Syllabus

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Automation and Computer Science
1.3 Departament	Automation
1.4 Field of study	Automation. Applied Informatics and Intelligent Systems
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Automation and Applied Informatics (English)
1.7 Form of education	Full time

2. Data about the subject

2.1 Subject name	***Physics***			Discipline code		**6.00**
2.2 Course responsible/lecturer	Prof. Dr. Abil. Radu Fechete rfechete@phys.utcluj.ro					
2.3 Teachers in charge of applications	Lect. Dr. Dumitrita Corpodean Dumitrita.Corpodean@phys.utcluj.ro					
2.4 Year of study	I	2.5 Semester	1	2.6 Assessment *(E/C/V)*		C
2.7 Type of subject	*DF – fundamental, DS – specialty, DC – complementary*					DF
	DOB – compulsory, DOP – elective, DFA – optional					DOB

3. Estimated total time

3.1 Number of hours per week	4	of which:	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	2	3.3 Project	0
3.4 Total hours in the teaching plan	56	of which:	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	28	3.6 Project	0

3.7 Time distribution (hours per semester) for:	
(a) Manual, lecture material and notes, bibliography	6
(b) Supplementary study in the library, online and in the field	10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(d) Tutoring	6
(e) Exams and tests	3
(f) Other activities:	5
3.8 Total hours individual study hours (sum of (3.3(a)...3.3(f)))	44
3.9 Total hours per semester (3.2+3.4)	100
3.10 Number of credits 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 homework problems (the seminar is missing). • To use measurement devices during the laboratory time, like ammeter, voltmeter, ohmmeter, thermometer, thermocouple, spectroscope, microscope. • To 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 automation 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 orders of magnitude and with the physical constants • Write a paper into a scientifically form using a MS Word template.

7. Expected learning outcomes

Knowledge	• Knowledge of physical concepts, theories, laws and principles. • The ability to correctly use the language of physics, units of measurement and graphic symbols. • Identifying and explaining physical processes in the environment and technology.
Skills	• Solving problems using mathematical models and physical formulas • Conducting experiments, observing and interpreting the results. • Processing experimental data, graphical representation of phenomena and their interpretation. • Analysis of information and phenomena from the perspective of the notions learned in physics.
Responsibilities and autonomy	• Ability to collaborate in working groups. • Developing an environmentally conscious attitude and ethical use of technology. • The ability to search for information and deepen knowledge independently.

8. Course objectives

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.
Specific objectives	♦ Understanding of the most important laws of classical mechanics. ♦ Knowledge of the oscillatory and wave phenomena. ♦ Knowledge of the sound characteristic's phenomena ♦ Knowledge of the electrical, magnetically and electromagnetic 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 describing a law of physics. ♦ The ability to use commercial computer programs for interpretation of 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

9. Contents

9.1 Lecture	No. hours	Teaching methods	Notes
L01: Introduction in Physics. Fundamental and derivate physical quantities and their measurement units.	2	Didactic discourse, exposure and explanation of 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	
L02: Basics of kinematics: Elements of motion (reference system, trajectory, space). Velocity. Linear motions with constant velocity. Acceleration. Linear motion with constant acceleration.	2		
L03: 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.	2		
L04: Dynamics: 1st, 2nd and 3rd principles of dynamics. Inertial mass. Force. Linear momentum. Mechanic work. Power. Energy (kinetic, potential, total).	2		

L05: Dynamics: Momentum of force. Angular momentum. Conservations laws of: linear momentum, kinetically momentum, energy. Types of forces.	2	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.	
L06: Oscillatory motion: The energy of an oscillatory motion. Linearly harmonically oscillator.	2		
L07: Oscillatory motion: Dumped oscillations. Forced oscillations, resonance.	2		
L08: Waves: Types of waves. Velocity of waves. Wave function. Huygens' principle.	2		
L09: Waves: Interference. Diffraction. Standing waves.	2		
L10: Acoustics: Definition. Sound sources. Fundamental sound and superior harmonics. Sounds quality (sound intensity, sound pressure, sound level, acoustic level, timbre, noise).	2		
L11: Electricity. Introduction. Electric charge. Coulomb's Force. Electric Field. Electric Field intensity. Electric Flux. Gauss law for the electric field. Electric field work.	2		
L12: Electric current. Definition. Electric current intensity. Density of the electric current. Electrons in solids (Drude's model). Electrically conductibility. Ohm's law.	2		
L13: 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). Biot-Savart law. Magnetic field produced by a liner conductor. Magnetic field produced by a loop. Ampere's law. Electromagnetic induction. Faraday's law. Maxwell's equations	2		
L14 Colloquium	2		

Bibliography

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

9.2 Applications (seminar/laboratory/project/practical work)	**No. hours**	**Teaching methods**	**Notes**
A01: Introduction. Work Protection. Graphic representation.	2	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.	
A02: Study of transverse standing waves in vibrating strings.	2		
A03: Calibration of a spectroscope. Qualitative spectral analysis.	2		
A04: Applications of classical mechanics	2		
A05: Study of the electrical conductivity of metals	2		
A06: Determining the activation energy of a semiconductor	2		
A07: Applications of oscillatory motion	2		
A08: The study of the thermoelectric effect	2		
A09: Study of the photoelectric effect and determination of Planck's constant	2		
A10: Application of waves and acoustics	2		
A11: Experimental verification of Stefan-Boltzmann's law	2		
A12: The study of the Hall effect	2		
A13: Applications of electric and magnetic phenomena	2		
A14: Recovery of missed laboratories	2		

Bibliography

1. Simona Nicoara, Codruta Badea, Radu Fechete, Problems and Applications of PHYSICS for Students of Engineering, U.T. PRESS, Cluj - Napoca, ISBN 978-606-737-619-7, pg. 154, (2022).
2. Radu Fechete, Dumitrita C. Moldovan, Ramona I. Chelcea, Lidia Pop, Maria Bosca, Fizica. Îndrumator de lucrari virtuale de laborator, U.T. PRESS, Cluj - Napoca, ISBN 978-606-737-519-0, pg. 238, (2021).
3. R. Fechete, R. Chelcea, D. Moldovan, S. Nicoara, I. Coroiu, C. Badea, E. Culea, I. Cosma, N. Serban, Fizica: Indrumator de laborator, U.T. PRESS, Cluj-Napoca, ISBN 978-973-662-952-5, (2014).
4. R. Fechete, Fundamental physics for engineers, course notes.

5. E. Culea, S. Nicoara, Fundamentals of Physics, RISOPRINT, Cluj-Napoca 2004
6. R. Fechete, Elemente de Fizica pentru Ingineri, Ed. UTPress, 2008.

10. 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).

11. Evaluation

Activity type	11.1 Assessment criteria	1.2 Assessment methods	11.3 Weight in the final grade
11.4 Course	Colloquium examination assumes a test of 2 hours from theoretical and applications (laboratory work and standard problems) subjects.	Written test	70 – 90 %
11.5 seminar/laboratory /project/ practical work	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 %
11.6 Minimum performance standard Students must obtain a minimum of 2.75 points for the written test and accumulate 1.75 points (total 4.5) for the practical applications.			

Date of filling in:		Title First NAME	Signature
15.06.2026	Course	Prof. Dr. Fiz. Radu Fechete	
	Applications	Lect. Dr. Dumitrita Corpodean	

Date of approval by the Department Board	Head of Departament Prof.dr.ing. Honoriu VĂLEAN
Date of approval by the Faculty Council	Dean Prof.dr.ing. Vlad MUREȘAN