engineering and the impact of radiation on matter and the formation of structural defects	T2A_W02
S2ENJ_W05	has knowledge of the mining and processing of uranium ore, fuel enrichment, production of the fuel assemblies, management of spent fuel and radioactive waste	T2A_W04
S2ENJ_W06	has ordered knowledge of the classification, construction and the operation of the basic types of nuclear reactors	T2A_W04 T2A_W05 T2A_W06
S2ENJ_W07	has knowledge of the construction and the operation of the fundamental machinery and equipment used in the processes of nuclear fuel cycle	T2A_W04
S2ENJ_W08	has ordered knowledge of the types and sources of ionizing radiation, radiation effects, dosimetric devices and the main principles and techniques of radiological protection	T2A_W03
S2ENJ_W09	has knowledge of the sources of danger in a nuclear power plant, the use of nuclear safety principles and the assessment and verification of incidents at nuclear facilities by the international event scale	T2A_W03
SKILLS		
S2ENJ_U01	is able to solve tasks related to thermal and flow	T2A_U09

	processes in a nuclear reactor	
S2ENJ_U02	is able to solve tasks in the field of nuclear physics and reactor theory	T2A_U09
S2ENJ_U03	is able to solve basic tasks in plasma physics	T2A_U09 T2A_U12
S2ENJ_U04	is able to use a specialized methodology to study the structure of materials and the analysis of structural changes	T2A_U08
S2ENJ_U05	can make a balance of mass and energy in the selected fuel cycle processes	T2A_U09 T2A_U14
S2ENJ_U06	Can use special software for computer simulation of nuclear power plants with the basic types of reactors and has the ability to analyze and interpret the changing of working parameters of the reactor during normal operation and failure of power unit	T2A_U08
S2ENJ_U07	can use basic dosimetric instruments, calculate the radiation dose and assess risks	T2A_U08
S2ENJ_U08	is able to present and discuss selected issues of the safety engineering in nuclear power engineering	T2A_U04 T2A_U07 T2A_U13

Appendix 4

LEARNING OUTCOMES FOR SPECIALIZATION

Faculty: Mechanical and Power Engineering
Field of study: Power Engineering (ENG)
Level of study: II (post-graduate)
Specialization: RENEWABLE SOURCES OF ENERGY (OZE)

Learning outcome for post-graduate studies in specialization: OZE	**DESCRIPTION OF THE MAIN LEARNING OUTCOMES** **After completion of the post-graduate studies in the field of Power Engineering and specialization Renewable Sources of Energy, the graduate:**	**Reference to learning outcomes for the area of technical sciences (T)**
KNOWLEDGE		
S2OZE_W01	has ordered and theoretically founded detailed knowledge related to matters relating to physical phenomena and processes used in the renewable energy sector as well as the most important new developments and trends in the field of renewable energy sources	T2A_W01 T2A_W03 T2A_W04 T2A_W05
S2OZE_W02	has ordered and detailed knowledge of production technology, methods of preparation, purification of hydrogen for professional power engineering	T2A_W02 T2A_W06 T2A_W07
S2OZE_W03	has detailed knowledge of issues related to hydropower plants, hydropower plant construction, also has the knowledge necessary to understand the ecological conditions of engineering	T2A_W02 T2A_W07 T2A_W08
S2OZE_W04	has an in-depth, ordered knowledge of the legal requirements and methodology for periodic measuring and monitoring pollutant emissions	T2A_W04 T2A_W08
S2OZE_W05	has theoretically founded a detailed knowledge of the systems implementing thermodynamic cycle (for heating) and methods of use of waste and low-parameters heat sources	T2A_W02 T2A_W04
S2OZE_W06	has theoretically founded detailed knowledge of issues related to wind energy	T2A_W04 T2A_W06 T2A_W07
S2OZE_W07	has ordered knowledge of geothermal energy	T2A_W03
S2OZE_W08	has theoretically founded detailed knowledge in the field of energy production from biomass	T2A_W03 T2A_W04
S2OZE_W09	has an expanded knowledge of solar energy conversion into heat and solar systems.	T2A_W02
SKILLS		
S2OZE_U01	is able to obtain information from literature, databases and other sources, is able to prepare (also in the group) a computational design dossier of simple energy system based on renewable energy sources, taking into account the preliminary economic analysis; can do a critical evaluation, draws conclusions and formulates and fully justify opinions	T2A_U01 T2A_U12 T2A_U14

