GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Nuclear Power Plants, PG_00042196		
Field of study	Power Engineering, Power Engineering, Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
Education level	first-cycle studies	Subject group	Optional subject group 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	6	ECTS credits	2.0
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. Marcin Jaskólski 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	15.0	0.0	30

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	30	3.0	17.0	50

Subject objectives

The purpose of this course is to familiarize students with following problems: reactor physics, neutron cross section definition, neutron slowing down and thermalisation; general principles of neutron transport and diffusion computations, multiplication factor, reactivity, critical equation, critical size, critical mass, reactor fuel rod behaviour, radiation shielding and radiological protection, fuel cycles; decommissioning, waste disposal and safeguard; nuclear engineering development.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W08	Student recognizes the general data concerning the large part and importance of nuclear energy systems in the world. He classifies the world-wide existing different types of nuclear reactors and these reactors wchich are foreseen for Poland. He learns to analyse and etimate importance of overall nuclear safety approach and safety of nuclear power plant in particular.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
K6_W12	Student recognizes the elements of nuclear physics regarding especially light water reactors (LWR), thermal hydraulics and also radiation protection and shieldings problems. Student masters knowledge on a scale of specific character of nuclear fuel cycle for LWR.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation

<table>
<tr><td>Subject contents</td><td>Introduction to nuclear physics. Structure of matter: atom, atomic nucleus, atomic number, mass number, elements and isotopes. Nuclear reactions. Energy balance in radioactive transitions: , -, +, . Neutron induced reactions: elastic and inelastic scatering, neutron thermalization, resonance neutron absorption, fission reaction, chain reaction, prompt and delayed neutron emission. Neutron balance: the for factors formula. Diffusion equation and theory. Solutions of the diffusion equation. Critical condition of the homogeneous bare reactor. Critical dimensions of the reactor. Reactor kinetics: multiplication factor, reactivity, kinetics without and kinetics with delayed neutrons. Some thermal hydraulics problems: heat transfer in tubes and rod bundles. Conduction in fuel elements (rods). Temperature distribution in the reactor fuel channel. Basic reactor types in the modern nuclear power stations. Construction and main operating parameters. Seminar: Solving of the neutron diffusion equation. Calculation of the multiplication factor. Determination of the reactor critical dimensions. Determination of the temperature distribution in the reactor fuel channel. Overall safety approach in the nuclear energy systems. Analysis of past accidents and evolution of safety-criticality criteria.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Good knowledge of elements of physics (basic lows, physical quantities and their units and measures, mechanics, electrical engineering, thermodinamics, heat transfer). Knowledge of electrical energy generation technologies: energy conversions, efficiency of single conversion, efficiency of conversioncycle and thermodinamic cycle efficiency. Basic knowledge of mathematics: algebra, geometry, trigonometry, differential and integral calculus.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
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<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Paper with presentation and discussion</td><td>60.0%</td><td>40.0%</td></tr>
<tr><td>Lecture test</td><td>60.0%</td><td>60.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Kubowski J.: Nowoczesne elektrownie jądrowe. Warszawa: WNT 2010.
2. Marecki J.: Podstawy przemian energetycznych. Warszawa: WNT 2007
3. Kiełkiewicz M.: Jądrowe reaktory energetyczne. Warszawa: WNT 1978.</td></tr>
<tr><td>Supplementary literature</td><td>1. Jezierski G.: Energia jądrowa wczoraj i dzisiaj. Warszawa: WNT 2005.
2. Żyszkowski W.: Podstawy teorii reaktorów jądrowych. Materiały szkoleniowe dla studiów podyplomowych. Gdańsk: Wydawnictwo Politechniki Gdańskiej 1991.
3. Żyszkowski W.: Wymiana ciepła w reaktorach jądrowych. Materiały szkoleniowe dla studiów podyplomowych. Gdańsk: Wydawnictwo Politechniki Gdańskiej 1991.
4. Celiński Z., Strupczewski A.: Podstawy energetyki jądrowej. Warszawa: WNT 1984.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Jądrowe reaktory energetyczne [2022/23] - Moodle ID: 25018
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=25018</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>• what is the role and significance of nuclear energy in the global economy,
• review types of nuclear reactors applied in the world,
• discuss physical effects that occurs in a nuclear reactor,
• discuss fuel cycle,
• review of safety systems used in modern nuclear reactors.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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