COURSE DESCRIPTION CARD - SYLLABUS

Course name
Nuclear power engineering [N1Energ2>EJ]

Course

Field of study
Power Engineering

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr hab. inż. Bartosz Ceran prof. PP
bartosz.ceran@put.poznan.pl

Lecturers

Prerequisites

The student has basic knowledge of physics, chemistry, basics of power engineering and basics of thermal power plants. Student is able to solve mass and energy balance equations in simple thermal power plant's cycle. Is aware of the need to expand their competences, readiness to cooperate within a team.

Course objective

Acquiring basic knowledge in the field of physics of nuclear power reactors and becoming familiar with currently available technologies used in nuclear energy.

Course-related learning outcomes

Knowledge:
1. Student understands the essence of phenomena occurring in nuclear reactors and the technological process implemented in nuclear power plants.
2. Has basic knowledge about the construction of nuclear reactors and types of nuclear power plants and. Student knows the basic technical solutions that guarantee safe operation of a nuclear power plant.
3. Knows and understands the impact of energy transformation processes in a nuclear power plant on

the natural environment.

Skills:
1. Student can carry out basic calculations of criticality conditions of a nuclear power reactor.
2. Student is able to calculate thermal cycles in nuclear power plants.

Social competences:
1. Is aware of the great responsibility of a power engineering engineer at a nuclear power plant for making decisions.

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. The minimum passing threshold is 50%.
Tutorials:
Assessment on the basis of current checking of knowledge and a written test on accounting tasks. The minimum passing threshold is 50%.

Programme content

Basics of the theory of nuclear reactors. Types of nuclear reactors.
Calculation of critical dimensions of a reactor with a given geometry.

Course topics

Lecture:
Nuclear fuels and their properties. The essence of fission of uranium nuclei, fission fragments, fission energy, radioactive chains of fission fragments. Interaction of neutrons with matter, active cross-sections, slowing down of neutrons, escape of neutrons from the reactor. Neutron life cycle, reactor criticality conditions. Equation of neutron balance in the reactor. Solution of the wave equation of the ball reactor. Types of nuclear reactors. Safety systems used in nuclear power plants. Fuel Cycle. Storage of nuclear waste.

Tutorials:
Calculation of critical dimensions of a reactor with a given geometry made of U-235
Calculation of the critical dimensions of a reactor with a given geometry composed of U-235 and a moderator.
Calculation of the critical dimensions of a reactor with a given geometry made of U-238 enriched in U235 and a moderator.

Teaching methods

Lecture:
Lecture with multimedia presentation with additional examples given on the board.
Tutorials:
Tasks counted 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. Glasstone S., Podstawy techniki reaktorów jądrowych, WNT, Warszawa 1958

3. Kiełkiewicz M., Teoria reaktorów jądrowych, WNT, Warszawa 1987
4. Kiełkiewicz M., Podstawy fizyki reaktorów jądrowych. Cz. 1, Wydawnictwa Politechniki Warszawskiej, Warszawa 1977
5. Kiełkiewicz M., Podstawy fizyki reaktorów jądrowych. Cz. 2, Wydawnictwa Politechniki Warszawskiej, Warszawa 1980
6. Młynarski T., Energetyka jądrowa wobec globalnych wyzwań bezpieczeństwa energetycznego i reżimu nieproliferacji w erze zmian klimatu, Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków 2016

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00