



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Nuclear power plant in the power system

### Course

Field of study

Power Engineering

Area of study (specialization)

Nuclear energy

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

30

### Number of credit points

4

### Lecturers

Responsible for the course/lecturer:

dr hab. inż. Krzysztof Walczak

Responsible for the course/lecturer:

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Wydział Inżynierii Środowiska i Energetyki

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### Prerequisites

The student has structured knowledge in the field of power engineering, operation of power plants and knows the principles of the power system. Has the ability to solve differential equations, knows the integral calculus and has knowledge of thermodynamics, fluid mechanics and nuclear physics. Is aware of the need to expand competences, readiness to cooperate within a team.

### Course objective

Understanding the basic types of nuclear reactors. Familiarization with their construction, concept and thermal systems. Addressing issues related to the security of nuclear power plants. Understanding development trends in nuclear energy.



## Course-related learning outcomes

### Knowledge

1. Understands the essence of phenomena occurring in nuclear reactors and the technological process implemented in nuclear power plants, understands the impact of energy transformation processes occurring in nuclear power plants on the natural environment.
2. Knows and understands the principle of cooperation between nuclear power units and the power system.
3. Understands civilization dilemmas and knows the basic economic, legal and environmental conditions related to the development of nuclear energy. Knows the construction of a nuclear reactor and is able to perform basic calculations of criticality conditions for an energy reactor.

### Skills

1. Student is able to perform basic calculations of the criticality conditions of a nuclear power reactor and calculate the mass flow of the coolant necessary to receive heat generated in the core. Knows approximate methods for solving neutron balance equations.
2. Based on the parameters of the nuclear reactor, the student is able to design a thernak cycle of the power plant.
3. The student is able to analyze the principle of operation of active and passive safety systems in nuclear power plants and assess the effects of possible failures of a nuclear power plant on the environment.
4. Can determine the legitimacy of the application of a given nuclear technology used in a particular branch of the economy.

### Social competences

1. Is aware of the great responsibility of a power engineering engineer at a nuclear power plant for making decisions. Understands the need for continuous training and raising competences in the field of nuclear energy. The student is ready to critically assess his knowledge and to provide the public with reliable information and opinions on nuclear energy, presenting different points of view.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

### Lecture:

Assessment of knowledge and skills takes place at the written colloquium on the 13th lecture. The colloquium consists of 10 open questions, with various points. The minimum passing threshold is 51%.

### Project:

Evaluation of the project of a selected element of the primary/secondary cycle in a nuclear power plant with pressurised water reactor; continuous assessment during each class (rewarding activities).

## Programme content

### Lecture:



The state of development of nuclear energy in the world. Classification of nuclear reactors. Generations of energy nuclear reactors. Basic thermal schemes of nuclear power plants. Thermodynamic cycles of nuclear power plants. Losses and efficiency. Operation of nuclear power plants. Organization and maintenance of reception. Auxiliary devices and systems. Problems of nuclear power security - the importance of nuclear power plant safety and the security of all nuclear power. Development trends in nuclear energy.

Project:

Characteristics of freshwater reactors. Parameters of nuclear blocks. Elements of the reactor control and protection system. Regulating cassette and boric acid systems.

### Teaching methods

Lecture with multimedia presentation with additional examples given on the board.

### Bibliography

Basic

1. Celiński Z., Strupczewski A., Podstawy energetyki jądrowej, WNT, Warszawa 1984
2. Kiełkiewicz M., Jądrowe reaktory energetyczne, WNT, Warszawa 1978
3. Kubowski J., Nowoczesne elektrownie jądrowe, WNT, Warszawa 2010
4. Celiński Z., Energetyka jądrowa, PWN, Warszawa 1991
5. Kubowski J., Elektrownie jądrowe, WNT, 2014

Additional

1. Ackermann G., Eksploatacja elektrowni jądrowych, WNT, Warszawa 1987
2. Gałdyś H., Matla R., Praca elektrowni w systemie elektroenergetycznym, WNT, Warszawa 1990
3. Glasstone S., Podstawy techniki reaktorów jądrowych, WNT, Warszawa 1958
4. Kiełkiewicz M., Teoria reaktorów jądrowych, WNT, Warszawa 1987
5. Kiełkiewicz M., Podstawy fizyki reaktorów jądrowych. Cz. 1, Wydawnictwa Politechniki Warszawskiej, Warszawa 1977
6. Kiełkiewicz M., Podstawy fizyki reaktorów jądrowych. Cz. 2, Wydawnictwa Politechniki Warszawskiej, Warszawa 1980
7. Jezierski G., Energia jądrowa wczoraj i dziś, WNT, Warszawa 2005

### Breakdown of average student's workload

	Hours	ECTS
Total workload	110	4
Classes requiring direct contact with the teacher	65	2
Student's own work (literature studies, preparation for tests/exam, project preparation) <sup>1</sup>	45	2

<sup>1</sup> delete or add other activities as appropriate