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/Undergraduate
1.6 Programme of studies	Microelectronics, Optoelectronics and Nanotechnologies

2. Date despre disciplină

2.1 Course name (ro) (en)				Circuite electronice fundamentale 2 - Proiect Fundamental Electronic Circuits 2 - Project			
2.2 Course Lecturer							
2.3 Instructor for practical activities				Prof. dr. ing. Florin Drăghici, Conf. dr. Mihaela Pantazică			
2.4 Year of studies	3	2.5 Semester	1	2.6. Evaluation type	V	2.7 Course regime	Ob
2.8 Course type		D	2.9 Course code	04.D.05.O.006		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	1	Out of which: 3.2 course	0.00	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	14	Out of which: 3.5 course	0	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.					34
Tutoring					0
Examinations					2
Other activities (if any):					0

3.7 Total hours of individual study	36.00
3.8 Total hours per semester	50
3.9 Number of ECTS credit points	2

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Completion and/or promotion of the following subjects: • Basics of electrical engineering • Electronic devices • Fundamental electronic circuits • Passive components and circuits • Computer Aided Graphics - CAD Techniques for Electronics • Spice models • Measurements in electronics and telecommunications • CAD Techniques for designing electronic modules
4.2 Results of learning	• Gaining knowledge in the following domains: ◦ Fundamentals of electrical engineering ◦ Electronic devices ◦ Electronic circuits ◦ Analysis of electrical circuits ◦ Passive components and circuits ◦ Circuit simulation ◦ Measurements in electronics and telecommunications ◦ Computer-aided design

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

5.1 Course	• Project type
5.2 Seminary/ Laboratory/Project	• The project classes (analysis and design) will take place in a room with special equipment that must include: Video projector, blackboard, internet connection.

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 design techniques specific to analog circuits. Use of knowledge acquired in the disciplines of Electronic Devices, Fundamental Electronic Circuits, Passive Components and Circuits, Spice Models, and CAD Techniques related to: diodes and transistors (models and parameters), amplification stages, negative feedback, multistage amplifiers, liniar voltage regulators, oscillators, computer-aided design of analog electronic modules of medium complexity. The proposed project themes are focused on circuit topologies of medium complexity used in engineering practice:amplifiers, voltage regulators, oscillators, etc.

Design of the electrical and interconnection structure in a given technology. Development of documentation for manufacturing.

Elaboration of the technical documentation for the developed project.

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	• The ability to design electronic circuits of low/medium complexity and implement them to a given specification in a given technology using the CAD techniques. • The ability to evaluate circuit performance through analytical computations and simulations. • The ability to select and use electronic components (active and passive) according to manufacturer's documentation (data sheets) and operating conditions of the designed circuit. • The ability to implement an interconnection structure in a specific technology. • The ability to prepare documentation for the manufacturing of a circuit designed in a specific technology. • The ability to present the obtained results synthetically and in a domain-specific vocabulary.
Transversal (General) Competences	• Coordinates efforts with others to solve specific situations with varying degrees of difficulty. • Independence and critical thinking: ability to think in technical terms, independently research and analyze data, and derive and present new solutions. • Ability to analyze and synthesize: present acquired knowledge in synthetic form, as the result of a systematic analysis process. • Adherence to the principles of academic ethics. • Correctly cites bibliographic sources used as references in own communicated and published work. • Applies elements of emotional intelligence in appropriate social-emotional interactions with real/academic/professional situations and demonstrates self-control and objectivity in decision-making or stressful situations. • Respects deadlines in order to coordinate with the entire team.

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.* • Designs block diagrams based on the requirements stated in a design specification/topic of low/medium complexity. • Selects a circuit-level implementation variant based on electrical and technological design specifications. • Demonstrates circuit operation and compliance with design requirements through analytical computations. • Implements the design in a CAD environment at the schematic and interconnection structure level. • Simulates the operation of the designed circuit based on the models of the selected electronic components. • Verifies in the CAD environment the correspondence between the simulated schematic diagram and the interconnection structure. • Generates files for manufacturing the interconnection structure on a PCB in an industrial facility. • Documents the design, simulation, assembly and testing activities.
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 in a given context. • Appropriately applies specific principles to design electronic modules of low/medium complexity. • Suggests practical applications for the electronic components and circuits studied. • Recognizes the importance of model parameters for the electrical operation of electronic devices and circuits. • Solves practical problems using theoretical knowledge. • Experimentally verifies (through simulation) the solutions determined.Interprets causal relationships adequately. • Analyzes and compares electronic component specifications for use in a circuit. • Identifies solutions and develops project plans. • Formulates conclusions about experiments conducted. • Justifies the solutions identified. • Works well in a team environment.

Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Selects and evaluates appropriate bibliographic sources. • Respects principles of academic ethics and correctly cites bibliographic sources used. • Demonstrates responsiveness to new learning contexts. • Demonstrates collaboration with other colleagues and faculty staff in carrying out educational activities. • Demonstrates independence in organizing the learning context or in choosing a solution for a problem-based situation. • Contributes to improving the quality of social life through new solutions related to his field of activity. • Is aware of the value of his/her contribution in the field of engineering to the identification of viable/sustainable solutions to solve problems in social and economic life (social responsibility). • Applies the principles of professional ethics/deontology in analyzing the technological impact of proposed solutions in his field of activity on the environment. • Analyzes and exploits opportunities for entrepreneurial development in the field. • Demonstrates coping skills in real-life situations.

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.)*

Based on the analysis of the students' learning characteristics and their specific needs, the teaching process uses both expository (lecture, exposition) and conversational-interactive teaching methods based on models of discovery learning facilitated by direct and indirect exploration of reality (experimentation, demonstration, modeling), but also by action-oriented methods such as exercises, practical activities and problem solving.

Instruction is based on both classical methods and multimedia resources and techniques. The complex issues are demonstrated on the blackboard. The materials used are: presentations, assignment collections and course notes, data sheets; most materials are available in electronic form through the project website and Moodle. Pictures and diagrams are used in the presentations so that the information presented is easy to understand and internalize.

The "Fundamental Electronic Circuits 2 - Project" subject area includes information and hands-on activities designed to support students in their learning efforts and to develop optimal collaborative and communicative relationships in a climate conducive to discovery learning. It is also a bridge between theoretical concepts acquired in the various disciplines and engineering practice.

The practice of active listening and assertive communication skills, as well as mechanisms for building feedback, are encouraged to regulate behavior in different situations and to adapt the pedagogical approach to the learning needs of students.

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**

1	• Presentation of the project. • Presentation of the project's topics. • Presentation of the design data/specifications. • Systematization of knowledge about electronic devices and circuits.	1
2	• Selection criteria for the general schematic of the designed circuit, based on the circuit topologies used in technical practice. • Block diagram of the circuit.	1
3	• Typical schematics and design algorithms for: Bias circuits (voltage references, current sources, etc.), input stages, output stages, etc. • Selection of components. Use of data sheets. • DC and AC Analysis: Determination of static and dynamic parameters of the circuit.	3
4	• Editing the electrical circuit diagram. • Simulation of the operation of the circuit. Selection of models for circuit components. • The (final) selection of components and packages for the components (see data sheets). • Bill of materials (BOM).	2
5	• Design of the interconnection structure for the developed circuit. Dimensioning of the interconnect copper traces. Minimizing the length of the traces and the area occupied by the components on the PCB. • Finding solutions for heat dissipation problems. • Cross-reference schematic diagram-layout. • Generation of files for manufacturing (GERBER and Excellon).	6
6	• Presentation of the electrical design activity.	0.5
7	• Evaluation of the electrical design activity.	0.5
	Total:	14

Bibliography:

