

LEARNING OUTCOMES FOR THE FIELD OF STUDY

(Assumed educational effects)

Faculty: Mechanical and Power Engineering

Field of study: POWER ENGINEERING (ENG)

Specialization: Nuclear Power Engineering (ENJ)

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	DESCRIPTION OF THE MAIN LEARNING OUTCOMES	Reference
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outcome for post-graduate studies in the field of study: ENG specialization: ENJ	After completion of the post-graduate studies in the field of <i>Power Engineering</i> in specialization <i>Nuclear Power Engineering</i> the graduate:	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
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		
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
S2ENJ_U01	is able to solve tasks related to thermal and flow processes in a nuclear reactor	T2A_U09

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
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 *NUCLEAR POWER ENGINEERING*
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>Nuclear Power Engineering</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	S2ENJ_W01 S2ENJ_W02 S2ENJ_W03
T2A_W02	has detailed knowledge in the field of study related to the studied discipline		S2ENJ_W04
T2A_W03	has organized, general knowledge and theoretical grounding including key issues related to the studied discipline	K2ENG_W03 K2ENG_W07	S2ENJ_W08 S2ENJ_W09
T2A_W04	has detailed knowledge and theoretical grounding connected with the chosen issues in the field of the studied discipline		S2ENJ_W02 S2ENJ_W03 S2ENJ_W05 S2ENJ_W06 S2ENJ_W07
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	S2ENJ_W02 S2ENJ_W03 S2ENJ_W06
T2A_W06	has fundamental knowledge of the lifecycle of devices, objects and technical systems		S2ENJ_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	S2ENJ_W01
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	S2ENJ_W02
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	S2ENJ_U08
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		S2ENJ_U08
T2A_U08	is able to plan and run experiments including measurements and computer simulations, interpret results and draw conclusions	K2ENG_U06 K2ENG_U07	S2ENJ_U04 S2ENJ_U06 S2ENJ_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	S2ENJ_U01 S2ENJ_U02 S2ENJ_U03 S2ENJ_U05
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	

T2A_U12	is able to assess the usefulness and possibilities of new achievements (technological and technical) in the field of the studied discipline		S2ENJ_U03
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		S2ENJ_U05
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	
T2A_U16	is able to plan improvements in existing technical solutions	K2ENG_U01	
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	
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	

