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	Masters
1.6 Programme of studies	Micro and Nanoelectronics

2. Date despre disciplină

2.1 Course name (ro) (en)				Circuite analogice pentru microelectronică			
2.2 Course Lecturer				Prof. Dr. Lidia Dobrescu			
2.3 Instructor for practical activities				Prof. Dr. Lidia Dobrescu			
2.4 Year of studies	1	2.5 Semester	1	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		F	2.9 Course code	3		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	3	Out of which: 3.2 course	2	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	42	Out of which: 3.5 course	28	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.					40
Tutoring					0
Examinations					18
Other activities (if any):					0

3.7 Total hours of individual study	58.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Fundamental Courses of Electronic Devices, Electronic Circuits
4.2 Results of learning	General knowledge of physics, electronic devices, electronic circuits and software simulation of electronic circuits

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 or on the MSTeams platform
5.2 Seminary/ Laboratory/Project	The project will take place in a specific room, which must include: computers, Internet connection, SPICE electronic circuit simulator or MSTeams platform, etc, students with computers with a SPICE simulator installed.

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)*

Analogue circuit analysis for microelectronics using MOS and bipolar transistors using appropriate simulation software tools.

There are highlighted architectures of negative-reaction amplifiers and classical oscillators, current references and voltage references, analyzing in detail the Brokaw reference and PTAT and CTAT compensation techniques.

· Presentation of design topologies for MOS and bipolar transistor circuits;

Functioning, performance, limitations and typical applications of fundamental analog circuits.

The advantages of using negative reactions.

Design of an oscillator with imposed frequency and type of positive feedback loop, checking the oscillation condition.

Analytical and design techniques for basic analog circuits.

Stationary and dynamic analysis of practical schemes of reaction amplifiers, stabilizers and oscillators.

Interaction device–circuit and comparisons between similar schemes with bipolar transistor and MOS respectively.

Presentation of the LTSpice simulation environment

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	C1. Use of fundamental elements relating to electronic devices, circuits, systems, instrumentation and technology C2. Design, simulation and testing of devices, integrated circuits and micro and nanoelectronic systems with modern software tools C3. Modeling and processing of integrated devices and circuits using advanced technologies C4. Design, simulation and testing of optoelectronic devices, circuits and systems with modern micro and nanoelectronic software tools and technologies

Transversal (General) Competences	CT1 Adaptation to new technologies, professional and personal development, through continuous training using printed documentation sources, specialized software and electronic resources in Romanian and at least, in a language of international circulation.

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.* List types of electron circuits Defines the specific parameters of microelectronics Describe/classify model parameters Highlights the peculiarities of special constructive solutions
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 about the types of electronic circuits Arguably uses specific principles in order to preserve or neglect some model parameters. Work productively in a team to carry out the project. Elaborates a scientific text in the drafting of the project Experimentally check the design solutions within the laboratory. Solves practical applications within the project, processing measured data sets. Adequately interprets causal relationships between extracted values. Analyzes and compares measured and projected values. Identifies solutions and elaborates the discipline project. Conclusions on the experiments carried out. Arguments the solutions identified in the project .
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 quoting the used bibliographic sources. Demonstrate responsiveness for new learning contexts. Demonstrates collaboration with other colleagues and teachers in carrying out teaching activities Demonstrates autonomy in organizing the learning situation/context or problem-solving situation Promotes/contributes through new solutions, related to the specialty field. Awareness of the value of its contribution to the field of engineering in identifying viable/sustainable solutions Apply ethical principles

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.)*

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

Lectures will be used in the teaching activity, based on PowerPoint presentations or different Internet pages that will be made available to students. Each course will start with the recapitulation of the chapters already covered, with an emphasis on the notions taken at the last course.

The presentations use images and schemes so that the information presented is easily understood and assimilated.

This discipline covers information and practical activities designed to support students in their learning efforts and to develop optimal relationships of collaboration and communication in a climate conducive to learning through discovery.

The practice of active listening and assertive communication skills, as well as feedback building mechanisms, will be considered, as ways of behavioral regulation in various situations and of adapting the pedagogical approach to the learning needs of the students.

The ability to work in teams to solve different learning tasks will be practiced.

