Universitatea Națională de Știință și Tehnologie Politehnica București
Facultatea de Electronică, Telecomunicații și Tehnologia Informației

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	**Electronic Devices, Circuits and Architectures**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Microelectronics, Optoelectronics and Nanotechnologies

2. Date despre disciplină

2.1 Course name (ro) (en)				Dispozitive dielectrice si magnetice Dielectric and magnetic devices			
2.2 Course Lecturer				Lect. Dr. Eng. Alina-Elena Marcu			
2.3 Instructor for practical activities				Lect. Dr. Eng. Alina-Elena Marcu			
2.4 Year of studies	4	2.5 Semester	2	2.6. Evaluation type	V	2.7 Course regime	Ob
2.8 Course type		S	2.9 Course code	04.S.08.O.415		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.					17
Tutoring					0
Examinations					4
Other activities (if any):					0

3.7 Total hours of individual study	19.00
3.8 Total hours per semester	75
3.9 Number of ECTS credit points	3

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	• Physics 1 • Physics 2 • Fundamentals of Electrical Engineering 1 • Fundamentals of Electrical Engineering 2
4.2 Results of learning	General knowledge of physics and fundamentals of electrical engineering

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

5.1 Course	Room with video projector
5.2 Seminary/ Laboratory/Project	Laboratory room A408. Attendance at laboratory sessions is mandatory (according to the undergraduate study regulations at UNSTPB).

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)*

Familiarizing students with the main dielectric and magnetic devices (both circuit-type and transducer-type).

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	Developing skills for using dielectric and magnetic devices in various projects, and correctly selecting them for a specific application. Acquiring competencies in technological implementation, characterization, and performance improvement of dielectric and magnetic devices.
Transversal (General) Competences	The ability to adapt to new manufacturing technologies for dielectric and magnetic devices and to document oneself in Romanian and at least one international language, for professional and personal development through continuous training

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.* • Knowledge of the main types of dielectric and magnetic devices and their characterization. • Knowledge of the performance of these devices. • Mastering the principles for designing these devices. • Mastering the main manufacturing technologies.

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).* • Knowledge of fundamental theoretical notions; • Knowledge of how to apply theory to specific problems. • Knowledge of the characteristics and performance of the studied dielectric and magnetic devices
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Selects suitable bibliographic sources and analyzes them. • Respects the principles of academic ethics, correctly citing the bibliographic sources used. • Demonstrates openness to new learning contexts. • Shows collaboration with other colleagues and teaching staff in carrying out didactic activities • Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved • Shows social responsibility through active involvement in student social life/involvement in events of the academic community • Promotes/contributes with new solutions in the field of specialization to improve the quality of social life.

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.)*

Teaching is based on the use of the video projector (covering the communication and demonstrative function); the oral communication methods used are the expository method and the problematization method, used frontally. The teaching materials used are course notes and presentations, also available in electronic format.

The teacher gives a short theoretical presentation of the concepts to be used in that laboratory, then guides students in carrying out practical applications. The teaching materials are the laboratory platforms included in the laboratory guide.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**

1	Ch. 1 – Piezoelectric devices with bulk elastic wave 1.1. Quartz piezoelectric resonators 1.2. Piezoceramic resonators 1.3. Filters with discrete piezoelectric devices 1.4. Integrated (monolithic) filters 1.5. Piezoceramic transformers 1.6. Piezoelectric transducers with bulk elastic wave 1.7. Amplification of bulk elastic waves	10
2	Ch. 2 – Piezoelectric devices with surface elastic wave 2.1. Classification of surface elastic waves 2.2. Principles of generation and reception of surface elastic waves 2.3. Components for generation, processing, and reception of surface elastic waves (transducers, reflector structures, microstrips, guides) 2.4. Functional dielectric devices with surface elastic wave (band-pass filters, oscillators, delay lines, matched analog filters, programmable matched filters) 2.5. Surface elastic wave transducers 2.6. Amplification of surface elastic waves	6
3	Test 1	2
4	Ch. 3 – Magnetostatic devices 3.1. Principles of generation and reception of magnetostatic waves 3.2. Functional devices with magnetostatic wave (band-pass filters, oscillators, delay lines, matched analog filters)	4
5	Ch. 4 – Nonlinear dielectric and magnetic devices 4.1. Nonlinearity of the generation of electrostatic and magnetostatic waves 4.2. Devices for implementing the convolution function 4.3. Devices for implementing the correlation function	4
6	Ch. 5 – Magnetic memories 5.1. Physical principles of random-access magnetic memories (RAM) 5.2. Inductive magnetic memories (magnetic disks and tapes) 5.3. Magnetoresistive memories (MRAM)	4
7	Test 2	2
	Total:	28

