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 3 - Proiect Fundamental Electronic Circuits 3 - 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	2	2.6. Evaluation type	V	2.7 Course regime	Ob
2.8 Course type		D	2.9 Course code	04.D.06.O.008		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	0.5	Out of which: 3.2 course	0.00	3.3 seminary/laboratory	0.5
3.4 Total hours in the curricula	7	Out of which: 3.5 course	0	3.6 seminary/laboratory	7
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.					2
Tutoring					4
Examinations					2
Other activities (if any):					10

3.7 Total hours of individual study	18.00
3.8 Total hours per semester	25
3.9 Number of ECTS credit points	1

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Completion and/or promotion of the following subjects: • Fundamental Electronic Circuits 2 - Project • Basics of electrical engineering • Electronic devices • Fundamental electronic circuits • Electronic circuits - laboratory • 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	-
5.2 Seminary/ Laboratory/Project	• The project classes will be held in laboratories with special equipment that must include: Video projector, whiteboard, internet connection, equipment for assembly of electronic modules manufactured in SMT and THT technologies, general purpose equipment for testing and troubleshooting of electronic modules manufactured in SMT and THT technologies, PCs or laptops and appropriate software for displaying schematics, simulations, data sheets, interconnection structures, manufacturing files, etc.

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 discipline Fundamental Electronic Circuits 3 - Project continues the activity started in Fundamental Electronic Circuits 2 - Project and, like it, aims to familiarize students with the design, simulation and implementation techniques for analog circuits, but also with the assembling techniques of electronic modules in SMT and THT technology, followed by testing, measurements and validation. This will be done using the knowledge acquired at the disciplines: Fundamental Electronic Circuits 2 - Project, Electronic Devices, Basic Electronic Circuits, Passive Components and Circuits, Spice Models and CAD techniques, in relation to: diodes and transistors (models and parameters), gain stages, negative feedback, multi-stage amplifiers, liniar voltage regulators, oscillators; computer-aided design of analog electronic modules of medium complexity.

The assembled and tested projects focus on circuit topologies of medium complexity used in engineering practice: amplifiers, voltage regulators, oscillators, etc.

Elaboration of documentation for the designed, manufactured, tested and validated electronic modules.

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 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 manufacture of a circuit designed in a specific technology. • The ability to represent 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.* • Assemble and test a designed electronic module. • Demonstrates through testing/characterization that the circuit works and meets design requirements. • Documents design/test/characterization/validation 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. • Practical usage and testing of the studied electronic components and circuits. • Identifies the importance of electrical and mechanical parameters given in the data sheets for the used electronic components. • Solves practical problems using theoretical knowledge. • Experimentally verifies (through measurements) the solutions determined. • Interprets causal relationships adequately. • 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 situation/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.)*

Interaction with students is direct and individual. Students are guided during project classes to physically implement, test, and debug the electronic module designed in Fundamental Electronic Circuits 2 - Project.

Based on the specifics of this activity, the interaction between teacher and student will explore conversational-interactive teaching methods based on models of discovery learning facilitated by direct exploration of reality (the experiment), but also on action-oriented methods such as practical activities and problem solving.

The materials used are: the electrical schematics and layout resulting from the activities in Fundamental Electronic Circuits 2 - Project, the data sheets, the PCBs manufactured based on the files submitted by the students and validated by the teaching staff, the assembled perf-boards, the equipment for the assembly of electronic modules in SMT and THT technologies, the test equipment, the computers, the equipment for repair and rework (soldering stations, specific materials, etc.).

The files with the schematic diagrams, layout and documentation of the project are submitted by each student in electronic form on the Moodle platform.

The Fundamental Electronic Circuits 3 - Project discipline contains information and hands-on activities designed to assist students in their learning efforts and in developing optimal relationships of collaboration and communication in a climate conducive to learning through discovery and experimentation. It is also a bridge between the theoretical concepts acquired at different disciplines and the technical practice, with the industrial environment in which they will work as future electronic engineers.

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

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**
1	Assembly of electronic modules	2
2	Testing/repair and rework/characterization of assembled modules	4
3	Documentation and presentation of the assembling and validation activities Evaluation of the hands-on activities	1
	Total:	7

Bibliography:
1. https://curs.upb.ro/2024/course/view.php?id=8709.
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;
10. G. Băjeu, Gh. Stancu, Generatoare de semnale sinusoidale, Ed. Tehnică, Bucureşti, 1979;
11. D. Dascălu, A. Rusu, M. Profirescu, I. Costea, Dispozitive şi circuite electronice, Ed. Didactică şi Pedagogică, Bucureşti, 1983;
12. A. M. Manolescu, A. Manolescu, Analog Integrated Circuits, Ed. Electronica 2000, Bucureşti, 2011;
13. D. Self, Audio Power Amplifier Design Handbook, Fourth edition, Newnes, 2006;
14. G. A. Rincon-Mora, Voltage References – from Diodes to Precision High-Order Bandgap Circuits, John Wiley, 2001;
15. I. Ristea, C. A. Popescu, Stabilizatoare de tensiune, Ed. Tehnică, 1983;
16. M. Ciugudean, Proiectarea unor circuite electronice, Ed. Facla, 1983;
17. A. Lăzăroiu, Ş. Naicu, Generatoare de semnal analogice şi digitale - scheme practice, Matrixrom, 2000;
18. http://www.dce.pub.ro;
19. 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;
20. http://www.cetti.ro/v2/tehnicicad.php;
21. http://www.cetti.ro/v2/labtie.php;
22. http://www.elect2eat.eu;
23. 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 skills of practical implementation, assembling and testing of an electronic module	Grading students in each phase of the project based on how well they meet the requirements of each stage.	90
	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 discipline Fundamental Electronic Circuits 3 - Project is an introduction of the future engineer to an activity specific to a company that develops and manufactures electronic devices and modules. The activity carried out within the framework of the project uses and unifies the knowledge acquired in the specialized courses of the first two years, as well as the results of the design and production preparation, which come from the activities carried out at Fundamental Electronic Circuits 2 - Project discipline of the previous semester.

The knowledge regarding the fundamentals of electrical engineering, electronic components and circuits, passive components, computer-aided design (CAD), practical implementation of electronic schematic diagrams, electrical and electronic measurements, signals, electronic circuits and devices - laboratory is used.

The requirements of the market are met so that the future engineer gets a picture of the process of designing, manufacturing, testing and characterization of an electronic circuit, in this case, with discrete components. The student who completes the discipline Fundamental Electronic Circuits 3 - Project will be introduced to the design and implementation of an electronic module at an industrial level, finding an optimal solution within technological and time limits. By completing the two subjects, Fundamental Electronic Circuits 2 - Project and Fundamental Electronic Circuits 3 - Project, the student of the faculty ETTI-POLITEHNICA Bucharest is practically introduced to all phases of the design and implementation of an electronic module at industrial level.

In this way, the student develops the skills required by the current needs of the market, so that he can be quickly employed in an electronics company after graduation. The subject is thus part of the policy of 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

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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