SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Physics and Chemistry
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Telecommunications Technologies and Systems/ Engineer Applied Electronics/Engineer
1.7 Form of education	Full time
1.8 Subject code	TST-E03.00/EA-E03.00

2. Data about the subject

2.1 Subject name	Physics I						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Prof. Ioan ARDELEAN, Ph.D – ioan.ardelean@phys.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Prof. Ioan ARDELEAN, Ph.D – ioan.ardelean@phys.utcluj.ro Assoc.Prof. Traian PETRISOR, Ph.D - traian.petrisorjr@phys.utcluj.ro						
2.5 Year of study	I	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DF/DI

3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar / laboratory	28
Distribution of time					hours
Manual, lecture material and notes, bibliography					20
Supplementary study in the library, online specialized platforms and in the field					-
Preparation for seminars / laboratories, homework, reports, portfolios and essays					18
Tutoring					3
Exams and tests					3
Other activities:					0

3.7 Total hours of individual study	44
3.8 Total hours per semester	100
3.9 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 curriculum	Basic background in Physics from High school
4.2 competence	Basic knowledge of Math from High school

5. Requirements (where appropriate)

5.1. for the course	Amphitheatre, Cluj-Napoca
5.2. for the seminars / laboratories / projects	The presence at the seminaries is compulsory.

6. Specific competences

Professional competences	C1. Use of the fundamental elements related to devices, circuits, systems, instrumentation and electronic technology C2. Applying the basic methods for the acquisition and processing of signals C4. Design, implementation and operation of data, voice, video and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information C5. Selecting, installing, configuring and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks C6. Solving specific problems of the broadband communications networks: propagation in different environment, circuits and equipment for high frequencies (microwaves and optical).
Transversal competences	N/A

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

7.1 General objective	Developing the competences and knowledge related to Elementary Physics useful for Electronics and Applied Electronics.
7.2 Specific objectives	1. Understanding and manipulation of basic concepts in Physics, combined with Math. 2. Developing skills and abilities necessary for solving simple and complex problems of Physics. 3. Developing skills and abilities for the analysis of fundamental phenomena in nature and technics which are transposed as problems in the Engineering domain.

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
Units, physical quantities and vectors The Nature of Physics. Solving Physics Problems. Physical Quantities. Standards and Units. Uncertainty, Significant Figures, Orders of magnitude. Scalar and Vector Physical Quantities. Operations with Vectors.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation, learning by discovery	Mainly use the blackboard, the projector used only for presentation of some movies with recorded experiments of physics.
Kinematics The Point Approach. Position Vector. Displacement Vector. Velocity and Acceleration Vectors. Motion Along a Stright Line. Free Falling Bodies. Motion in		

Two and Three Dimensions.Projectile Motion. Circular Motion. Equations of Movement. x(t), v(t), a(t) Representations. Integral definitions: Calculations of Velocity and Equation of Movement by Integration.		
Dynamics NEWTON'S LAWS OF MOTION Types of forces:Gravitational force (Universal Attraction Law), Friction Forces, Viscosity Forces. Fundamental Forces of Nature. Using Newton's Laws: Translational Equillibrium, Dynamics of Particles.		
Dynamics. *Work, energy and conservation laws* Work. Kinetic Energy and the Work-Energy Theorem. Integral definitions. Power. Gravitational Potential Energy. Elastic Potential energy. Conservative and Nonconservative Forces. Force and Potential Energy. Energy conservation. *Momentum, impulse and collisions* Momentum and Impulse. Internal and External Forces, Conservation of Momentum. Collisions. Center of Mass.		
Kinematics and dynamics of rotational motion Beyond the point approach: the rigid body. Angular Velocity and Acceleration. Equations of Rotational Movement. Energy. Moment of Inertia. Relating Translational and Rotational Motion. Torque. Torque and Angular Acceleration. Work and Power. Angular momentum. Theorem of Angular Momentum. Conservation of angular momentum.		
Equilibrium and elasticity General Conditions of Equillibrium for the Rigid Body (translation+rotation). Center of Gravity. Stability Against Overturn. *Elements of elasticity* Beyond the Rigid Body Approach. Stress, Strain and Ellastic Moduli. Tensile and Compression Stress and Strain.Bulk Stress and Strain. Shear Stress and Strain. Elasticity and Plasticity		
Periodic motion Describing Oscillation. *Simple Harmonic Motion.* Equation of movement. Solution. Elements of SHM: amplitude, period, frequency, angular frequency, phase,...Energy in Simple Harmonic Motion. Applications of SHM (The Simple Pendulum, The Physicsl Pendulum). *Damped Oscillations.* Equation of movement. Solution. Important Physical Quantities: logarithmic decrement of damping, relaxation time, Quality Factor. *Forced Oscillations and Resonance.* Equation of movement. Solution. Resonance, applications		

