# SYLLABUS

## 1. Data about the program of study

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| 1.1 Institution | The Technical University of Cluj-Napoca |
| 1.2 Faculty | Faculty of Automation and Computer Science |
| 1.3 Department | Computer Science |
| 1.4 Field of study | Computer Science and Information Technology |
| 1.5 Cycle of study | Bachelor of Science |
| 1.6 Program of study / Qualification | Computer science / Engineer |
| 1.7 Form of education | Full time |

## 2. Data about the subject

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| 2.1 Subject name | ***Physics*** | | | Subject code | **6** |
| 2.2 Course responsible / lecturer | Prof. dr. fiz. Fechete Radu - Radu.FECHETE@phys.utcluj.ro | | | | |
| 2.3 Teachers in charge of seminars / Laboratory / project | Lect. dr. Corpodean Dumitrița - Dumitrita.MOLDOVAN@phys.utcluj.ro | | | | |
| 2.4 Year of study | I | 2.5 Semester | 1 | 2.6 Type of assessment (E - exam, C - colloquium, V – verification) | E |
| 2.7 Subject category | Formative category: DF – fundamental, DS – specialty, DC – complementary | | | | DF |
| | Optionality: DOB – mandatory, DOP – optional (alternative), DFA – optional (free choice) | | | | DOB |

## 3. Estimated total time

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|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3 | of which: | Course | 2 | Seminars | - | Laboratory | 1 | Project | - |
| 3.2 Number of hours per semester | 42 | of which: | Course | 28 | Seminars | - | Laboratory | 14 | Project | - |

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| 3.3 Individual study: | |
| (a) Manual, lecture material and notes, bibliography | 16 |
| (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 | 10 |
| (e) Exams and tests | 3 |
| (f) Other activities: | 5 |
| 3.4 Total hours of individual study (suma (3.3(a)…3.3(f))) | 58 |
| 3.5 Total hours per semester (3.2+3.4) | 100 |
| 3.6 Number of credit points | 4 |

## 4. Pre-requisites (where appropriate)

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| 4.1 Curriculum | Good knowledge in high school physics<br>Good knowledge in high school mathematics |
| 4.2 Competence | Some knowledge in operating computers (Word, Power Point, Excel, HTML, JavaScript). |

## 5. Requirements (where appropriate)

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

**6. Specific competence**

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| 6.1 Professional competences | The students will be able to:<br>• 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).<br>• Use the measurement devices during the laboratory time, like: ammeter, voltmeter, ohmmeter, thermometer, thermocouple, spectroscope, microscope, luxmeter.<br>• Evaluate the measurement errors, the absolute and the relative errors.<br>• To define and apply some basics concepts, physically principles and theory applied to computer science and engineering.<br>• To identify and analyze specific problems and to elaborate strategies to solve them.<br>To be able to identify diverse physical systems, to describe their properties and relations/interactions between the system components. |
| 6.2 Cross competences | The students will be able to:<br>• Draw graphics of the variation of a specific quantity function of various parameters which are measured experimentally.<br>• Plot the graphics using computer scientific software like Origin.<br>• Operate with units with different order of magnitude and with the physical constants<br>Write a paper into a scientifically form using a MS Word template. |

**7. Expected Learning Outcomes**

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| Knowledge | Describes, identifies and summarizes basic concepts and methods regarding physics as a science, particularly:<br>• Principles of dynamics, various law of mechanics, electric current, electricity and magnetism;<br>• Use the physical principles, laws and hypothesis to describe the surrounding environment at macroscopic and microscopic level.<br>• Identify, define, characterize physical phenomena. |
| Skills | Apply the physical laws and principles to describe specific phenomena and to calculate the values of various parameters in particular circumstances.<br>Understand the cause and effect of simple or complex mechanical, electric or magnetic problems and calculate the consequences and describe the effects of various actions and reactions.<br>Apply the physical laws and principles for the optimization problems (less effort, less energy, highest outcome). |
| Responsibilities and autonomy | Has an honorable, responsible, ethical behavior, in the spirit of the law to ensure the reputation of the profession and title of engineer. Has the ability to work in teams, good communications with coworkers, and the ability to solve alone specific problems/tasks. |

**8. Discipline objective (as results from the *key competences gained*)**

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| 8.1 General objective | • Introduction of the most important physical quantities that are encountered in computer sciences and automation engineering.<br>• Introduction of the main laws of physics that play a central role in computer sciences engineering's applications. |
| 8.2 Specific objectives | • Understanding of the most important laws of classical mechanics<br>• Knowledge of the oscillatory and wave phenomena<br>• Knowledge of the electrical, magnetically and electromagnetic phenomena.<br>• The ability to document alone in a given scientific problem using the books library and the Internet.<br>• The ability to elaborate and to present a report on a given scientific problem<br>• The ability to represent graphically the physical quantities.<br>• The ability to use commercial computer programs for interpretation of the experimental data. |

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| | • The ability to solve a given physical problem and to express it in a mathematical form.<br>• The ability to work in a team for solving real physical problems |