S2OZE_U02	is able to prepare and give a presentation on a topic related to energy from renewable sources and lead a discussion regarding the above presentation, as well as to assess the discussion	T2A_U01 T2A_U04 T2A_U05
S2OZE_U03	is able to plan and carry out experiments related to the production of hydrogen and to interpret the results and draw conclusions	T2A_U08
S2OZE_U04	is able to specify the required parameters for various types of hydropower stations	T2A_U01 T2A_U07 T2A_U09 T2A_U15
S2OZE_U05	can formulate design specifications of components of the hydropower station system	T2A_U01 T2A_U07 T2A_U09 T2A_U15
S2OZE_U06	can formulate measuring specifications of components of systems for measurement and monitoring of pollution	T2A_U17 T2A_U18
S2OZE_U07	is able to design systems performing thermodynamic cycle (for heating) and using the waste and low-parameters heat sources; provides the thermodynamic, energy, technical and economic analysis for local technical conditions	T2A_U08 T2A_U09
S2OZE_U08	can formulate design specifications of components of wind power system	T2A_U01 T2A_U07 T2A_U09 T2A_U15
S2OZE_U09	can formulate design specifications of components of geothermal power plant	T2A_U01 T2A_U07 T2A_U09 T2A_U15
S2OZE_U10	is able to identify and formulate specifications of complex engineering tasks related to the use of biomass in power engineering	T2A_U07 T2A_U15 T2A_U17
S2OZE_U11	is able to prepare and present an oral presentation on the use of biomass for power engineering	T2A_U04
S2OZE_U12	can formulate design specifications of a system using solar radiation for heating	T2A_U19

MATRIX OF CORRELATION BETWEEN EDUCATIONAL OUTCOMES/ EFFECTS IN THE FIELD OF TECHNICAL SCIENCES AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

2nd level, main field of study *Power Engineering* (ENG), general academic profile

Legend: CCK – Refrigerating, Heating and Air-Conditioning , ENJ – Nuclear Power Engineering, ENA – Power Engineering and Air Protection, OZE – Renewable Sources of Energy (pl), RSE – Renewable Sources of Energy (English)

Symbol of the educational outcome in the field of technical sciences	Description of the educational outcomes/ effects in the field of technical sciences	Reference to educational outcomes for 1st level, main field of study ENG					
		Main field of study effects	Specialization effects				
			CCK	ENJ	ENA	OZE	RSE
KNOWLEDGE							
T2A_W01	has expanded and broadened knowledge of mathematics, physics and chemistry and other areas related to the studied discipline necessary to formulate and solve complex tasks in the field of the studied discipline	K2ENG_W01 K2ENG_W02 K2ENG_W03	S2CCK_W01 S2CCK_W10	S2ENJ_W01 S2ENJ_W02 S2ENJ_W03	S2ENA_W08 S2ENA_W09	S2OZE_W01	S2RSE_W01 S2RSE_W04
T2A_W02	has detailed knowledge in the field of study related to the studied discipline		S2CCK_W02 S2CCK_W03 S2CCK_W05 S2CCK_W08 S2CCK_W09 S2CCK_W10	S2ENJ_W04	S2ENA_W01 S2ENA_W02 S2ENA_W05	S2OZE_W02 S2OZE_W03 S2OZE_W05 S2OZE_W09	S2RSE_W02 S2RSE_W03 S2RSE_W05 S2RSE_W09
T2A_W03	has organized, general knowledge and theoretical grounding including key issues related to the studied discipline	K2ENG_W03 K2ENG_W07	S2CCK_W08	S2ENJ_W08 S2ENJ_W09	S2ENA_W01 S2ENA_W06	S2OZE_W01 S2OZE_W07 S2OZE_W08	S2RSE_W01 S2RSE_W04 S2RSE_W07 S2RSE_W08
T2A_W04	has detailed knowledge and		S2CCK_W01	S2ENJ_W02	S2ENA_W07	S2OZE_W01	S2RSE_W01

