SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Materials and Environmental Engineering
1.3	Department	Physics and Chemistry
1.4	Field of study	Electronics and Telecommunications Engineering
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					Elements of Physics					
2.2	Subject area					Physics					
2.3	Course responsible/lecturer					Prof. Coriolan TIUSAN, PhD					
2.4	Teachers in charge of applications					Prof. Coriolan TIUSAN, PhD Assistant Traian PETRISOR, PhD					
2.5	Year of study	I	2.6	Semester	1	2.7 Assessment	Exam	2.8	Subject category	DID/DOB	

3. Estimated total time

Year / Sem.	Subject name	No. of weeks	Course [hours/week]	Applications [hours/week] S	L	P	Course [hours/sem.]	Applications [hours/sem.] S	L	P	Indiv. study	TOTAL	Credits
I / 1	Elements of Physics	14	2	2			28	28			48	104	4

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the curriculum	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	20
Supplementary study in the library, online and in the field	-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	22
Tutoring	3
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	48
3.8	Total hours per semester	104
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 applications	The presence at the seminaries is compulsory.

6. Specific competences

Professional competences	Theoretical knowledge (what the student must know):	- Basic elements of general physics from high school in the following areas: Mechanics, Thermodynamics and Heat, Electricity and Magnetism, Optics, Atomic and Nuclear Physics. - Specific theoretical knowledge related to fundamental concepts: force, Energy, Conservation laws. - Elementary knowledge in Math: Linear Algebra, Differential an Integral calculus, function representation and analysis.
	Acquired skills (what the student is able to do):	After completing the discipline, the students will be able to: - Manipulate fundamental concepts in Physics: force, elements of mechanical movement, energy, momentum, conservation laws, periodic motion and periodic phenomena, resonance. - Extrapolate the basic concepts of mechanics for electric phenomena in electronic circuits: transitory regime, oscillating circuits, damped and forced oscillators and specific elements (quality factor, relaxation time, resonance, logarithmic decrement of damping,etc). - Extrapolate the knowledge of Physics, Math, technics of measuring, data analysis in applied electronics area. - Solve problems based on a general algorithm with the following steps: Analyze the formulation and identify the relevant concepts, Set-up the problem (given the concepts identify the known and target quantities and write down the relevant equations, drive the relevant sketch), Execute the solution, Evaluate and discuss the answer.
	Acquired abilities: (what type of equipment the student is able to handle)	N.A.
	In accordance with Grila1 and Grila2 RNCIS	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology C2. To apply basic methods for signal acquisition and processing C4. To design, implement and operate data, voice, video and multimedia services, based on the understanding and application of fundamental concepts from the field of communications and information transmission. C5. To select, install, configure and exploit fixed and mobile telecommunications equipment. To equip a site with common telecommunications networks. C6. To solve wide-band telecommunications networks' specific problems: propagation in various transmission media, high frequency circuits and equipment (microwaves and optical).
Cross competences (Grila1 and Grila2 RNCIS)		N.A.

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

7.1	General objectives	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
1	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.
2	Kinematics. The Point Approach. Position Vector. Displacement Vector. Velocity and Acceleration Vectors. Motion Along a Straight 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.		
3	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 Equilibrium, Dynamics of Particles.		
4	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 Non-conservative 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.		
5	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.		
6	Equilibrium and elasticity. General Conditions of Equilibrium for the Rigid Body (translation + rotation). Center of Gravity. Stability Against Overturn. *Elements of elasticity.* Beyond the Rigid Body Approach. Stress, Strain and Elastic Moduli. Tensile and Compression Stress and Strain. Bulk Stress and Strain. Shear Stress and Strain. Elasticity and Plasticity		
7	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.		
8	*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.		
9	*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.		
10	*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.		
11	*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.		
12	*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.		
13	*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.		
14	Recapitulation. Preparation for the final exam.		
8.2. Applications (seminary)		Teaching methods	Notes
1	Introduction. Labor protection	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; 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 – Fizică generală, Ed. Did. şi Pedag., Bucureşti.

On-line references

Tiusan Coriolan. *Elements of Physics* (course content, course an seminaries), http://www.c4s.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 organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job, and the expectations of the national organization for quality assurance (ARACIS).

10. Evaluations

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		The level of acquired theoretical knowledge and practical skills, logical coherence, skills of operating with acquired knowledge in individual complex activities.		- 3 formative evaluation tests (sets of problems solving) - Summative evaluation written exam (theory and problems)		- T, max 10 pts. 20% - E, max 10 pts. 60%
Applications (seminary)		The level of acquired theoretical knowledge and abilities for problems analysis and solving		- Continuous formative evaluation - seminary individual work		- S, max. 10 pts. 20%
10.4 Minimum standard of performance						
$S \geq 5$ and $E \geq 4$ and $0,6E+0,2S+0,2T \geq 4.5$						

Date of filling in
28.01.2015

Course responsible
Prof. Coriolan TIUSAN, PhD

Teachers in charge of applications
Prof. Coriolan TIUSAN, PhD
Assist. Traian PETRISOR, PhD.

Date of approval in the department
28.01.2015

Head of department
Prof. CULEA Eugen, PhD