**9. Contents**

| **9.1 Lectures** | Hours | Teaching methods | Notes |
|---|---|---|---|
| **C1.** Introduction in Physics. Fundamental and derivate physical quantities and their measurement units. Basics of kinematics: | 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 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. | |
| **C2.** Elements of motion (reference system, trajectory, space). Velocity. Linear motions with constant velocity. Acceleration. Linear motion with constant acceleration. Kinematics: Curvilinear motions (trajectory, velocity and acceleration). | 2 | | |
| **C3.** 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 | | |
| **C4.** Dynamics: 1st, 2nd and 3rd principles of dynamics. Inertial mass. Force. Linear momentum. Mechanic work. Power. Energy (kinetic, potential, total). | 2 | | |
| **C5.** Momentum of force. Angular momentum. Conservations laws of: linear momentum, kinetically momentum, energy. | 2 | | |
| **C6.** Types of forces: The law of universal attraction. The gravitational attraction force. The weight. The friction force. The elastic force. | 2 | | |
| **C7.** Oscillatory motion: Energy of an oscillator. Linearly harmonically oscillator. Solution of the second order differential equations. | 2 | | |
| **C8.** Waves: Oscillatory motion: Dumped oscillations. Logarithmic decrement. Relaxation time. Forced oscillations, resonance. | 2 | | |
| **C9.** Waves: Definition. Classification of waves. Examples. Wave function. Characteristic phenomena: interference, diffraction. | 2 | | |
| **C10.** Electricity. Introduction. Electric charge. Coulomb Force. Electric Field. Electric Field intensity. Electric Flux. Gauss law for the electric field. Electric field work. Electric potential. | 2 | | |
| **C11.** Electric current. Definition. Electric current intensity. Density of the electric current. Ohm's law. Electrons in solids. Electrically conductibility. | 2 | | |
| **C12.** Magnetism: Magnetic field. Sources of the magnetic field. Lorentz force. | 2 | | |
| **C13.** Magnetic flux. Gauss law for the magnetic field. Element of current. Magnetic force (Laplace force). Biot-Savart law. | 2 | | |
| **C14.** Magnetic field produced by a liner conductor. Magnetic field produced by a loop. Ampere's law. Electromagnetic induction. Faraday's law. Maxwell's equations (differential and integral forms). | 2 | | |

Bibliography: In UTC-N library

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. 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).
5. I.Ardelean, Fizica pentru ingineri, Ed. UTPres, 2005.
6. I. Coroiu, E. Culea, Fizica I, Ed. UT. Press, 1999.

Multimedia teaching aids

7. Microsoft Encarta Encyclopedia.
8. Encyclopedia Britannica.

| **9.2 Applications - Seminars / Laboratory / Project** | Hours | Teaching methods | Notes |
|---|---|---|---|
| **L1.** Work Protection. The study of thermoelectrically effect. | 2 | Heuristic discovery In 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. | |
| **L2.** Longitudinal and transverse standing waves. | 2 | | |
| **L3.** Optical spectroscopy. | 2 | | |
| **L4.** The study of photoelectric effect. | 2 | | |
| **L5.** The determination of the energy gap of a semiconductor. | 2 | | |
| **L6.** The study of Hall Effect. | 2 | | |
| **L7.** Polarizations of light. | 2 | | |

Bibliography:

1. 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).
2. https://phys.utcluj.ro/resurse/Laboratoare/LabOnline/ThermoelectricEffect/
3. https://phys.utcluj.ro/resurse/Laboratoare/LabOnline/StandingWaves/
4. https://phys.utcluj.ro/resurse/Laboratoare/LabOnline/AtomicSpectra/
5. https://phys.utcluj.ro/resurse/Laboratoare/LabOnline/PhotoelectricEffect/
6. https://phys.utcluj.ro/resurse/Laboratoare/LabOnline/HallEffect/
7. https://phys.utcluj.ro/resurse/Laboratoare/LabOnline/EnergyGap/
8. https://phys.utcluj.ro/resurse/Laboratoare/LabOnline/PolarizationOfLight/
9. http://www.phys.utcluj.ro/resurse/Facultati/Calculatoare/2020-2021/AnICalculatoareEng_2020-2021.html

**Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.*

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

**11. Evaluation**

| Activity type | Assessment criteria | Assessment methods | Weight in the final grade |
|---|---|---|---|
| Course | Theoretical Knowledges accumulated at class, individual study | Written test (9 questions, each one 1 p) | 70% |
| Seminar | - | - | - |
| Laboratory | Practical knowledges (abilities) accumulated in TUCN Laboratory + Individual study (essays on a general Physics subject or practical) | Essay, Practical Presentation, PPT presentation, written Problems, Numeric simulations of physical processes. On Line Assessment | 30% |
| Project | - | - | - |
| Minimum standard of performance: | | | |

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| 2.75/10 points (2.75 mark + (2.75 student – 1 default = 1.5) total 4.5 rounded to 5) + all laboratories |

| **Date of filling in:** 30.04.2026 | **Responsible** | **Title, First name Last name** | **Signature** |
|---|---|---|---|
| | Course | Prof.dr.fiz. Radu FECHETE | |
| | Applications | Lect.dr.eng. fiz. Dumitrita CORPODEAN | |
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| Date of approval in the department | Head of Department,<br>Prof.dr. ing. Rodica Potolea |
| Date of approval in the Faculty Council | Dean,<br>Prof.dr.ing. Vlad Mureșan |