Bibliography:

[1] P. Schiopu, C. Schiopu, Dispozitive piezoelectrice, Editura Matrix Rom, București, 2011.
[2] P. Şchiopu, Dispozitive dielectrice şi magnetice, Editura Matrix Rom, București, 2010.
[3] O. Iancu, P. Schiopu, S. Vasilescu, Dispozitive dielectrice şi magnetice. Culegere de probleme, Tipografia Institutului Politehnic, Bucureşti, 1988.

LABORATORY

Crt. no.	Content	No. hours
1	Introductory session. Methods for processing experimental data.	2
2	Simulation of the frequency behavior of the equivalent circuit of the piezoelectric resonator	2
3	Simulation of the frequency behavior of the equivalent circuit of the piezomagnetic transducer	2

4	Circuit piezoelectric devices with bulk elastic wave	2
5	Piezoelectric transducers with bulk elastic wave	2
6	Piezoelectric devices with surface elastic wave	2
7	Written colloquium	2
	Total:	14
Bibliography:		

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- knowledge of fundamental theoretical notions; - knowledge of how to apply theory to specific problems.	Test 1	25%
	- knowledge of fundamental theoretical notions; - knowledge of how to apply theory to specific problems.	Test 2	25%
	- knowledge of fundamental theoretical notions; - knowledge of how to apply theory to specific problems.	Test 3	20%
11.5 Seminary/laboratory/project	- knowledge of the characteristics and performance of the studied dielectric and magnetic devices	Laboratory reports	20%
	- knowledge of the characteristics and performance of the studied dielectric and magnetic devices	Written colloquium	10%
11.6 Passing conditions			
• Obtaining at least 50% of the total score. • Obtaining at least 50% of the score related to activity within the laboratory.			

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 development of modern dielectric and magnetic devices has allowed electronics engineers to design and produce circuits, devices, and electronic equipment much more performant than classical ones. First, it became possible to generate acoustic and ultrasonic signals with desired frequency and amplitude, necessary for SONAR-type detection systems. Currently the extremely wide spread of applications of the “science of measurement” in all areas of activity is evident, with beneficial results on upward developments.

Secondly, dielectric and magnetic devices have enabled complex information processing through the interference of bulk and surface elastic waves. The evolution of piezoelectric devices has consisted both in discovering materials with superior properties, and in improving manufacturing technology, so this field addresses chemical engineers, as well as electronics engineers—designers, technologists, and circuit designers.

Industry has a significant demand for qualified electronics engineers with competencies in the field of dielectric and magnetic devices. The content of this course concretely addresses these current development and evolution requirements, subscribed to the European services economy in the field of Electronic Engineering and Telecommunications (ETC). Thus, future graduates of the MON specialization are provided with appropriate competencies in dielectric and magnetic devices, alongside modern, high-quality, and competitive scientific and technical training, enabling rapid employment after graduation and offering real professional opportunities both nationally and internationally.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Lect. Dr. Eng. Alina-Elena Marcu	Lect. Dr. Eng. Alina-Elena Marcu

Date of department approval	Head of department
26.09.2025	Prof. Dr. Claudius Dan

Date of approval in the Faculty Council	Dean
26.09.2025	Prof. Dr. Mihnea Udrea