SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Automation and Computer Science
1.3	Department	Automation
1.4	Field of study	System Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Automation and applied informatics
1.7	Form of education	Full time
1.8	Subject code	6.00

2. Data about the subject

2.1	Subject name			Physics			
2.2	Subject area			Physics			
2.3	Course responsible/lecturer			Prof. Dr. Abil. Radu Fechete rfechete@phys.utcluj.ro			
2.4	Teachers in charge of laboratory			Lect. Dr. Dumitrita Corpodean Dumitrita.Corpodean@phys.utcluj.ro			
2.5 Year of study	1	2.6 Semester	1	2.7 Assessment	Col.	2.8 Subject category	DF/DI

3. Estimated total time

3.1 Number of hours per week	4	3.2 of which, course:	3	3.3 applications:	1
3.4 Total hours in the curriculum	100	3.5 of which, course:	42	3.6 applications:	14
Individual study					hours
Manual, lecture material and notes, bibliography					6
Supplementary study in the library, online and in the field					10
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					14
Tutoring					6
Exams and tests					3
Other activities					5

3.7	Total hours of individual study	44
3.8	Total hours per semester	140
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Good knowledge of high school physics Good knowledge of high school mathematics
4.2	Competence	Some knowledge in operating computers (Word, Power Point, Excel, www).

5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	N/A

6. Specific competences

Professional competences	The students will be able to: • Manipulate the main physical quantities and measurement unit by using the fundamental physical laws characteristic to the studied phenomena during the solving of the home work problems (the seminar is missing). • Use the measurement devices during the laboratory time, like: ammeter, voltmeter, ohmmeter, thermometer, thermocouple, spectroscope, microscope, luxmeter. • Evaluate the measurement errors, the absolute and the relative errors. • To define and apply some basics concepts, physically principles and theory applied to computer science and engineering. • To identify and analyze specific problems and to elaborate strategies to solve them. • To be able to identify diverse physical systems, to describe their properties and relations/interactions between the system components.
Cross competences	The students will be able to: • Draw graphics of the variation of a specific quantity function of various parameters which are measured experimentally. • Plot the graphics using computer scientific software like Origin. • Operate with units with different order of magnitude and with the physical constants • Write a paper into a scientifically form using a MS Word template.

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	• Introduction of the most important physical quantities that are encountered in automation engineering. • Introduction of the main laws of physics that play a central role in automation engineering applications.
7.2	Specific objectives	♦ Understanding of the most important laws of classical mechanics ♦ Knowledge of the oscillatory and wave phenomena ♦ Knowledge of the sound characteristics and transfer phenomena ♦ Knowledge of the electrical, magnetically and electromagnetic phenomena. ♦ Knowledge of the quantum mechanical phenomena. ♦ The ability to document alone in a given scientific problem using the books library and the Internet. ♦ The ability to elaborate and to present a report on a given scientific problem ♦ The ability to represent graphically the physical quantities. ♦ The ability to use commercial computer programs for interpretation of the experimental data. ♦ The ability to solve a given physical problem and to express it in a mathematical form. ♦ The ability to work in a team for solving real physical problems

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1.	Introduction in Physics. Fundamental and derivate physical quantities and their measurement units. Basics of kinematics: Elements of motion (reference system, trajectory, space).	Didactic discourse, exposure and explanation of	

	Velocity. Linear motions with constant velocity. Acceleration. Linear motion with constant acceleration.	curricular subjects, narrative-story related to the physics history and association with real life facts. Didactic conversation (heuristics and catechetic) in which the students are involved. Demonstration of physical laws in mathematical form and using objects to represents the physical phenomena at reduced scale. Demonstration with actions performed by students which are asked to: extract from problem the significant data, to observe, identify and classify physical laws and types of motions. Demonstration with technical means like multimedia presentations (Power Point presentation on PC, video-projections). Problematization (problematize) presentations of laws and principles of general physics with situations from real life, and situations from the future work of students.	
2.	Kinematics: Curvilinear motions (trajectory, velocity and acceleration). Circular motion (angle, circular velocity, circular acceleration, law of motion with uniform angular velocity, law of motion with uniform angular acceleration). Relations between linear and circular quantities. Specific measurement units.		
3.	Dynamics: 1st, 2nd and 3rd principles of dynamics. Inertial mass. Force. Linear momentum. Mechanic work. Power. Energy (kinetic, potential, total). Momentum of force. Angular momentum. Conservations laws of: linear momentum, kinetically momentum, energy.		
4.	Oscillatory motion: Linearly harmonically oscillator. Dumped oscillations. Forced oscillations, resonance. Superposition of parallel and perpendicular oscillations.		
5.	Waves. Wave function. Differential equation. Huygens' principle. Characteristic phenomena: reflection, refraction, interference, diffraction, dispersion, absorption. Elastic waves. Longitudinal waves in solids, liquids and gases. Standing waves.		
6.	Acoustics: Definition. Sound sources. Fundamental sound and superior harmonics. Sounds quality (sound intensity, sound pressure, sound level, acoustic level, timbre, noise). Closed chambers acoustics, sound reverberation, reverberation time.		
7.	Electricity. Introduction. Electric charge. Coulombian Force. Electric Field. Electric Field intensity. Electric Flux. Gauss law for the electric field. Electric field work.		
8.	Electric current. Definition. Electric current intensity. Density of the electric current. Electrons in solids (Drude's model). Electrically conductibility. Ohm's law. Elements of electric circuit. Operational amplifiers.		
9.	Magnetism: Magnetic field. Sources of the magnetic field. Lorentz force. Magnetic flux. Gauss law for the magnetic field. Element of current. Magnetic force (Laplace force).		
10.	Biot-Savart law. Magnetic field produced by a liner conductor. Magnetic field produced by a loop. Ampere's law. Electromagnetic induction. Faraday's law.		
11.	Maxwell's equations (differential and integral forms). Electromagnetic waves: Maxwell's equations without sources, velocity, transversally, intensity, and range. Photometrical quantities. Polarization of light.		
12.	Quantum mechanics: thermal radiation, photoelectrical effect, Compton effect, light pressure. Waves attached to particles. Davisson-Germer experiment. Wave group.		
13.	Schrödinger equation. Wave function properties. Potential gap. Potential barrier. Hydrogen atom. Quantum numbers. Spin quantic number (magnetic loop, magnetic moment, orbital magnetic		