1. Course: 04-ETTI-L-A3-S1: Circuite electronice fundamentale 2 - Proiect (Seria E - 2024) | POLITEHNICA Bucureşti Elearning
2. F. Drăghici,“Amplificatoare. Noţiuni de proiectare”, Editura Matrix Rom, Bucureşti, 2021, ISBN 978-606-25-0665-0, 111 pagini.
3. P. R. Gray, P. J Hurst, S. H. Lewis, R. G. Meyer, Analysis and Design of Analog Integrated Circuits, J. Wiley & Sons, 2001;
4. G. Brezeanu, F. Drăghici, Circuite electronice fundamentale, Ed. Niculescu, Bucureşti, 2013;
5. G. Brezeanu, F. Draghici, F. Mitu, G. Dilimot, Circuite electronice fundamentale - probleme, Editura Rosetti Educational, Bucuresti, editia II–2008;
6. G. Brezeanu, F. Draghici, F. Mitu, G. Dilimot, Dispozitive electronice - probleme, Editura Rosetti Educational, Bucuresti, 2009;
7. P. Svasta, V. Golumbeanu, C. Ionescu, Al. Vasile, Componente electronice pasive –Rezistoare, Proprietăţi, Construcţie, Tehnologie, Aplicatii., Ed. Cavallioti, Bucuresti 2011;
8. P. Svasta, Al. Vasile, Ciprian Ionescu, V. Golumbeanu, “Componente şi circuite pasive – Condensatoare”, Proprietăţi, Construcţie, Tehnologie, Aplicatii., Ed. Cavallioti, Bucureşti 2010;
9. Norocel Codreanu, ”Metode avansate de investigaţie a structurilor ”PCB””, Modelare şi simulare, integritatea semnalelor, Ed. Cavallioti, Bucureşti 2009;G. Băjeu, Gh. Stancu, Generatoare de semnale sinusoidale, Ed. Tehnică, Bucureşti, 1979;
10. Dascălu, A. Rusu, M. Profirescu, I. Costea, Dispozitive şi circuite electronice, Ed. Didactică şi Pedagogică,
11. A. M. Manolescu, A. Manolescu, Analog Integrated Circuits, Ed. Electronica 2000, Bucureşti, 2011;
12. D. Self, Audio Power Amplifier Design Handbook, Fourth edition, Newnes, 2006;
13. G. A. Rincon-Mora, Voltage References – from Diodes to Precision High-Order Bandgap Circuits, John Wiley, 2001;
14. I. Ristea, C. A. Popescu, Stabilizatoare de tensiune, Ed. Tehnică, 1983;
15. M. Ciugudean, Proiectarea unor circuite electronice, Ed. Facla, 1983;
16. A. Lăzăroiu, Ş. Naicu, Generatoare de semnal analogice şi digitale - scheme practice, Matrixrom, 2000;
17. http://www.dce.pub.ro;
18. Norocel Codreanu, Ciprian Ionescu, Mihaela Pantazică, Alina Marcu, ”Tehnici CAD de realizare a modulelor electronice - suport de curs şi laborator”, Editura Cavallioti, PIM , Iaşi, Decembrie 2017;
19. http://www.cetti.ro/v2/tehnicicad.php;
20. http://www.cetti.ro/v2/labtie.php;
21. http://www.elect2eat.eu;
22. www.ipc.org.

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course			

11.5 Seminary/laboratory/project	• The ability to select a solution that meets the requirements of an electrical design topic. • Design skills, evaluation through analytical computations and simulations of a circuit.	• Grading students in each phase of the project based on how well they meet the requirements of each stage.	50%
	• Design and layout skills in a CAD environment. • Skills in the preparation of manufacturing files. • Skills in the preparation of technical documentation.	• Grading students in each phase of the project based on how well they meet the requirements of each stage.	40%
	• Presentation of all projects' activities and results obtained.	• Final evaluation of the projects' activities and results obtained.	10%
11.6 Passing conditions			
• Obtaining 50% of the total grade. • Obtaining 50% of the grade related to the activity during the semester.			

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 analog, digital and mixed circuits is a test of maturity for an engineer. The current achievements of companies in the field of electronics are based on design activities that, together with the new technologies, allow them to offer on the market devices and electronic systems with the smallest dimensions, with the greatest autonomy and number of functions at the lowest prices.

The project "Basic Electronic Circuits 2" is an introduction of the future engineer to a specific activity performed in a development company. The activity carried out in the project is exclusively for the application and processing of the knowledge acquired in the specialized courses of the first two years. Knowledge of the fundamentals of electrical engineering, electronic devices and circuits, passive components and computer-aided design (CAD) are used.

Market requirements are met so that the future engineer has an idea of the design and manufacturing process of an electronic circuit/module, which, in this case, uses only discrete components. The student attending "Basic Electronic Circuits 2 - Project" is introduced to industrial design, where he/she must find an optimal solution within technological and time limits constraints.

In this way, the student acquires the skills required by the current needs of the market, which will enable him/her to be quickly employed in an electronics company after graduation.

The subject is thus part of the policy of National University of Science and Technology Politehnica Bucharest, both in terms of content and structure, and in terms of international openness offered to students.

Date	Course lecturer	Instructor(s) for practical activities
21.09.2026		Conf. Dr. Mihaela Pantazică
		Prof. dr. ing. Florin Drăghici

Date of department approval	Head of department
22.09.2026	Prof. Dr. Claudius Dan

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