COURSE DESCRIPTION CARD - SYLLABUS

Course name
Atomic and Nuclear Physics

Course

Field of study
Technical Physics

Year/Semester
2/4

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
20	15	
Tutorials	Projects/seminars	
15		

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
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Wydział Inżynierii Materałowej i Fizyki Technicznej

Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Knowledge of physics, chemistry and mathematics (program basis for high schools, standard level).

Skills in solving problems in physics based on the knowledge possessed, ability to extract information from the recommended sources.

Understanding of the necessity of extending one’s competences, readiness to cooperate within a team.

Course objective

1.Transfer of fundamental knowledge in atomic and nuclear physics, within the range defined by the program relevant for the field of study.

2. Development of skills in perception of examples of achievements of in of atomic physics operating principles and construction of research facilities.

3. Development of skills in using and understand the sources of popular-scientific and, describing the achievements of modern physics and their application and development of skills in self-study and team work.

Course-related learning outcomes

Knowledge

1. Student can define the basic concepts of atomic and nuclear physics.

2. Student can formulate and explain basic laws atomic and nuclear physics, and give examples of their use for the description phenomena in the surrounding world.

3. Student can give simple examples of the use of achievements of atomic and nuclear physics in the operation and construction of scientific instruments .

Skills

1. Student can apply basic laws of atomic and nuclear physics and simplified models to describe phenomena in the surrounding world and for the description action of selected scientific instruments.

2. Student can formulate simple conclusions on the basis of the results of calculations and simulations and mathematical analysis to describe the phenomena of of atomic physics.

3. Student can use, with understanding, the recommended sources of knowledge (basic references list), as well as gain knowledge from other sources.

4. Student can prepare and present a brief presentation of the results of the engineering task.

5. Student has the ability to self-education, among others to improve professional skills .

Social competences

1. Student can get actively involved in solving problems stated, develop and extend his (her) competences unaided.

2. Student can cooperate within a team, fulfill the duties resulting from division of team work, show responsibility for his (her) own work and joint responsibility for the results of team work.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written exam:

Evaluation criteria:

3.0 : 50.1%-70.0%

4.0 : 70.1%-90.0%

5.0 : od 90.1%

Tutorials - test of the tasks of of atomic physics

Evaluation criteria:

3.0 : 50.1%-70.0%

4.0 : 70.1%-90.0%

5.0 : od 90.1%

Evaluation activity in the classroom: report to the panel, explaining the problems to other students

Laboratories - student can perform a simulation of atomic physics in Mathematica.

Evaluation criteria:

3.0 : student can perform simulations of of physical processes on the basis of clues leading

4.0 : student can independently perform simulations of physical processes and draw correct conclusions

5.0 : student can independently perform simulations of of physical processes, draw correct conclusions and propose their own solution to the problem

Programme content

1.Thermal Radiation and Planck's Postulate.

2.De Broglie's Postulate--Wavelike Properties of Particles.

3.Bohr's Model of the Atom.

4.Schroedinger's Theory of Quantum Mechanics.

5.Quantum mechanics in three dimensions (Schrodinger equation in 3D)

6.One-Electron Atoms.

7.Magnetic Dipole Moments, Spin, and Transition Rates.

8.Hydrogen atom fine structure.

8.Spin in a magnetic field.

9.Two-particle systems - The helium atom.

10. Time-independent perturbation theory.

11.The variational principle.

12. Magnetic resonance.

13. Multielectron Atoms--Optical Excitations. Multielectron Atoms - Atoms Periodic Table

14. Nuclear Spin, Hyperfine Structure.

15.Nuclear Moments and Nuclear Magnetic Resonance.

16. Elements of nuclear physics.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given in the presentation.

2. Computer laboratories: solving tasks in the field of atomic and nuclear physics in the program environment, eg Mathematica, prepared by the teacher.

3. Solving problems in atomic and nuclear physics at auditory classes.

Bibliography

Basic

1. R.Eisberg, R.Resnick, Fizyka kwantowa, PWN Warszawa 1983

2. H.Haken, H.Wolf, Atomy i kwanty, PWN Warszawa 2002

3. Paul A. TiplerRalph A. Llewellyn, Fizyka współczesna, PWN 2012

4. G.K. Woodgate, Struktura atomu, PWN Warszawa 1974

Additional

1. S.Wolfram, The Mathematica Book , 5 th ed., Wolfram Media 2003

2. S.N. Levine, Fizyka kwantowa w elektronice, PWN 1968

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate