

LEARNING OUTCOMES FOR THE FIELD OF STUDY

(Assumed educational effects)

Faculty: Mechanical and Power Engineering

Field of study: POWER ENGINEERING (ENG)

Specialization: Power Engineering and Air Protection (ENA)

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.

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	DESCRIPTION OF THE MAIN LEARNING OUTCOMES	Reference to learning
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post-graduate studies in the field of study: ENG specialization: ENA	After completion of the post-graduate studies in the field of <i>Power Engineering</i> in specialization <i>Power Engineering and Air Protection</i> the graduate:	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
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	T2A_W03

	processes, has knowledge of instrumental analytical methods	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		
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+ and possibly for level C1+ of the 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 fields of science and scientific disciplines relevant to the <i>Power Engineering</i> in accordance with the requirements for level A1 or A2 or B1 of the European Framework of Reference for Languages	T2A_U02
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
S2ENA_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
SOCIAL COMPETENCIES		
K2ENG_K01	understands the need to improve professional, personal and social skills; identifies and resolves dilemmas associated with his profession	T2A_K01 T2A_K05
K2ENG_K02	is aware of the importance of non-technical aspects and impacts of social engineering and the role of university graduates	T2A_K02 T2A_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
K2ENG_K06	is aware of the necessity of individual and group activities that go beyond the activities of engineering	T2A_K02 T2A_K03

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL OUTCOMES/ EFFECTS IN THE FIELD OF TECHNICAL SCIENCES
AND EDUCATIONAL EFFECTS**

for 2nd level, main field of study *POWER ENGINEERING* in specialization *POWER ENGINEERING AND AIR PROTECTION*
general academic profile

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 2 nd level main field of study	
		main field of study <i>Power Engineering</i>	specialization <i>Power Engineering and Air Protection</i>
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	S2ENA_W08 S2ENA_W09
T2A_W02	has detailed knowledge in the field of study related to the studied discipline		S2ENA_W01 S2ENA_W02 S2ENA_W05
T2A_W03	has organized, general knowledge and theoretical grounding including key issues related to the studied discipline	K2ENG_W03 K2ENG_W07	S2ENA_W01 S2ENA_W06
T2A_W04	has detailed knowledge and theoretical grounding connected with the chosen issues in the field of the studied discipline		S2ENA_W07 S2ENA_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	S2ENA_W03 S2ENA_W04 S2ENA_W09 S2ENA_W10
T2A_W06	has fundamental knowledge of the lifecycle of devices, objects and technical systems		S2ENA_W05
T2A_W07	knows fundamental methods, techniques, tools and materials used for solving simple engineering tasks in the field of the studied discipline	K2ENG_W05	S2ENA_W01 S2ENA_W02 S2ENA_W03 S2ENA_W04

			S2ENA_W05 S2ENA_W06 S2ENA_W07 S2ENA_W08 S2ENA_W09 S2ENA_W10
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 practice	K2ENG_W04 K2ENG_W06	S2ENA_W02 S2ENA_W09 S2ENA_W10
T2A_W09	has fundamental knowledge of management, including quality management and running a business	K2ENG_W06 K2ENG_W07	
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			
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	
T2A_U02	is able to communicate in their professional environment and other environments using various techniques, either in English or another foreign language regarded as a language for international communication in the studied discipline	K2ENG_U02 K2ENG_U09	
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	
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	
T2A_U05	is able to establish directions of further education and follow the process of self-learning	K2ENG_U03	
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	
T2A_U07	is able to use information and communication technologies necessary to perform tasks typical of engineering activities		S2ENA_U01

T2A_U08	is able to plan and run experiments including measurements and computer simulations, interpret results and draw conclusions	K2ENG_U06 K2ENG_U07	S2ENA_U03
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	S2ENA_U05 S2ENA_U06 S2ENA_U07 S2ENA_U08
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	
T2A_U11	is able to formulate and test hypotheses connected with engineering problems and simple research problems	K2ENG_U07	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		S2ENA_U05 S2ENA_U10
T2A_U13	is prepared to work in an industry environment and knows safety rules in the workplace	K2ENG_U08	
T2A_U14	is able to carry out primary economic analysis of undertaken engineering activities		S2ENA_U01 S2ENA_U02 S2ENA_U09
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
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	
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	

T2A_U19	is able – according to a given specification which considers non –technical aspects- to design a 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	K2ENG_U01	S2ENA_U03 S2ENA_U09
SOCIAL COMPETENCIES			
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 K2ENG_K06	
T2A_K03	is able to cooperate and work in a group, taking up different roles	K2ENG_K03 K2ENG_K06	
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 environmental engineering and other aspects of engineering activity; makes attempts at sharing such information and opinions in an understandable way	K2ENG_K02	