STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Atomic and Nuclear Physics		**1010401241010420032**
Field of study: **TECHNICAL PHYSICS**	Profile of study (general academic, practical): **general academic**	Year /Semester: **2 / 4**
Elective path/specialty: **-**	Subject offered in: **Polish**	Course (compulsory, elective): **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time): **full-time**	
No. of hours: Lecture: **2** Classes: **1** Laboratory: **1** Project/seminars: **-**		No. of credits: **4**
Status of the course in the study program (Basic, major, other): **other**	(university-wide, from another field): **university-wide**	
Education areas and fields of science and art: **technical sciences**		ECTS distribution (number and %): **100 4%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Fundamental knowledge of physics and mathematics (program basis for high schools, standard level).
2	**Skills**	Skills in solving elementary problems in physics based on the knowledge possessed, ability to extract information from the recommended sources.
3	**Social competencies**	Understanding of the necessity of extending one?s competences, readiness to cooperate within a team.

Assumptions and objectives of the course:

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.

Development of skills in self-study and team work

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student can define the basic concepts of atomic and nuclear physics. - [K_W01++ K_W04+++ K_W05+]]

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 - [K_W01++ K_W04+++ K_W05+]]

3. Student can give simple examples of the use of achievements of atomic and nuclear physics in the operation and construction of scientific instruments - [K_W01++ K_W04+++ K_W05+]]

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 - [K_U01++ K_U02++ K_U03++ K_U04+ K_U05++ K_U06++]]

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 - [K_U04+ K_U05++ K_U06++]]

3. Student can use, with understanding, the recommended sources of knowledge (basic references list), as well as gain knowledge from other sources - [K_U02++ K_U03++ K_U04+]]

Social competencies:

1. Student can get actively involved in solving problems stated, develop and extend his (her) competences unaided - - [K_K01+++ K_K03+++]
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 - [K_K01+++]

Assessment methods of study outcomes

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

Course description

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.
Multielectron Atoms--Ground States and X-Ray Excitations.

Basic bibliography:

1. R.Eisberg, R.Resnick, Fizyka kwantowa, PWN Warszawa 1983
2. G.K. Woodgate, Struktura atomu, PWN Warszawa 1974
3. Paul A. Tipler Ralph A. Llewellyn, Fizyka współczesna, PWN 2012
4. 2. H.Haken, H.Wolf, Atomy i kwanty, PWN Warszawa 2002

Additional bibliography:

1. S.Wolfram, The Mathematica Book , 5 th ed., Wolfram Media 2003
2. S.N. Levine, Fizyka kwantowa w elektronice, PWN 1968

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures	30
2. Participation in laboratory classes	15
3. Participation in auditorium (accounting) classesPreparation for laboratory classes	15
4. Preparation for final testPreparation of laboratory classes reports	6
5. Preparation of laboratory classes reports	12
6. Participation in consultation concerning education process, in particular laboratory classes	3
7. Preparation for exam	12
8. Participation in exam	3

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	96	4
Contact hours	50	3
Practical activities	16	1