COURSE DESCRIPTION CARD - SYLLABUS

Course name
Safety of nuclear power

Course

Field of study
Power engineering

Year/Semester
2/3

Area of study (specialization)
Nuclear power engineering

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars
30

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Mathematics: algebra - functions, equations and inequalities, plane and space geometry, trigonometry, analytic geometry, basic probability theory, equations and systems of equations, elements of differential and integral calculus of functions of one variable at a level 6 PRK. Physics: fundamental lows of physics, rules of mass momentum and energy conservation in classical mechanics, statics, kinematics, dynamics, hydraulics, nuclear physics and safety of nuclear power at level 6 PRK. Solving algebraic equations and systems of algebraic equations, formulating physical problems in the language of mathematics, solving differential equations, the use of integral calculus to calculate the geometrical quantities (e.g., surface areas) and physical quantities (e.g., average values of velocity, momentum of inertia), solving typical

problems in classical mechanics - statics, kinematics, dynamics and hydraulics. Solving of basic problems in in nuclear power engineering at level 6 PRK.

Course objective

Obtained by the students expanded knowledge and skills in safety of nuclear power technology, safety and security rules applied in nuclear technology, influence of nuclear power plant on the environment both during normal operation and emergency situations.

Course-related learning outcomes

Knowledge

1. The student knows and understands the International Nuclear Event Scale - INES.

2. The student knows in detail the construction of Nuclear power plant (NPP) emergency systems (especially reactor cooling systems and containment system).

3. The student has in-depth knowledge about radioactive wastes and methods of their protection.

4. The student has knowledge about decommissioning of nuclear power plants.

Skills

1. Student is able to make a preliminary design of the NPP emergency cooling system.

2. The student can estimate the maximum values of pressure and temperature in NPP containment during loss of coolant accident (LOCA).

3. Student is able to determine the type, quantity and activity of nuclear waste generated during regular operation of the NPP and in emergency situations.

Social competences

1. The student understands the need for teamwork in solving theoretical and practical problems.

2. The student understands the necessity of systematically deepening and expanding their competences.

3. The student is aware of the controversy of nuclear energy in individual and social reception.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures

A 60-minute written exam. Time of the exam and a full list of questions are specified and published at the beginning of the semester. The exam consists in answering 4 selected questions. In doubtful cases, the exam is extended by the oral part. Students' activity is assessed on each lecture.

Design (project)

Continuous evaluation on each class, discussion of student decisions and solutions Final presentation of the project and its defense by the student or students teams.

Grading system: 0-9 points = 2,0 (failed); 10-12 points = 3,0 (sufficient); 13-14 points = 3,5 (sufficient plus); 15-16 points = 4,0 (good); 17-18 points = 4,5 (good plus); 19-20 points = 5,0 (very good)

In order to pass the exam there is necessary to obtain minimum 10 points.

Programme content

Lectures

The International Nuclear Event Scale - INES. The philosophy of security and safety in the fourth generation of NPP. Systems of emergency cooling of the reactor core and the containment operation. Technical and organizational safety of a nuclear power plant. Classification of radioactive wastes. Protection of spent nuclear fuel. Transport and processing of high and low active radioactive wastes. NPP decommissioning.

Design classes

Advanced design (one problem solved by 2-3 person team): thermal shield against radiation, biological shield against radiation, high pressure emergency core cooling system, reactor building spray system.

Teaching methods

Lectures

Lecture with multimedia presentation (including drawings, photos, animations). supplemented with examples considering different aspects of the issues presented, including: economic, environmental, legal and social.

Design classes

Discussing typical cases, discussion of proposed assumptions and solutions, detailed evaluation of projects by the tutor, presentations by students, work in teams, developing skills through activity-, project-, and problem-based (APPB) learning

Bibliography

Basic

1. Ablewicz Z., Dąbrowski W.B. Osłony przed promieniowaniem jonizującym. Arkady, W-wa 1986.

2. Ackermann G., Eksploatacja elektrowni jądrowych. WNT, W-wa 1987.

3. Hrynkiewicz Z. (Red.): Człowiek i promieniowanie jonizujące. PWN, W-wa, 2001.

4. Kiełkiewicz M. Jądrowe reaktory energetyczne. WNT, W-wa 1978.

5. Petrangeli G.: Nuclear Safety. 1st Ed. Butterworth-Heinemann, 2006

6. Elkmann P.:Emergency Planning for Nuclear Power Plants. CRC Press, 2009

Additional

Murray R.L., Nuclear Energy (6th Ed.), Elsevier, Amsterdam 2009.

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for design classes, preparation for exam) [1]	30	1,0

[1] delete or add other activities as appropriate