SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Electrical Engineering
1.3	Department	Electrotechnics and Measurements
1.4	Field of study	Electrical Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/ Qualification	Electrical System/ Engineering
1.7	Form of education	Full time
1.8	Subject code	4

2. Data about the subject

2.1	Subject name			Physics II		
2.2	Course responsible/ lecturer			L.dr.Eng. Boşca Maria – Maria.Bosca@phys.utcluj.ro		
2.3	Teachers in charge of Seminars/ Laboratory/ Project			L.dr.Eng. Boşca Maria – Maria.Bosca@phys.utcluj.ro		
2.4 Year of study	I	2.5 Semester	II	2.6 Type of assessment *(E – exam, C – colloquium, V – verification)*	E	
2.7 Subject category	*DF – fundamental, DD – in the field, DS – specialty, DC – complementary*				DF	
	DI – compulsory, DO – elective, Dfac – optional				DI	

3. Estimated total time

3.1 Number of hours per week:	3	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	2	3.3 Project	-
3.2 Total hours per semester	42	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	28	3.6 Project	-

3.7 Individual study:	
(a) Guidebook, course documentation, notes and bibliography study	28
(b) Supplementary study in the library, online and in the field specialty documentation	14
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(d) Tutoring	-
(e) Exams and tests	2
(f) Other activities	-
3.8 Total hours of individual study *[sum (3.7(a) to 3.7(f))]*	58
3.9 Total hours per semester *[sum of 3.4 and 3.8]*	100
3.10 Number of credit points	4

4. Prerequisites (where applicable)

4.1	Curriculum	Basic background knowledge in Physics from High school
4.2	Competences	Basic physics knowledge and mathematical analysis

5. Requirements (where appropriate)

5.1	For the course	Amphitheatre, Technical University of Cluj-Napoca
5.2	For the applications	The presence at the seminaries is compulsory.

6. Specific competences

Professional Competences	- Definition of the main physical quantities and their measurement units. - The use of integral and differential calculus for the description of physical phenomena. - Acquiring the concepts of filed (electric, magnetic, electro-magnetic). - Acquiring the notions of the main quantities (electric and magnetic) of solid body. - Identify physical phenomena and explain them. - Operate with physics formulae and demonstrate physics laws. - Solve problems and interpret results. - Process measurements results for determining other physics quantities. - Compare practical results against theories and draw conclusions. - Graphical representation on various coordinates and obtain relevant information. - Estimate errors which affect obtained data through measurements or data obtained based on experiments. - Identify installations components in the lab and understand how they work. - Measure with various instruments.
Cross competences	- Utilize physics fundamentals in electrical engineering domain. - Understand and explain a physical phenomenon. - Understand physics specific laws in correlation with other disciplines.

7. Discipline objectives (based on specific competencies acquired)

7.1	General objective	The development of theoretical knowledge and experimental skills in the field of fundamental laws which govern electric and magnetic processes.
7.2	Specific objectives	1. Assimilation by students of the quantities and laws that govern the fundamental physical phenomena for the purpose of the intellectual training of the future engineer. 2. Initiating future engineers in the development and use of physical models, as a practical way of extracting the essential from a complex set of empirical phenomena. 3. Training the skills to quantitatively approach complex problems through exercises applying the fundamental laws of physics.

8. Contents

8.1. Course (Lectures)		Number of hours	Teaching methods	Additional remarks
	Course 1. Notions of elasticity. Electric field. Electric force. Intensity and potential of an electric field.	2 hours	Systematic exposition of physical phenomena, conversations, theoretical and experimental demonstrations,	Exposure and free discussions. Computer, video projector, blackboard.
	Course 2. Electric field flux. Gauss law and applications.	2 hours		
	Course 3. Electric dipole. Dielectrics in electric field. Condenser with dielectric. Electric field's density of energy.	2 hours		
	Course 4. Electro-kinetics topics. Electric current. Phenomenon theory of electric conductivity.	2 hours		
	Course 5. Magnetism topics. Magnetic field. Biot-Savart law and applications. Lorentz force.	2 hours		

