STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Physics**		Code
Field of study **Technologia Ochrony Środowiska**	Profile of study (general academic, practical) **general academic**	Year /Semester **1 / 2**
Elective path/specialty	Subject offered in: **Polish**	Course (compulsory, elective)
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **45** Classes: **15** Laboratory: **0** Project/seminars: **0**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **basic**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art		ECTS distribution (number and %) **4 100%**

Responsible for subject / lecturer:

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 ones competences, readiness to cooperate within a team

Assumptions and objectives of the course:

1. Transfer of fundamental knowledge in physics, within the range defined by the program relevant for the field of study
2. Development of skills in solving elementary problems and performing simple experiments, as well as the analysis of results obtained, based on the knowledge possessed
3. Development of skills in self-study and team work

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

Knowledge:

1. W01-. student can define basic physical concepts, within the range covered by program relevant for the field of study, and indicate simple examples of their application in the surrounding world K_W02
2. W02-student can formulate and explain fundamental physical laws, within the range covered by program relevant for the field of study, define general restrictions and the range of their applicability, give examples of their application in phenomena in the surrounding world, student can explain the aim and meaning of simplified models in description of physical phenomena K_W02, K_W12

Skills:

1. U01-student can apply basic physical laws and simple models in solving simple problems within the range covered by program relevant for the field of study K_U13
2. U02-. student can plan and perform standard problems concerned with basic physical phenomena K_U13
3. U03-student can perform a qualitative and quantitative analysis of the results of simple physical experiments K_U07, K_U16
4. U04-student can formulate simple conclusions on the basis of solving problems K_U16
5. U05-. student can use, with understanding, the recommended sources of knowledge (basic references list), as well as gain knowledge from other sources K_U01

Social competencies:

1. K01-student can get actively involved in solving problems stated, develop and extend his (her) competences unaided K_K01, K_K03
2. K02-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
3. K03-comply with fundamental ethical principles K_K05

Assessment methods of study outcomes
W01,W02: written/oral exam
3.0: 50.1%-60.0%
3.5: 60.1%-70.0%
4.0: 70.1%-80.0%
4.5: 80.1%-90.0%
5.0: from 90.1%
U01, U02: written test
U03, U04, U05: solving problems in physics at auditory classes, written/oral exam, written test
3.0: 50.1%-60.0%
3.5: 60.1%-70.0%
4.0: 70.1%-80.0%
4.5: 80.1%-90.0%
5.0: from 90.1%
K01, K02, K03: activity at auditory classes, written test
3.0: 50.1%-60.0%
3.5: 60.1%-70.0%
4.0: 70.1%-80.0%
4.5: 80.1%-90.0%
5.0: from 90.1%
Course description

1. Mechanics:
- kinematic and dynamic of translation (Newton's Laws, conservation of mechanical energy, conservation of linear momentum),
- kinematic and dynamic of rotation (Newton's second Law for rotation, conservation of angular momentum),
- oscillations: mechanical oscillations (simple harmonic motion (SHM), kinematics and energy of SHM, forced oscillations, damping, resonance),
- mechanical waves: transverse and longitudinal waves, the speed of a traveling wave, energy and power of a traveling wave, the principle of superposition for waves, interference of waves, standing waves, sound waves, ultrasounds, infrasounds, Doppler effect.

2. Gravitation:
- gravitational field and force, orbits and energy of satellites, effect of gravity on space-time, curvature of space.

3. Thermodynamics:
- The Zeroth, First and Second Law of Thermodynamics,
- the kinetic theory of gases,
- heat transfer mechanisms.

4. Electromagnetism:
- electric field (the electric field due to a point charge and an electric dipole, Coulomb's Law, the Gauss' Law: cylindrical, plannar and spherical symmetry, electric potential, capacitance),
- magnetic field (magnetic field due to a current, electrodynamic force, Biot–Savart Law, Ampere's Law, Gauss' Law for magnetic, Faraday's Law of induction, Lenz's Law),
- charge particle in electric and magnetic field; cyclotrons and synchrotrons,
- conductivity/ the electrical properties of solids, energy levels in solids (metals, insulators, semiconductors, *n*-type and *p*-type semiconductors, the *p*-*n* junction), superconductors,
- magnetic materials (diamagnetism, paramagnetism, ferromagnetism).
- electromagnetic waves: Maxwell's equations, the electromagnetic spectrum.

5. Optics:
- reflection and refraction of light, total internal reflection of light, critical angle, white light, dispersion, diffraction, interference and polarization of light, diffraction gratings, Brewster's Law,
- travelling of electromagnetic waves in the medium (VIS and IR range) – classical and photonic optical fibres,
- lasers – work and applications.

6. Special theory of relativity (relativity, the speed of light postulate, mass and energy, time dilatation, length contraction, the twin paradox, Doppler effect of light).

7. Selected problems of modern physics:
   - the hydrogen atom
   - quantum nature of light (photons, the photoelectric effect),
   - matter waves (de Broglie waves),
   - Schrödinger's equation, Heisenberg's uncertainty principle,
   - barrier tunneling effect – STM the scanning tunneling microscope,
   - low-dimensional structures (nanocrystallites, quantum dots, quantum corrals, graphene).

Basic bibliography:

1. D.Halliday, R.Resnick, J.Walker, *Podstawy fizyki*, t. 1-5, PWN, Warszawa 2003.
2. D.Halliday, R.Resnick, J.Walker, *Podstawy Fizyki*, Zbiór zadań, PWN, Warszawa 2005.
3. K.Jezierski, B.Kołodka, K.Sierański, *Fizyka. Zadania z rozwiązaniami*, t. 1-2, Oficyna Wydawnicza *Scripta*, Wrocław 2009.

Additional bibliography:

1. J. Masalski, *Fizyka dla inżynierow*, t.1-2, WNT, Warszawa 1980.
2. J. Orear, Fizyka, t. 1-2, WNT, Warszawa1998.

Result of average student's workload

Activity	Time (working hours)

1. participation in lectures	**45**
2. participation in auditory classes	**15**
3. preparation for auditory classes	**15**
4. .preparation for written test	**15**
5. participation in consultation concerning education process	**2**
6. preparation for exam	**45**
7. participation in exam	**2**

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	**139**	**4**
Contact hours	**64**	
Practical activities	**45**	