MODULE SPECIFICATION

Module code	
Module title in Polish	**Fizyka II**
Module title in English	**Physics 2**
Module running from the academic year	**2016/2017**

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	**Surveying and Cartography**
Level of qualification	first cycle (first cycle, second cycle)
Programme type	academic (academic/practical)
Mode of study	full-time (full-time/part-time)
Specialism	**All**
Organisational unit responsible for module delivery	**The Department of Physics**
Module co-ordinator	**Medard Makrenek, PhD**
Approved by:	**Prof. Andrzej Okniński, PhD hab.**

B. MODULE OVERVIEW

Module type	core module (core/programme-specific/elective HES*)
Module status	compulsory module (compulsory/optional)
Language of module delivery	**English**
Semester in the programme of study in which the module is taught	**semester 2**
Semester in the academic year in which the module is taught	**Summer semester** (winter semester/summer semester)
Pre-requisites	None (module code/module title, where appropriate)
Examination required	**Yes** *(yes / no)*
ECTS credits	**5**

* elective HES – elective modules in the Humanities and Economic and Social Sciences

Mode of instruction	lectures	classes	laboratories	project	others
Total hours per semester	**30**		**15**		

C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to acquaint students with the description of physical phenomena in macroscopic physical systems comprising multiple atoms or particles as part of thermodynamics and statistical physics. Other aims include: understanding the properties of the equilibrium state and irreversible processes; the ability of making simple calculations with the use of the probability calculus.

Module outcome code	Module learning outcomes	Mode of instruction *(l/c/lab/p/ others)*	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student has knowledge on the properties of the equilibrium state and irreversible processes.	l/l	GiK_W01	T1 A_W01
W_02	A student is knowledgeable about the description of physical phenomena in macroscopic physical systems which consist of several atoms of particles as part of thermodynamics and statistical physics.	l/l	GiK_W01	T1 A_W01
W_03	A student knows and understands the principles of thermodynamics.	l/l	GiK_W01	T1 A_W01
U_01	A student can solve simple problems concerning thermodynamics and the ideal gas models (with the use of the probability calculus.	l	GiK _U01 GiK _U03 GiK _U18 GiK _U21	T1A_U01 T1A_U05 T1A_U09 T1A_U13 T1A_U15
U_02	A student can plan and conduct technical experiments (as well as present their results).	l	GiK _U01 GiK _U03 GiK _U18 GiK _U21	T1A_U01 T1A_U05 T1A_U09 T1A_U13 T1A_U15
K_01	A student understands and knows the possibilities of continuous learning and raising his/her own professional, personal, and social competences.	l/l	GiK _K01 GiK _K02	T1A_K01 T1A_K02 T1A_K05 T1A_K07
K_02	A student can work in a group by accepting various roles in it and understanding specific priorities to complete a task.	l	GiK _K06 GiK _K07 GiK _K08	T1A_K03 T1A_K04

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1	Thermodynamic paradoxes and their explanation.	W_01 U_01
2	Equilibrium state as the most probable state. Irreversible processes.	W_01 U_01
3	A model of an ideal gas.	W_02 U_01 K_01
4	Fluctuations. Brownian motion.	W_02 U_01
5	Deriving a formula for mean free path.	W_02 U_01
6	Deriving a formula for gas pressure. Calculating the velocity of gas particles.	W_02 U_01

7	The definition of temperature.	W_03 U_01
8	The zeroth law of thermodynamics. Kelvin temperature scale.	W_03 U_01 U_02
9	The first law of thermodynamics.	W_03 U_01 K_01
10	Heat transfer in gases, liquids, and solid bodies.	W_03 U_01
11	Demonstrating the properties of liquid nitrogen as well as the properties of materials in low temperatures.	W_03 U_02
12	Deriving an equation of the state of a real gas (van der Waals).	W_03 U_03
13	Analysing van der Walls equation.	W_03 U_02
14	The distribution of gas particle velocity.	W_03 U_01
15	The second law of thermodynamics. Entropy.	W_03 U_01 K_01

2. Topics to be covered in the laboratories

No.	Topics	Module outcome code
1	Introduction to the calculus of errors.	U_02
2, 3	Mechanical Laboratory (two laboratory exercises to choose from): M1 – Examining uniformly variable motion with the Atwood machine M2 – Determining Young's modulus M3 – Determining the Cp/Cv ratio with the Clement-Desormes method M4 – Determining specific heat of solid bodies, determining ice fusion heat M6 – Hooke's law. Harmonic oscillations. M7 – Determining gravitational acceleration with Kater's pendulum M8 - Determining the coefficient of fluid viscosity with the Hoppler viscometer	U_02 K_02
4, 5	Electrical Laboratory (two laboratory exercises to choose from): E1 – Examining magnetic hysteresis loop of ferromagnetic substances with an oscilloscope E3 – Determining static characteristics of a bipolar transistor in the common emitter system E5 – Examining resonance in the RLC circuit E6 – Determining copper electrochemical equivalent and Faraday constant E7 – Examining a single-phase transformer	U_02 K_02
6, 7	Optical Laboratory (two laboratory exercises to choose from): O1 – Determining angle of polarisation plane and torsion of a typical sugar solution O3 – Examining optical spectra O4 – Determining the refractive index with a microscope O5 – Determining constant diffraction grating and the length of light waves O6 – Examining polarised light O7 - Determining focal distance of a lens O8 – Measuring numerical aperture of optic fibre O9 – Photometric law of distance	U_02 K_02

Assessment methods

Module outcome code	Assessment methods *(Method of assessment; for module skills – reference to specific project, laboratory and similar tasks)*
W_01	An examination, a mid-term test, a final test, and oral presentations
W_02	An examination, a mid-term test, a final test, and oral presentations
W_03	An examination, a mid-term test, a final test, and oral presentations
U_01	An examination, a mid-term test, a final test, and oral presentations
U_02	Observing a student's involvement, a test on six classes, reports on the classes
K_01	Observing a student's involvement during the classes and a discussion during the classes
K_02	Observing a student's involvement during laboratory classes

D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	**Study time/ credits**
1	Contact hours: participation in lectures	**30**
2	Contact hours: participation in classes	
3	Contact hours: participation in laboratories	**15**
4	Contact hours: attendance at office hours (2-3 appointments per semester)	**3**
5	Contact hours: participation in project-based classes	
6	Contact hours: meetings with a project module leader	
7	Contact hours: attendance at an examination	**2**
8		
9	**Number of contact hours**	**50** *(sum)*
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**2.0**
11	Private study hours: background reading for lectures	**20**
12	Private study hours: preparation for classes	
13	Private study hours: preparation for tests	**5**
14	Private study hours: preparation for laboratories	**15**
15	Private study hours: writing reports	**15**
16	Private study hours: preparation for a final test in laboratories	
17	Private study hours: preparation of a project/a design specification	
18	Private study hours: preparation for an examination	**20**
19		
20	**Number of private study hours**	**75** *(sum)*
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**3.0**

22	**Total study time**	**125**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**5**
24	**Number of practice-based hours** *Total practice-based hours*	**45**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**1.7**

E. READING LIST

References	
Module website	