	theoretical grounding connected with the chosen issues in the field of the studied discipline		S2CCK_W02 S2CCK_W04 S2CCK_W06 S2OZE_W06 S2CCK_W09 S2CCK_W12	S2ENJ_W03 S2ENJ_W05 S2ENJ_W06 S2ENJ_W07	S2ENA_W08	S2OZE_W04 S2OZE_W05 S2OZE_W06 S2OZE_W08	S2RSE_W04 S2RSE_W05 S2RSE_W06 S2RSE_W08
T2A_W05	has knowledge of trends in development and the most crucial and newest achievements in scientific disciplines and fields of study related to the studied discipline and other related scientific disciplines	K2ENG_W04	S2CCK_W03 S2CCK_W05 S2CCK_W11 S2CCK_W12	S2ENJ_W02 S2ENJ_W03 S2ENJ_W06	S2ENA_W03 S2ENA_W04 S2ENA_W09 S2ENA_W10	S2OZE_W01	S2RSE_W01 S2RSE_W04
T2A_W06	has fundamental knowledge of the lifecycle of devices, objects and technical systems		S2CCK_W08	S2ENJ_W06	S2ENA_W05	S2OZE_W02 S2OZE_W06	S2RSE_W02 S2RSE_W06
T2A_W07	knows fundamental methods, techniques, tools and materials used for solving simple engineering tasks in the field of the studied discipline	K2ENG_W05	S2CCK_W02 S2CCK_W06	S2ENJ_W01	S2ENA_W01 S2ENA_W02 S2ENA_W03 S2ENA_W04 S2ENA_W05 S2ENA_W06 S2ENA_W07 S2ENA_W08 S2ENA_W09 S2ENA_W10	S2OZE_W02 S2OZE_W03 S2OZE_W06	S2RSE_W02 S2RSE_W03 S2RSE_W06
T2A_W08	has fundamental knowledge necessary to understand social, economical ,legal and other non-technical factors of engineering activities as well as taking them into consideration in engineering	K2ENG_W04 K2ENG_W06	S2CCK_W03 S2CCK_W04 S2CCK_W07 S2CCK_W10	S2ENJ_W02	S2ENA_W02 S2ENA_W09 S2ENA_W10	S2OZE_W03 S2OZE_W04	S2RSE_W03

	practice						
T2A_W09	has fundamental knowledge of management, including quality management and running a business	K2ENG_W06 K2ENG_W07	S2CCK_W01 S2CCK_W06 S2CCK_W10				
T2A_W10	knows and understands basic concepts and rules related to industrial property protection and copyright laws and knows the necessity of these laws and rules in managing intellectual property resources; is able to use patent information resources						
T2A_W11	knows general rules related to establishing and developing individual entrepreneurial activity, using knowledge of scientific disciplines and fields of study related to the studied discipline	K2ENG_W06					
SKILLS							
1) general skills (not related to the area of engineering education)							
T2A_U01	is able to obtain information from literature, databases and other properly selected sources, either in English or another foreign language regarded as a language for international communication in the studied discipline ; is able to integrate obtained information, interpret and critically evaluate it, draw conclusions, formulate and justify opinions in full	K2ENG_U01	S2CCK_U02 S2CCK_U03 S2CCK_U04 S2CCK_U09			S2OZE_U01 S2OZE_U02 S2OZE_U04 S2OZE_U05 S2OZE_U08 S2OZE_U09	S2RSE_U01 S2RSE_U02 S2RSE_U04 S2RSE_U05 S2RSE_U06 S2RSE_U08 S2RSE_U09
T2A_U02	is able to communicate in their professional environment and other	K2ENG_U02 K2ENG_U09	S2CCK_U04 S2CCK_U09				

	environments using various techniques, either in English or another foreign language regarded as a language for international communication in the studied discipline						
T2A_U03	is able to prepare a scientific study in Polish language and also a short scientific report, with the results of own research, in a foreign language regarded as a basic one in the scientific disciplines and fields of study related to the studied discipline	K2ENG_U03	S2CCK_U04 S2CCK_U07 S2CCK_U09				
T2A_U04	is able to prepare and give an oral presentation concerning detailed issues in the field of the studied discipline both in Polish and a foreign language	K2ENG_U02	S2CCK_U04 S2CCK_U05 S2CCK_U09	S2ENJ_U08		S2OZE_U02 S2OZE_U11	S2RSE_U02 S2RSE_U06 S2RSE_U11
T2A_U05	is able to establish directions of further education and follow the process of self-learning	K2ENG_U03	S2CCK_U07			S2OZE_U02	S2RSE_U02 S2RSE_U06
T2A_U06	has language skills in scientific disciplines and fields of study related to the studied discipline according to CEFR requirements for B2+ level	K2ENG_U04					
2) fundamental engineering skills							
T2A_U07	is able to use information and communication technologies necessary to perform tasks typical of engineering activities		S2CCK_U05 S2CCK_U08	S2ENJ_U08	S2ENA_U01	S2OZE_U04 S2OZE_U05 S2OZE_U08 S2OZE_U09 S2OZE_U10	S2RSE_U04 S2RSE_U08 S2RSE_U09 S2RSE_U10