	Course 6. Ampere law and applications. Magnetic field generated by an infinite thread. Field generated by a surface current.	2 hours	observations and analysis of studied phenomena, learning through discovery.	
	Course 7. Electromagnetism topics. Electromagnetic induction law. Maxwell equations. Inductance, auto-inductance. Magnetic field energy.	2 hours		
	Course 8. Magnetic materials. Magnetic momentum. Magnetization. Para-magnetism. Diamagnetism. Ferromagnetism. Other magnetic status: antiferromagnetism, ferrimagnetism.	2 hours		
	Course 9. Electromagnetic waves. Electromagnetic waves equation. Transversality of electromagnetic waves. Energy transported by electromagnetic waves. Vector Poynting.	2 hours		
	Course 10. Introduction to quantic physics. Photoelectric effect. Stability problem for hydrogen atom. Bohr postulates. Broglie wave.	2 hours		
	Course 11. Wave mechanics topics. Schrödinger's equation. Applications: Free particle. The particle in the infinite potential well. The tunnel effect. The microscope with tunnel effect.	2 hours		
	Course 12. From atom to condensate status. The atom, quantic numbers, energy levels, spin. Electrons' energy bands in solid bodies. Metals, semiconductors, insulators.	2 hours		
	Course 13. Geometric optics topics. Plane dioptre. Spheric dioptre. Plane mirror. Spherical mirror. Thin lenses.	2 hours		
	Course 14. Galvano-magnetic and thermoelectric effects. Hall normal and abnormal effect. Nernst effect. Seebeck effect. Peltier effect.	2 hours		

Bibliography

1. E. Culea, Fizică – Elemente de fizică pentru ingineri, Risoprint, 2010.
2. I. Ardelean, Fizica pentru ingineri, Ed. U.T. PRES, Cluj-Napoca, 2005.
3. T. I. Cretu, Fizica-curs universitar, Ed. Tehnica, Bucuresti, 1996.
4. Cursul de Fizica Berkeley, Vol. II – Electricitate si Magnetism, Ed. Didactica si Pedagogica, 1981.
5. P.W. Sears, M.W. Zemansky, H.D. Young, *Fizica*, Ed. didactica si pedagogica, 1983.

8.2. Applications - Seminar /Laboratory/Project		Number of hours	Teaching methods	Additional remarks
	Laboratory 1. Electrostatics applications: Colombian forces, intensity and potential of an electric field.	2 hours	Theoretical and	
	Laboratory 2. Applications of Gauss law and electric field lines.	2 hours		
	Laboratory 3. Applications of Ampere law.	2 hours		

	Laboratory 4. Applications of electromagnetic induction law.	2 hours	experimental demonstration, conversation, observation, and analysis.	Laboratory work is performed practically.
	Laboratory 5. Electric conduction in metals and semiconductors.	2 hours		
	Laboratory 6. Photoelectric effect and Broglie waves.	2 hours		
	Laboratory 7. Applications of geometric optics.	2 hours		

Bibliography

1. I. Cosma, T. Ristoiu, Fizică aplicată: probleme rezolvate, Ed. U.T. Press, Cluj-Napoca, 2005.
2. I.Milea, E.Culea, T.Ristoiu, R.Muntean, I.Lazar, Fizica aplicata-exercitii si probleme pentru invatamantul superior, Ed.UT Pres, 1998.

9. Alignment of course content with expectations of the epistemic community, professional associations, and representative employers in the field

The acquired skills are necessary for them and will help them to understand other disciplines, especially when they will carry out their activity in engineering fields.

10. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade (%)
10.4 Course	The completeness and correctness of the accumulated knowledge, logical coherence and the ability to operate with the assimilated knowledge in complex intellectual activities.	Summative evaluation - assessment	80%
10.5 Laboratory	Ability to apply the knowledge, in various situations.	Formative evaluation along the way, activity in the laboratory and solving problems/applications.	20%
10.6 Minimum standard of performance: Final grade= 0.8 · T + 0.2 · L = 10 - maximum grade The minimum passing grade for the exam is 5			

Date of completion	Lecturers	Title/ Surname/ Name:	Signature
19.09.2024	Course	L.dr.Eng. Maria Boşca	
	Applications Seminar/ Laboratory/ Project		
		L.dr.Eng. Maria Boşca	

Date of approval in the ETHM Department Council **September 2024**	**Head of Department:** Prof. Eng. MICU Dan Doru, PhD
Date of approval in the Faculty of Electrical Engineering Council **September 2024**	**Dean:** Assoc. Prof. Eng. CZIKER Andrei, PhD