



## Subject card

Subject name and code	Nuclear power engineering, PG_00055902						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2022		Academic year of realisation of subject		2024/2025		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		1.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Electrical Power Engineering -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Marcin Jaskólski				
	Teachers		dr inż. Tomasz Minkiewicz				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	15		1.0		9.0	25
Subject objectives	The aim of the course is to familiarize students with the technology of generating electricity in nuclear power plants.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W06] knows classic and developmental energy technologies, rules for the selection and operation of heat and energy devices and installations, basic principles of energy systems operation, basic issues regarding the reliability of energy devices and diagnostics, environmental effects of energy technologies used, methods of using renewable energy sources		They know generation II, III/III+ and IV nuclear power reactors. They know the environmental effects resulting from the use of current generation nuclear power plants.		[SW1] Assessment of factual knowledge		
	[K6_U06] is able to use the basic knowledge on the operation of energy equipment in the field of thermal power plants, thermal and energy and heating systems, combustion engines, compressors and rotating machines to assess the technical condition of the system		They know and are able to describe the cycles of nuclear power plants and the processes occurring in thermal and fast nuclear reactors.		[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information		
	[K6_W13] has basic knowledge of the operation of energy equipment in the field of thermal power plants, thermal and energy and heating systems, internal combustion engines, compressors and rotating machines, has basic knowledge of the regulation of energy equipment and methods of their selection depending on the needs		They have basic knowledge of the structure and operation of power equipment in nuclear power plants.		[SW1] Assessment of factual knowledge		

Subject contents	Atom structure. Historical overview of nuclear energy. Nuclear power in the world. Fission of the uranium nucleus. Multiplication factor and reactivity. Microscopic and macroscopic cross-section. Slowing neutrons. Nuclear reactions. Classification of nuclear reactors. Construction of the basic types of nuclear units. Nuclear power plant efficiency. Nuclear fuel cycle. The future of nuclear energy.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final test	60.0%	100.0%
Recommended reading	Basic literature	1. Krivit B. K. i in.: Nuclear Energy Encyclopedia: Science, Technology, and Applications, John Wiley and Sons 2011 2. Glasstone S., Sesosnke A., Nuclear Reactor Engineering, Springer 1984	
	Supplementary literature	1. <a href="https://www-pub.iaea.org/MTCD/Publications/PDF/cnpp2019/pages/index.htm">https://www-pub.iaea.org/MTCD/Publications/PDF/cnpp2019/pages/index.htm</a> 2. <a href="https://www.intechopen.com/books/nuclear-power-plants">https://www.intechopen.com/books/nuclear-power-plants</a> 3. <a href="https://www.iaea.org/publications/series">https://www.iaea.org/publications/series</a>	
	eResources addresses	Adresy na platformie eNauczanie: Energetyka jądrowa [2024/25] - Moodle ID: 36928 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=36928">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=36928</a>	
Example issues/ example questions/ tasks being completed	Draw a basic diagram of a pressurized water reactor power plant. Label the devices in the layout and their functions.		
	Draw a basic diagram of a boiling water reactor power plant. Label the devices in the layout and their functions.		
	Draw and describe the structure of the pressurized water reactor core and its individual elements. Show an exemplary reaction scheme of the fission of a uranium nucleus by thermal neutrons.		
	What typical nuclear reactions occur in a reactor? Draw diagrams illustrating the initial, intermediate and final phases.		
	Explain the differences between microscopic and macroscopic cross sections.		
	What is nuclear resonance and in what range of neutron energies does nuclear resonance occur (give approximate energy values on a logarithmic scale)?		
	Write the relation for the effective multiplication factor for a finite system (taking into account Fermi's four-factor formula). Explain the symbols. State the criticality condition of a nuclear reactor.		
	How is the power of a nuclear unit with a pressurized water reactor controlled?		
	What influence does the ratio of the number of moderator nuclei to the number of fuel nuclei ( $N_m/N_u$ ) have on the criticality of a nuclear reactor?		
	What effect does the degree of nuclear fuel enrichment have on the criticality of the reactor?		
	Present a diagram of the secondary circuit of a nuclear power unit with a pressurized water reactor with interstage superheating and feed water regeneration. Plot the cycle on the enthalpy-entropy diagram.		
	Compare on the temperature-entropy diagram the primary (without superheating and regeneration) secondary circuits of a nuclear unit with a pressurized water reactor for dry saturated steam and superheated steam (for live steam). Which of the cycles will be more efficient? What is the common constraint for both circuits?		
Work placement	Not applicable		

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