and consequences of resonance.		
Mechanical waves (I) Types of Mechanical Waves. Periodic Waves. Mathematical Description of a Wave. Speed of a Transverse Wave. Energy and Power in Wave Motion.		
Mechanical waves (II) Wave Interference, Boundary Conditions, and Superposition. Standing Waves in a String. Normal Modes of a String. Harmonic Analysis (Spectral Composition) of Complex Stationary Waves.		
Sound waves Speed of sound waves. Sound intensity. Standing Sound Waves and Normal Modes. Resonance and Sound. Interference of waves. Beats. The Doppler effect. Shock waves.		
Wave optics The principle of Fermat. Reflexion and refraction of sound waves. Diffraction of waves. The principle of Huygens-Fresnel. The sound wave attenuation. The reverberation of sound.		
Elements of ultrasounds and applications Definitions. The magnetostriction effect and the magnetostrictive generator. The inverse piezoelectric effects and the electrostrictive generator. Phenomena specific to ultrasound. Cavitation. Passive and active applications of ultrasounds.		
Elements of fluid mechanics Density and pressure in a fluid. Pressure in a fluid at rest. Pascal law. Applications. Buoyancy. Fluid flow. Continuity equation. Bernoulli equation. Viscosity and turbulence.		
Recapitulation. Preparation for the final exam.		

Bibliography

1) H. D. Young, R. A. Freedman - Sears and Zemansky's University Physics with Modern Physics Technology Update (Ib. engleza), Pearson - 2013; in romanian: Fizica, EDP Bucuresti (1993).
2) D. Halliday, R. Resnik, Physics (vol. I, II), John Willey et sons in Romanian: Fizica, EDP Bucuresti (1975).
3) Berkeley Physics Course (5 vol), vol.I Mechanics (Ch. Kittel, W. Knight, M.A. Ruderman), McGRAW-HILL BOOK COMPANY. in Romanian: EDP Bucuresti, 1981-. Editura Tehnica, Bucuresti, (1984).
4) E. Luca, Gh. Zet si altii ii – Fizică generală, Ed. Did. şi Pedag., Bucureşti.

On-line references

5. Tiusan Coriolan. *Elements of Physics* (course content, course an seminaries), https://spin.utcluj.ro/webphysics/Physics.html

8.2 Seminar / laboratory / project	Teaching methods	Notes
1/ Introduction.	Didactic and experimental proof, didactic exercise, conversation, observation and analysis, individual and team work	Use of white/magnetic board, computers and computer programs for data analysis.
2/ Vectors		
3/ Kinematics		
4/ Force and Potential Energy		
5/ Free falling of bodies. Projectile motion.		
6/ Collisions		
7/ Circular Movement. Gravitation		

8/ Single Harmonic Oscillator		
9/ Damped Oscillations. Electrical analogy: RLC oscilator		
10/ Mechanical waves		
11/ Sound Waves		
12/ Sound intensity level and sound optics.		
13/ Laboratory test		
14/ Recapitulation. Preparation for the final exam.		

Bibliography

1. H. D. Young, R. A. Freedman - Sears and Zemansky's University Physics with Modern Physics Technology Update (lb. engleza), Pearson - 2013;
2. On-line references*:* Tiusan Coriolan. *Elements of Physics* (course content, course an seminaries), https://spin.utcluj.ro/webphysics/Physics.html

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

The discipline content and the acquired skills are in agreement with the expectations of the professional Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills, logical coherence, skills of operating with acquired knowledge in individual complex activities.	Formative evaluation tests (sets of problems solving) -Summative evaluation written exam (theory and problems)	*80%*
10.5 Seminar/ Laboratory	The level of acquired theoretical knowledge and abilities for problems analysis and solving	- Continuous formative evaluation - seminary individual work	*20%*
10.6 Minimum standard of performance			

<u>Quality level:</u>

Minimum knowledge:

- Knowledge of the basic principles of mechanism (statics, Newtonian dynamics)
-Knowledge of main concepts and Physical quantities (force, work, energy, momentum, angular momentum)
-Knowledge of basic conservation laws in Physics (energy, momentum, angular momentum)
-Knowledge of main motion phenomena: linear an curved path motion, periodic motion/oscillation, mechanical waves

Minimum competences:

- Manipulate scalar and vector physical quantities.
- From second principle of dynamics solve a motion problem, derive the law of motion, calculate energies (kinetic, potential).
- Apply conservation laws in analysis of a physical phenomenon
- Be able to solve standard problems in Physics related to motion of objects.
- Succeed to make analysis of a real mechanical phenomenon and put it in a problem to be solved

- The exam and laboratory notes must be at least 5.
-The mark for the subject is calculated with the relation: 0.8 * Exam score + 0.2 * Worker grade (seminary contribution)

Date of filling in:	**Responsible**	**Title First name SURNAME**	**Signature**
16.06.2025	Course	Prof. Ioan ARDELEAN, Ph.D.	
	Applications	Assoc. Prof. Traian PETRISOR, Ph.D.	

Date of approval in the Council of the Communications Department 18.06.2025	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of the Faculty of Electronics, Telecommunications, and Information Technology 25.06.2025	Dean Prof. Ovidiu POP, Ph.D.