MODULE INFORMATION SHEET

Name of Module Unit	**Physics**
Name in polish language	Fizyka
Module type	compulsory
Form of studying	full-time day courses
Level of study	undergraduate course (B.Sc. level)
Type of study (for extra-mural courses)	-
Programme	Environmental Engineering
Speciality	Environmental Engineering
Responsible department	Faculty of Physics
Responsible person	Dr Wojciech Gębicki

Semester	Lectures(E)	Tutorials	Laboratory	Computer Exercises	Projects	ECTS
1	30 (Exam)	30				6

Objectives (summary)

The objective of the subject (compulsory optional) is to acquaint students with physical phenomena and to teach the skills of understanding and to make use of the gained knowledge to solve technical and everyday life tasks. Another objective is to teach students the skills of correct definition and measurements of physical phenomena. The scope covered by the subject is mechanics, gravitation, physics of vibrations and waves, thermodynamics. The subject results in knowledge and understanding of classical physics combined with limited information on modern physics. Basic level skills of solving physical problems and physical parameters measurements complete the task. The tutorials teach students practical skills of application the acquainted knowledge to simple physical tasks and to use simple mathematical tools to solve varied physical and technical problems.

Prerequisites

none

Rules of integrated grade setting

First semester 0.6(exam note)+0.4 (training note)

Recommended readings

Halliday, Resnick, Walker: *Fundamentals of Physics*
Further lecture position will be discussed with students

Contents of lectures (syllabus)

	Topics	**Time** (hrs.)	**Scope** (S / Ex)
1	Introduction, Vectors, Components of vectors. Vector addition. Unit vectors. Scalar product. Vector product. Mixed product,	2	S
2	Elements of integral and differential calculus. Displacement, velocity, acceleration. Kinetic energy.	2	S

3	Change of the reference system. Inertial and noninertial reference systems. Summation of velocities; classical and relativistic.	2	S
4	Summation of velocities; classical and relativistic. Newton principles of dynamics, forces, momentum, momentum conservation principle. Potential and kinetic energy. Energy conservation	2	S
5	Rotational movement, angular displacement, angular velocity and acceleration Rigid body. Moment of inertia. Steiner low.	2	S
6	Centripetal acceleration. Torque. Work and power in rotational motion. Angular momentum, Principle of conservation of angular momentum. Gyroscope	2	S
7	Gravitational field, gravitational potential. Force and potential.	2	S
8	Harmonic oscillator – differential equation. Energy in simple harmonic motion. Examples: simple pendulum. Physical pendulum. Energy conservation in harmonic motion. Damped oscillations – differential equation. Logarithmic decrement. Forced oscillations – differential equation. Mechanical resonance.	2	S
9	Damped oscillations – differential equation. Logarithmic decrement. Forced oscillations – differential equation. Mechanical resonance. Combination of simple harmonic motions . Beats. Lissajous figures. Fourier series. Harmonic analysis	2	S
10	Wave motion – differential equation. Phase and group velocity of wave propagation. Amplitude and wavelength. Refraction. Superposition of waves : standing waves, interference, diffraction. Doppler effect	2	S
11	Principles of thermodynamics. Kelvin and Celsius temperature scale. Thermodynamic system, state of a system, state variables, state functions, equations of state, thermodynamic processes - reversible, irreversible. Ideal gas. Ideal-gas equation. Internal energy. First. law of thermodynamics. Heat capacities	2	S
12	Thermodynamic processes in ideal gases. Work in thermodynamic processes. Carnot cycle. Thermodynamical definition of entropy. Clausius statement of the second law of thermodynamics.	2	S
13	Hydrodynamics – Bernoulli's equation, Transport of mass (diffusion), transport of momentum (viscosity), transport of energy (heat conductivity)	2	S/Ex
14	Real gases – van der Waals equation. First and second order phase transitions. Gibbs phase rule	2	S
15	Principles of statistical physics. Probability and probability density. Mean value of energy in ideal gases. Maxwell distribution. Boltzmann distribution. Entropy, phenomenological and statistical definition of the second law of thermodynamic.	2	S
	Total	**30**	**hours**

S – topics listed in the legal study programme standards from 12.07.2007
Ex – extended topics

Lecturers

Dr Wojciech Gębicki

Assessment method

Exam

Contents of tutorials

	Topics	Time (hrs.)	Scope (S / Ex)
1	Vectors and scalars, reference systems, products of vectors scalar products, Vector products, Mixed products	2	S
2	Elements of integral and differential calculus. Application to kinematics, constant velocity, acceleration. Simple applications of integrals and derivatives.	2	S
3	Inertial and noninertial reference systems. Cartesian and polar coordinates. Change of the reference system. Summation of velocities as vectors.	2	S
4	Applications of Newton principles of dynamics to simple mechanical tasks.	2	S
5	Forces and momentum. Principle of momentum conservation. Examples.	2	S
6	Moment of inertia. Simple examples of moment of inertia calculations. Rotational movement. Angular velocity and acceleration. Practical applications of torque and angular momentum conservation.	2	S
7	First test	2	S
8	Harmonic oscillators. Solutions of the differential equations. Springs. Damped oscillator – simple examples and solutions of the differential equations.	2	S
9	Waves – definitions and simple examples. Interference and diffractions. Complex numbers and description of plane waves. Energy of a wave.	2	S
10	Thermodynamics. First principle of thermodynamics. Equation of state of ideal gas and van der Waals gas. Application of the new formulas to simple applications (Heat capacity, work, etc.)	2	S
11	Second principle and third principles of thermodynamics. Calculation of thermodynamical cycle performance and entropy	2	S
12	Maxwell and Boltzmann distribution. Elements of statistics. Calculations of averages. Average value of velocity and energy. Calculations of simple material parameters based on statistical physics (Temperature, pressure etc.)	2	S
13	Applications of Bernoulli equations to simple gas and liquid transport. Viscosity. Diffusion, heat transport and viscosity of ideal gas.	2	S/Ex
14	Second test	2	S
15	General repetition. Coursework evaluation	2	S
	Total	**30**	**hours**

S – topics listed in the legal study programme standards from 12.07.2007
Ex – extended topics

Persons responsible for guided projects

To be determined

Assessment method for tutorials

Tests results 70% coursework 30%