Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Technologies and Telecommunications Systems

2. Date despre disciplină

2.1 Course name (ro) (en)				Fizică 2 Physics 2			
2.2 Course Lecturer				Conf. Dr. Gabriel Suliman			
2.3 Instructor for practical activities				Conf. Dr. Gabriel Suliman			
2.4 Year of studies	1	2.5 Semester	2	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		F	2.9 Course code	04.F.02.O.010		2.10 Tipul de notare	Nota

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week	4	Out of which: 3.2 course	3	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	56	Out of which: 3.5 course	42	3.6 seminary/laboratory	14
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					38
Tutoring					3
Examinations					3
Other activities (if any):					0

3.7 Total hours of individual study	44.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Physics 1 General knowledge of algebra, calculus, programming and physics from high school curricula

4.2 Results of learning	- Elementary mathematics - Solving the 1st and 2nd degree order equations - Building simple computer codes - Vector operations - Elementary dimensional analysis

5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	Room equipped with a video projector
5.2 Seminary/ Laboratory/Project	Specialized introductory physics laboratory at the Physics Department. Student attendance is mandatory.

6. General objective *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

The students make contact with the fundamental laws of nature and with their application in engineering. The students learn about how the theoretical results are confirmed by experiments. The students learn to solve problems in the field of electromagnetism and modern physics.

The students learn how to apply mathematical methods in practical situations. The start the study of modern physics and its use in electronics engineering.

The students apply mathematical and physical models to simple, fundamental cases.

The students are initiated in the methods used in scientific research.

7. Competences *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

Specific Competences	Understanding the methods and results of physics and how to apply them in actual engineering activities. The ability to build and apply physical and mathematical models Developing the ability to make correct measurements and to collect and analyze experimental data, to estimate measurement uncertainties and to present the results of experiments.
Transversal (General) Competences	Developing personal learning skills, learning to combine theoretical and experimental approaches, the ability to work as part of a team. Developing the ability to debate and argument and idea in a scientific context. Honorable, ethical and responsible professional behaviour. Awareness of the need for continuous training; efficient use of resources and learning techniques for personal and professional development.

8. Learning outcomes *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The*

learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* Developing personal learning skills, learning to combine theoretical and experimental approaches, the ability to work as part of a team. Developing the ability to debate and argument and idea in a scientific context. Honorable, ethical and responsible professional behaviour. Awareness of the need for continuous training; efficient use of resources and learning techniques for personal and professional development.
Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* Developing personal learning skills, learning to combine theoretical and experimental approaches, the ability to work as part of a team. Developing the ability to debate and argument and idea in a scientific context. Honorable, ethical and responsible professional behaviour. Awareness of the need for continuous training; efficient use of resources and learning techniques for personal and professional development.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Select appropriate bibliographic sources and analyze them. • Respect the principles of academic ethics, correctly citing the bibliographic sources used. • Demonstrates responsiveness to new learning contexts. • Demonstrates collaboration with other colleagues and teaching staff in carrying out learning activities. • Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved. • Demonstrates real-life situation management skills (organizing and managing own working time, collaborative vs. conflict).

9. Teaching techniques *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

The teaching process will explore both expository (lecture, exposition) and conversational-interactive teaching methods, based on modern learning models facilitated by exploration direct and indirect of reality (experiment, demonstration, modeling), but also on action-based methods, such as exercise, practical activities and problem solving.

In the teaching activity, lectures will be used, based on Power Point presentations or different videos that will be made available to the students. Each course will start with a recap of the chapters already covered, with an emphasis on the concepts covered in the last course.

Presentations use images and diagrams so that the information presented is easy to understand and assimilate.

This discipline covers information and practical activities designed to support students in their learning efforts and the development of optimal collaborative and communicative relationships in a climate conducive to learning the fundamental concepts and notions.

It will be considered the practice of active listening and assertive communication skills, as well as feedback construction mechanisms, as ways of regulating behavior in various situations and adapting the pedagogical approach to the students' learning needs.

The teaching activity will follow the development of efficient team work in solving the different learning tasks.

10. Contents

COURSE

Chapter	Content	No. hours
1	Electromagnetism: electromagnetic field, experiments and fundamental laws. Applications.	8
2	Undulatory optics: electromagnetic waves, characteristics, polarisation, reflection, refraction. Interference, diffraction, light polarization. Applications	8
3	Experimental basis of quantum mechanics. Characteristics of quantic entities.	4
4	Principles of quantum mechanics. Schrödinger equation	2
5	Unidimensional quantic systems: potential well, potential barrier, tunnel effect, the quantic harmonic oscillator. The hidrogen atom. Applications	8
6	Systems of identical particles. The Fermi-Dirac and Bose-Einstein statistics.	2
7	Elements of solid state quantum physics. The energy spectrum of electrons in periodic fields.	2
8	Applications of quantum physics in complex systems and devices.	4
9	Introduction to the physics of atomic nucleus and of the ionizing radiation. Environmental radioactivity, medical and industrial applications, nuclear energetics. The standard model of elementary particles. Cosmology	2
10	Elements of laser and plasma physics	2
	Total:	42

Bibliography:

1. Written course on the Physics Department web page
2. Halliday & Resnick, Fundamentals of Physics, 8-th ed. Wiley India Pvt. Limited, 2008

LABORATORY

Crt. no.	Content	No. hours
1	Determination of the specific charge of the electron	2
2	Determination of Rydberg constant	2
3	Determination of Plank constant	2
4	Study of Poisson and Gauss statistics	2
5	Electron diffraction (Debye-Scherrer)	2
6	Experimental study of the Heisenberg principle	2

7	The current-volage characteristic curve for a tunnel diode	2
8	The Seebeck effect	2
9	Determination of radioactive source activity	2
10	The Frank-Hertz experiment	2
11	The Compton effect	2
12	Determination of the linear mass attenuation coefficient for gamma radiation	2
13	The determination of the detector dead time	2
14	The study of Hall effect in semiconductors	2
	Total:	14

Bibliography:

1. Laboratory guide on the moodle page of the course
2. Laboratory guide on the webpage of the Physics Department (www.physics.pub.ro).

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- understanding of the fundamental theoretical notions - understanding the way the theory is applied to solve specific problems	-midterm exam in week 7/8	20%
	- understanding of the fundamental theoretical notions - understanding the way the theory is applied to solve specific problems	final examination	50%
11.5 Seminary/laboratory/project	Laboratory: -familiarity with the basics of scientific experiments, with the measurement methods and the data analysis	-reports containing the measured values, the data analysis and the conclusions of the experiment - final laboratory exam	30%
11.6 Passing conditions			
• Obtaining 50% of total score. • Obtaining 50% of the laboratory score. • Participation in all laboratory activities			

12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)

The Physics 2 course is one of the fundamental disciplines in the formation of the general technical expertise of the student. The course introduces the student to two of the most fruitful fields of study of the last decades.

The goal of the course is the emphasize the connection between the mathematical methods and models on one hand, and the physical models, on the other hand.

The course lays the foundation for the subsequent study of important phenomena like semiconductors, microwaves, lasers and optoelectronics.

The students are initiated in classical theories in physics, for example quantum mechanics.

Physics 2 is a course where the students carry out experimental work by performing real measurements, estimating uncertainties and drawing conclusions from their experiments.

Date	Course lecturer	Instructor(s) for practical activities
21.09.2026	Conf. Dr. Gabriel Suliman	Conf. Dr. Gabriel Suliman

Date of department approval	Head of department
22.09.2026	Conf. Dr. Serban Georgica Obreja

Date of approval in the Faculty Council	Dean
22.09.2026	Prof. Dr. Mihnea Udrea