T2A_U08	is able to plan and run experiments including measurements and computer simulations, interpret results and draw conclusions	K2ENG_U06 K2ENG_U07	S2CCK_U01 S2CCK_U06 S2CCK_U07	S2ENJ_U04 S2ENJ_U06 S2ENJ_U07	S2ENA_U03	S2OZE_U03 S2OZE_U07	S2RSE_U03 S2RSE_U07
T2A_U09	is able to use analytical, simulation and experimental methods to formulate and solve engineering tasks as well as simple research problems	K2ENG_U05 K2ENG_U07	S2CCK_U02 S2CCK_U03 S2CCK_U08 S2CCK_U11	S2ENJ_U01 S2ENJ_U02 S2ENJ_U03 S2ENJ_U05	S2ENA_U05 S2ENA_U06 S2ENA_U07 S2ENA_U08	S2OZE_U04 S2OZE_U05 S2OZE_U07 S2OZE_U08 S2OZE_U09	S2RSE_U04 S2RSE_U07 S2RSE_U08 S2RSE_U09
T2A_U10	is able - while formulating and solving engineering tasks- to integrate knowledge of scientific disciplines and fields of studies appropriate for the specialization and apply the system approach which also takes into account non-technical aspects	K2ENG_U05 K2ENG_U06 K2ENG_U08	S2CCK_U03 S2CCK_U11				
T2A_U11	is able to formulate and test hypotheses connected with engineering problems and simple research problems	K2ENG_U07	S2CCK_U01 S2CCK_U07 S2CCK_U11		S2ENA_U01 S2ENA_U02 S2ENA_U03 S2ENA_U04 S2ENA_U05 S2ENA_U08 S2ENA_U09 S2ENA_U10		
T2A_U12	is able to assess the usefulness and possibilities of new achievements (technological and technical) in the field of the studied discipline		S2CCK_U03 S2CCK_U06	S2ENJ_U03	S2ENA_U05 S2ENA_U10	S2OZE_U01	S2RSE_U01
T2A_U13	is prepared to work in an industry environment and knows safety rules in the workplace	K2ENG_U08		S2ENJ_U08			

T2A_U14	is able to carry out primary economic analysis of undertaken engineering activities		S2CCK_U06	S2ENJ_U05	S2ENA_U01 S2ENA_U02 S2ENA_U09	S2OZE_U01	S2RSE_U01
3) skills directly connected with solving engineering tasks							
T2A_U15	is able to carry out critical analysis of functioning and also assess – particularly in reference to the studied discipline- existing technical solutions, in particular devices, objects, systems, processes, and services	K2ENG_U08			S2ENA_U01 S2ENA_U02	S2OZE_U04 S2OZE_U05 S2OZE_U08 S2OZE_U09 S2OZE_U10	S2RSE_U04 S2RSE_U08 S2RSE_U09 S2RSE_U10
T2A_U16	is able to plan improvements in existing technical solutions	K2ENG_U01			S2ENA_U08 S2ENA_U10		
T2A_U17	is able to identify and formulate specifications of complex engineering tasks specific for the studied discipline including untypical tasks considering their non-technical aspects	K2ENG_U07	S2CCK_U10 S2CCK_U12			S2OZE_U06 S2OZE_U10	S2RSE_U10
T2A_U18	is able to assess the usefulness of methods and tools for solving an engineering task specific for the studied discipline, and notice limitations of these methods and tools; is able – by applying conceptually new methods- to solve complex engineering tasks specific for the studied discipline, including untypical tasks and tasks with a research component	K2ENG_U07				S2OZE_U06	
T2A_U19	is able – according to a given specification which considers non – technical aspects- to design a	K2ENG_U01	S2CCK_U10 S2CCK_U12		S2ENA_U03 S2ENA_U09	S2OZE_U12	S2RSE_U12

	complex device, object, system or process specific for the studied discipline and complete this project – at least partially- using appropriate methods, techniques and tools, adapting already existing tools or by creating new tools						
SOCIAL COMPETENCES							
T2A_K01	understands the necessity of a lifetime learning process; is able to inspire and organize the process of learning for others	K2ENG_K01					
T2A_K02	realizes the significance and understands non-technical aspects and consequences of engineering activity and especially its influence on the natural environment and the related responsibility for decisions	K2ENG_K02					
T2A_K03	is able to cooperate and work in a group, taking up different roles	K2ENG_K03					
T2A_K04	is able to set clear priorities leading to the realization tasks set by himself or others	K2ENG_K04					
T2A_K05	identifies correctly and solves dilemmas connected with the profession	K2ENG_K01					
T2A_K06	is able to think and act in an entrepreneurial way	K2ENG_K05					
T2A_K07	realizes the social role of technical university graduates and especially understands the need to formulate information and share it with society, e.g. through mass media, in relation to achievements in	K2ENG_K02					

	environmental engineering and other aspects of engineering activity; makes attempts at sharing such information and opinions in an understandable way						