COURSE DESCRIPTION CARD - SYLLABUS

Course name
Nuclear fuel cycle and radioactive waste from a nuclear power plant [S2EJ1>JCP]

Course

Field of study
Nuclear Power Engineering

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr inż. Wiesław Gorączko
wieslaw.goraczko@put.poznan.pl

Lecturers

Prerequisites

Knowledge of issues related to: basics of nuclear physics, types of ionizing radiation, the impact of ionizing radiation on matter, the basics of radiological protection.Mathematics: algebraic functions, basics of probability calculus, solving algebraic equations and systems of equations.

Course objective

The student has the ability to think independently and formulate conclusions resulting from the content presented at the lecture. Can ask questions for the listened lecture and participate in the discussion.

Course-related learning outcomes

Knowledge:
1. Nuclear uranium fuel cycle of power reactors. 2. Phenomena of interaction of ionizing radiation with matter, including biological systems. 3. Relationships between the type of radiation, distance from the source, its activity and residence time and the absorbed dose. 4. General knowledge of the application of radioactive substances in technology, industry, science and medicine. 5. Rules of dealing with nuclear radiation sources and characterizes probable hazards. 6. Distinguishes between types of nuclear radiation and classifies hazard. 7. Basics of radiation protection. 8. Uranium ore occurrence, enrichment

processes, fuel production and fuel cartridges, reactor fuel burning processes, spent fuel processing, spent fuel management, radioactive waste storage and spent fuel.

Skills:
1. Is able to formulate general and partial conclusions based on the lecture and own knowledge. 2. Has the ability to use subject literature, subject lecture, databases and other sources. 3. Can work and cooperate in a team of several people. 4. Can clearly formulate theses and conclusions on all discussed issues of the fuel cycle. 5. Has knowledge of solving fuel cycle problems in other countries.

Social competences:
1. Is aware of their own responsibility for working in a team. 2. Is aware of the limitation of his own knowledge; understands the need for further education. 3. Can clearly and professionally discuss the topics discussed during the lecture with both peers and people without basic technical preparation.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures
The final grade results from the student's activity during lectures and knowledge test in written assessment or multimedia form (multimedia presentation).

Programme content

Lectures
1. Occurrence, extraction and processing of uranium ores (production of concentrates, chemical conversion). 2. Uranium enrichment processes. 3. Production of fuel materials and assemblies. 4. The process of burning fuel in the reactor. 5. Temporary storage of spent fuel. 6. Open and closed cycle. 7. Spent fuel processing. 8. Handling of high-level waste generated in the process of spent fuel processing. 9. Storage of spent fuel without reprocessing. 10. Final disposal of spent fuel and high-level waste from nuclear reactors - an overview of technical solutions in the world. 11. Elements of the Polish Nuclear Energy development plan - fuel acquisition, processing and storage.

Teaching methods

Lecture delivered remotely using synchronous access methods.
Lectures: multimedia presentation (including drawings, photos, animations) supplemented with explanations provided on the blackboard.

Bibliography

Basic:
1. W.Gorączko, Ochrona radiologiczna, Politechnika Poznańska, Poznań, 2011. 2. W.Gorączko, Elementy chemii jądrowej, Politechnika Poznańska, Poznań 2012. 3. W.Gorączko, Radiochemia i ochrona radiologiczna, Politechnika Poznańska, Poznań, 2003. 4. W.Szymański, Chemia jądrowa, PWN, Warszawa, 1999. 5. Prawo atomowe, Ustawa z dnia 29 listopada 2000 r i z 2001 r. z uwzględnieniem tekstu jednolitego z 14 lutego 2007 r. (Dz. U. Nr 42, poz. 276) z późniejszymi zmianami.

Additional:
1. A.Hrynkiewicz, Człowiek i promieniowanie jonizujące, PWN, Warszawa, 2001. 2. A.Vertes, I.Kiss, Nuclear chemistry, Akademia Kiado, Budapest, 1987. 3. Principles of radiochemistry, H.Kay, Butterworths, London, 1985. 4. AREVA book - Od Atomu do Cyrkonu, Paris, 2010. 5. Nuclear Engineering Handbook Edited By Kenneth D. Kok Edition 2nd Edition First Published 2016 eBook Published 29 September 2016 Pub. Location Boca Raton Imprint CRC Press DOE

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
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)	25	1,00