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

2. Date despre disciplină

2.1 Course name (ro) (en)				Bazele electrotehnicii 1 Fundamentals of Electrical Engineering 1			
2.2 Course Lecturer				Assoc. Prof. Dr. Ruxandra Liana Costea			
2.3 Instructor for practical activities				Assoc. Prof. Dr. Ruxandra Liana Costea			
2.4 Year of studies	1	2.5 Semester	1	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		D	2.9 Course code	04.D.01.O.005		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	5	Out of which: 3.2 course	3	3.3 seminary/laboratory	2
3.4 Total hours in the curricula	70	Out of which: 3.5 course	42	3.6 seminary/laboratory	28
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.					45
Tutoring					2
Examinations					8
Other activities (if any):					0

3.7 Total hours of individual study	55.00
3.8 Total hours per semester	125
3.9 Number of ECTS credit points	5

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Completion and/or passing of the following subjects: Mathematics and Physics.
4.2 Results of learning	Adequate application of knowledge of Mathematics and Physics.

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

5.1 Course	The course will take place in a room equipped with a video projector and computer.

5.2 Seminary/ Laboratory/Project	At the seminar, students must be present for the seminar tests, which will be announced in advance.

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)*

This discipline is studied within the field of electric circuit theory and aims to familiarize students with the main approaches, models, and explanatory theories of electric circuit theory used in solving practical applications and problems, with relevance for stimulating students' learning processes.

The discipline addresses the following specific topics, basic notions, concepts, and principles, all contributing to providing students with an overall view of the methodological and procedural benchmarks of the field.

Basic knowledge of lumped-parameter electric circuit theory will be gradually introduced and presented, in close connection with electromagnetic field theory and through the lens of applications of interest in electronics, telecommunications, and information technology. The course develops students' skills in solving electric-circuit problems in DC, single-phase AC, and transient regimes; understanding the field assumptions of circuit theory; and the electric and magnetic field phenomena in capacitors, inductors, transformers, and magnetic circuits.

Students will be able to apply basic electric-circuit knowledge; understand, model, and analyze linear and nonlinear circuit problems; identify and compare their operating regimes; and understand the limits of circuit models.

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	Use of fundamental elements related to electronic devices, circuits, and instrumentation. Application, in typical situations, of basic methods for signal acquisition and processing.
Transversal (General) Competences	Honorable, responsible, and ethical behavior, in the spirit of the law, to ensure the profession's reputation. Awareness of the need for continuous training; efficient use of learning resources and 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.* · **Lists** the most important steps for solving problems in different operating regimes. · **Explains** specific notions for solving problems characteristic of each regime. · **Recognizes** and identifies the operating regime of electric circuits; · **Answers** simple questions during the course and seminar;
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).* · **Selects** and **groups** relevant information for a given electric circuit. · **Uses, with justification, specific principles to solve and understand** an electric circuit**.** · **Uses** a method of solution specific to the regime to which the electric circuit belongs. · **Formulates** viewpoints regarding different solution methods for an electric circuit from the perspective of the complexity of the equations to be solved. · **Properly interprets** causal relationships present in the solution. · **Identifies solutions** and **proposes** solution plans specific to the electric circuit to be studied and solved. · **Anticipates the simplest** ways of solving an electric circuit from the perspective of complexity.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* · **Selects** appropriate bibliographic sources and analyzes them. · **Respects principles of academic ethics,** correctly citing sources used. · **Demonstrates receptiveness** to new learning contexts specific to the field. · **Shows collaboration** with other colleagues and teaching staff in carrying out teaching 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 specific to the field** to improve the quality of social life. · **Becomes aware of the value of one's contribution in engineering** for identifying viable/sustainable solutions to solve problems in social and economic life (social responsibility). · **Applies principles of professional ethics/deontology in analyzing the technological impact of proposed solutions** in the specialty area on the environment. · **Analyzes and interprets business opportunities**/entrepreneurial development opportunities in the specialty field. · **Demonstrates management skills** for real-life situations (time management, collaboration 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.)*

Starting from the analysis of students' learning characteristics and their specific needs, the teaching process will explore both expository methods (lecture, presentation) and conversational-interactive methods, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modeling), as well as action-based methods such as exercises, practical activities, and problem solving.

Teaching activities will use lectures supported by PowerPoint presentations or various short videos that will be made available to students. Each course will begin with a review of the chapters already covered, emphasizing the topics from the previous course.

