STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Problems in modern physics**			Code **1010342531010417257**
Field of study **Mathematics**	Profile of study (general academic, practical) **(brak)**		Year /Semester **2 / 3**
Elective path/specialty **-**	Subject offered in: **polish**		Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**		
No. of hours Lecture: **2** Classes: **1** Laboratory: **-** Project/seminars: **-**			No. of credits **6**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**		
Education areas and fields of science and art **technical sciences**			ECTS distribution (number and %) **6 100%**

Responsible for subject / lecturer:

prof. dr hab. Piotr Pierański
email: piotr.pieranski@gmail.com
tel. 606814046
Wydział Fizyki Technicznej
ul. Nieszawska 13A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Physics at the high school level.
2	**Skills**	The ability to think logically. Ability to translate verbal description of the model on mathematical equations.
3	**Social competencies**	Understanding the role of technical university graduate in society, particularly in the discussions on issues related to technology.

Assumptions and objectives of the course:

Creation of a consistent image of the most important theories of physics and the ability to use their knowledge to analyze technical issues.

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

Knowledge:

1. Basic knowledge of the most important physical theories. - [-]

Skills:

1. The ability to use knowledge in the field of physics to the analysis of issues in which the laws of physics play a decisive role. - [-]

Social competencies:

1. Ability to critically evaluate material and new ideas emerging in society. - [-]

Assessment methods of study outcomes

A written examination carried out at the end of the course in which the student has to demonstrate knowledge of the physical theories discussed during the lectures and the ability to use them in the analysis of simple phenomena.

Course description

Mechanics: Newton's principle, the equations of motion, Hamilton's equations of motion, integrable and non-integrable equations of motion, the structure of phase space, invariant tori, KAM theorem, deterministic chaos.

Thermodynamics: principles of thermodynamics as a scientific justification of the reduced efficiency of technical devices, thermal conductivity, phase transitions, blackbody radiation.

Optics: equation of geometrical and wave optics, interference and diffraction, the design of optical instruments and their resolution.

Electrodynamics: Maxwell's equations, transformations of electric and magnetic fields when changing the reference system.

The special theory of relativity: the Lorentz transformation formulae, and their consequences, thus, shortening of moving bodies, time dilation, the equivalence of mass and energy.

Fundamentals of nuclear physics: fission and fusion as an energy source, the design of reactors and nuclear weapons, the synthesis of elements in the cores of stars.

Fundamentals of astrophysics: the cosmic microwave background, the structure of the universe, the life of the stars.

Fundamentals of quantum mechanics: Schrödinger equation, quantum correlations, Bell's theorem.

Basic bibliography:

1. D. Halliday, R. Resnick, J. Walker, Podstawy fizyki, tomy 1-5, PWN 2003.

Additional bibliography:

Result of average student's workload

Activity	Time (working hours)
1. A critical analysis of the issues discussed during the lectures	60

Student's workload

Source of workload	hours	ECTS
Total workload	90	6
Contact hours	30	3
Practical activities	0	0