	moment). Experimental proves of energy quantifications. Laser. Holography.		
14.	Electrons in solid body. Energy bands. Metals. Hall effect. Contact potential difference. Thermoelectrically effect. Peltier effect. Intrinsic semiconductors. Extrinsic semiconductors. Magnetic properties of solid body: magnetic moment, orbital magnetic moment, diamagnetism, paramagnetism, ferromagnetism. Superconductibility.		

Bibliography

In UTC-N library

2. R. Fechete, Fundamental physics for engineers, course notes.
3. E. Culea, S. Nicoara, Fundamentals of Physics, RISOPRINT, Cluj-Napoca 2004
4. R. Fechete, Elemente de Fizica pentru Ingineri, Ed. UTPress, 2008.
5. I.Ardelean, Fizica pentru ingineri, Ed. UTPres, 2005.
6. I. Coroiu, E. Culea, Fizica I, Ed. UT. Press, 1999.

Multimedia teaching aids

6. Microsoft Encarta Encyclopedia.
7. Encyclopedia Britannica.
8. www.wikipedia.org
9. http://users.pandora.be/educypedia/education/physicsbytopic.htm

8.2. Applications/Seminars		Teaching methods	Notes
1.	Work Protection. The study of thermoelectrically effect.	Heuristic discovery in laboratory (at applications seminars-laboratory) of some physical phenomena. Problematization (problematize) presentations of laws and principles of general physics with situations from real life, and situations from the future work of students. Role-play by students under the teaching supervision for some basics physical experiments.	
2.	Longitudinal and transverse standing waves.		
3.	Optical spectroscopy.		
4.	The study of photoelectric effect.		
5.	The study of Hall Effect.		
6.	The determination of the energy gap of a semiconductor.		
7.	Polarizations of light.		

Bibliography

R. Fechete, R. Chelcea, D. Moldovan, S. Nicoara, I. Coroiu, C. Badea, E. Culea, I. Cosma, N. Serban, Fizica: Indrumator de laborator, UT. PRESS, Cluj-Napoca, ISBN 978-973-662-952-5, (2014).

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field.

The Physics course aim to give to students the basics knowledge and abilities to interact with a technical environment (measurement technique, measurement units, physical law – mechanics, waves, electricity and magnetism – to realize an interface between environment properties and computer, to register an

electric signal from a sensor, to understand the meaning of the signal (physical property) and to act accordingly).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
Course	Colloquium examination assumes a test of 1 hour (part 1) and 1 hour (part 2) from theoretical subjects	Written test	70 – 90 %
Applications	Students have the possibility to submit a scientific essay, a PowerPoint presentation or to build a practical project (usually based on sensors connected to an Arduino microcontroller, and the data can be processed using various software)	Written report or practical project with microcontrollers and various sensors, actuators. Oral PowerPoint presentation Frontal presentation	10 – 30 %
10.4 Minimum standard of performance			
Students must obtain a minimum of 2.75 points for the written test and to accumulate 1.75 points (total 4.5) for the practical applications.			
10.5 Supplementary activities			
Students can write theoretical papers or carry out and to present practical projects (based on sensors, actuators, microcontrollers, but not only) alone or in teams for which they can receive extra points at the final grade.			

Date of filling in:	**Teachers in charge**	**Tite Surname NAME**	**Signarture**
15.03.2023	Course	Prof. Dr. Radu FECHETE	
	Applications	Lecturer Dr. Dumitrița CORPEDEAN	

Date of approval in the department of Automation	Head of Physics and Chemistry department Prof. Dr. Petru PĂȘCUȚĂ
Date of approval in the Board of the Faculty of Computer Science and Automatics	Dean Prof. dr. ing. Liviu Cristian MICLEA