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

This discipline covers information and practical activities meant to support students in their learning efforts and in developing optimal collaborative and communication relationships in a climate conducive to discovery learning. The field of electric circuits is a foundational one in training engineers in the faculty's specific domains.

Emphasis will be placed on practicing active listening and assertive communication skills, as well as feedback-construction mechanisms, as ways to regulate behavior in various situations and adapt the pedagogical approach to students' learning needs.

Teamwork skills will be practiced for solving various learning tasks and meeting requirements in different contexts.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Circuit elements: Resistor. Inductor. Capacitor. Magnetically coupled circuits. Transformer. Equivalent resistances; Voltage and current divider; Voltage and current sources; Dependent sources; Source transformation.	6
2	Resistive circuits: Kirchhoff's theorems. Linear circuit equations; Power conservation; Superposition. Thevenin and Norton equivalent circuits; Node-voltage method; Mesh-current method; Superposition theorem; Reciprocity theorem; Circuits with independent sources;	18
3	AC circuits: Phasors. Kirchhoff's theorems in complex form. Equivalent impedances. Resonant circuits. AC circuit analysis. Power in AC circuits.	10
4	Linear electric circuits in transient regime: Circuits with a single capacitive/inductive element (first-order circuit method). Circuits with multiple dynamic elements (Laplace transform method).	8
	Total:	42

Bibliography:

. Costea Ruxandra – Electronic course support; Moodle
2. Agarwal and J. Lang, "Foundations of Analog and Digital Electronic Circuits", Morgan Kaufmann Publishers, Elsevier, 2005.
3. Moraru, *Fundamentals of Electrical Engineering*, *Theory of Electric Circuits* , 2003. Web address: http://www.infocarti.ro/A.Moraru_BE2_TCElec/cuprins.html
4. Al. Timotin, V. Hortopan, M. Preda, Fl. Manea, *Lessons in Fundamentals of Electrical Engineering*, Publishing House
5. Didactică şi Pedagogică, Bucharest, 1979.
6. Al Nicolae, *The Nonsinusoidal Regime of Linear and Nonlinear Electric Circuits. Theory and Problems*, Matrix Rom Publishing, Bucharest, 2007.
7. Anca Tomescu, I.B.L. Tomescu, F.M.G. Tomescu, *Electrotechnics, Electromagnetic Field, Electric Circuits*, Matrix Rom Publishing, 2007.

SEMINARY

Crt. no.	Content	No. hours
1	Series and parallel resistors. Kirchhoff's theorems. Power.	2
2	Voltage and current divider. Source transformation. Superposition.	2
3	Thevenin and Norton equivalent circuits, Dependent sources.	6
4	Node-voltage and mesh-current methods.	4
5	Phasors. Kirchhoff's theorems in complex form. AC circuit analysis. Node and mesh methods (AC).	4
6	Thevenin and Norton equivalents (AC); Power in AC circuits.	6
7	Transient regimes in linear circuits.	4
	Total:	28

Bibliography:

. Costea Ruxandra – electronic support; Moodle platform;
2. A. Agarwal and J. Lang, "Foundations of Analog and Digital Electronic Circuits", Morgan Kaufmann Publishers, Elsevier, 2005.
3. E. Cazacu, I. Nemoianu, M. Maricaru, F. Enache, M. Stănculescu, A. Stănciulescu, A. Anghel, *Special Issues in Electric Circuit Theory – elements of theory and applications*, Matrix-ROM Publishing, Bucharest, 2005

E. Cazacu, Marilena Stănculescu, *Fundamentals of Electrical Engineering – seminar*, Matrix Rom Publishing

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	Two written verification tests of equal weight, one during the semester and the other in the exam session, held on dates set at the beginning of the course; the topics cover the entire material, creating a synthesis between the comparative theoretical coverage of the subject and the explanation of application models through exercises and problems.	80%
11.5 Seminary/laboratory/project	Assessment of seminar activity and individual study assignments	Verification tests throughout the semester.	20%
11.6 Passing conditions			
According to the University regulations and the ETTI Faculty Council			

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 discipline Fundamentals of Electrical Engineering 1 is a foundational subject in training future engineers.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Assoc. Prof. Dr. Ruxandra Liana Costea	Assoc. Prof. Dr. Ruxandra Liana Costea

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

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