COURSE DESCRIPTION CARD - SYLLABUS

Course name
Nuclear physics [S1Energ2>FJ]

Course

Field of study
Power Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

A student starting this subject should have knowledge of physics, chemistry, mathematics (differential calculus), programming (Python language preferred), basic operation of the Linux operating system. The student should have the ability to solve problems in physics on the basis of the knowledge they have, the ability to obtain information from indicated sources, understand the necessity of extending their knowledge and competence, and show willingness to cooperate as part of a team.

Course objective

Transfer of fundamental knowledge of nuclear physics as defined by the curriculum content specific to the field of study. To develop in students the ability to solve simple problems and to analyse results and phenomena based on acquired knowledge. To develop in students the skills of teamwork.

Course-related learning outcomes

Knowledge:
1. Student shall have knowledge in physics including mechanics, thermodynamics, atomic and nuclear physics and solid state physics, including the knowledge necessary to understand basic physical phenomena occurring in the field of nuclear energy.

2. Student has basic knowledge in the field of nuclear power including the construction of nuclear reactors, nuclear reaction mechanisms, nuclear power plant accidents, computational methods of reactor physics.

Skills:
1. Student is able to obtain information from literature, databases and other sources; is able to integrate information obtained, interpret it and make inferences and formulate and justify opinions.
2. Student is able to prepare and deliver a short presentation of the results of an engineering task.
3. Student has the ability for self-education, among other things, to improve professional competence.
4. Student is able to model a simple nuclear system.

Social competences:
1. Student is able to actively engage in solving problems posed, to independently develop and expand his/her competences.
2. Student is able to co-operate as a member of a team, fulfil the duties assigned in the division of work within the team, demonstrate responsibility for own work and co-responsibility for the results of the team's work.
3. Student is aware of the importance of and understands the non-technical aspects and consequences of the activities of a power engineer, including its impact on the environment, and the related responsibility for making decisions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge:
Lecture: written exam from selected issues in nuclear physics.
Evaluation criteria:
less than 50% - 2.0
50.1%-60.0% - 3.0
60.1%-70.0% - 3.5
70.1%-80.0% - 4.0
80.1%-90.0% - 4.5
from 90.1% - 5.0
The knowledge acquired in the laboratory will be evaluated on the basis of classroom activities and reports on the exercises carried out.

Programme content

The material presented during the lectures will cover key issues in nuclear physics and nuclear energy.

Course topics

1. Elements of atomic physics.
2. Structure and properties of the atomic nucleus.
3. Nuclear models.
4. Radioactivity - Alpha, Beta, and Gamma Decay.
5. Nuclear reactions.
6. Nuclear fission.
7. Principles of operation of a nuclear reactor.
8. Nuclear reactor theory.
9. Neutron life cycle.
10. Principles of operation of a nuclear reactor.
11. Overview of reactor types.
12. Fundamentals of nuclear fusion.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given in the presentation and on the board.
2. Laboratory: execution of tasks proposed by the teacher by means of the Monte Carlo code.

Bibliography

Basic:
1. D.Halliday, R.Resnick, J.Walker, Podstawy fizyki, tom 5,Wydawnictwo Naukowe PWN, Warszawa 2006
2. Z. Celiński, A. Strupczewski, Podstawy Energetyki Jądrowej, Wydawnictwo Naukowo-Techniczne, Warszawa 1984
3. T.Mayer-Kuckuk, Fizyka jądrowa, Wydawnictwo Naukowe PWN, Warszawa 1987
4. E.Skrzypczak, Z.Szefliński Wstęp do fizyki jądra atomowego i cząstek elementarnych, Wydawnictwo Naukowe PWN, Warszawa 2002
5. I.E.Irodow, Zadania z fizyki atomowej i jądrowej, PWN

Additional:
1. M.Kiełkiewicz, Podstawy fizyki reaktorów jądrowych, WPW
2. H. Anglart, Applied Reactor Technology, ITC Institute Heat Engineering - Warsaw University of Technology, Warszawa 2013
3. P.Tipler, R.Llewellyn, Fizyka współczesna, Wydawnictwo Naukowe PWN, Warszawa 2011

Breakdown of average student's workload

	Hours	ECTS
Total workload	102	4,00
Classes requiring direct contact with the teacher	32	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	70	2,50