The attention of students will be checked by rapid tests (quizz) during or at the end of the course at certain courses.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	1. Introduction 1.1. Course theme 1.2. Overview of specific objectives 1.3. Project overview	2
2	2. Basic configurations with MOS and bipolar transistors and amplification floors with (common source, common gate, common drain, distributed load with outlet from the drain or source, respectively common emitter, common base, repeater on the emitter, etc, distributed load with outlet from collector or emitter)(Part1)	4
3	3.Negative feedback and simulation of reaction circuits(Part1) 3.1. Structure of negative feedback amplifiers 3.2. Characteristics of negative feedback 3.3 Topologies of amplifiers	4
4	4.Oscillators (Part1) Wien Deck Design of an oscillator with imposed frequency and type of positive feedback loop, checking the oscillation condition	2
5	5. Voltage Regulators(Part1)	2
6	6. Voltage References (Part 2)	6

7	7. Brokaw Architecture(Part 2)	4
8	8.Compensation techniques PTAT, CTAT(Part 2)	4
	Total:	28

Bibliography:

.Dobrescu https://curs.upb.ro/2023/course/view.php?id=9677

P.R.Gray, P.J. Hurst, S.H.Lewis,R.G.Meyer, *Analysis and Design of Analog IC's*, editia a- 4 a, J.Whiley&Sons, 2001.

A. Rusu, D. Dobrescu, L. Dobrescu, "Dispozitive si Circuite Electronice note de curs si probleme rezolvate", Ed. Printech, Editură recunoscută de Consiliul Naţional al cercetării Ştiinţifice din Învăţământul Superior-Cod CNCSIS 54, ISBN 973-652-828-6, 90 pg, Bucuresti, 2003

D.Dobrescu, L. Dobrescu, "Dispozitive si Circuite Electronice-Caiet de Activitate", Ed. Printech, Editură recunoscută de Consiliul Naţional al cercetării Ştiinţifice din Învăţământul Superior-Cod CNCSIS 54, ISBN 973-652-829-4, 158 pg., Bucureşti, 2003;

A.P. Brokaw, How to make a bandgap voltage reference in one easy lesson, https://www.renesas.com/us/en/document/whp/how-make-bandgap-voltage-reference-one-easy-lesson-paul-brokaw

LABORATORY

Crt. no.	Content	No. hours
1	Presentation of the laboratory+Simulation of amplification floors with MOS transistors	4
2	Simulation of amplification stages with negativefeed back MOS transistors	4
3	Simulation of MOS transistor oscillators	4
4	Final laboratory colloquium	2
	Total:	14

Bibliography:

1. L.Dobrescu https://curs.upb.ro/2023/course/view.php?id=9677
2. Platforma de laborator1, Moodle
3. Platforma de laborator 2, Moodle
4. A.P. Brokaw, How to make a bandgap voltage reference in one easy lesson, https://www.renesas.com/us/en/document/whp/how-make-bandgap-voltage-reference-one-easy-lesson-paul-brokaw

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- basic knowledge of voltage and current references and Brokaw architecture	40%(exam test - Part 2)	40%
	basic knowledge of negative feed back aamplifiers (Part1)	40%(exam problem Part 1)	40%
11.5 Seminary/laboratory/project	Applications of LTSPICE-labrator simulator	Colloquium verification	20%
11.6 Passing conditions			

Recognition and simulation of architectures of negative-reaction amplifiers and classical oscillators.
Obtaining 50% of the total score of the laboratory and the project score during the semester.
Obtaining 50% of the laboratory and project score from the semester time.
Compliance with the UNSTPB regulation on promotion conditions.

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 increasing complexity of electronic circuits and systems and the need to reduce costs and research-design-manufacture cycles have imposed the development of computer-aided simulation, design and optimization techniques, in the form of various software tools.

The discipline provides graduates with adequate skills with the needs of current qualifications and modern, quality and competitive scientific and technical training.

Thus, the graduates are provided with a modern, quality and competitive scientific and technical training that will allow them to be hired quickly after graduation, being perfectly framed in the politics of the National University of Science and Technology Politehnica Bucharest, both in terms of content and structure, and in terms of international skills and openness offered to students.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Prof. Dr. Lidia Dobrescu	Prof. Dr. Lidia Dobrescu

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

Universitatea Națională de Știință și Tehnologie Politehnica București

Facultatea de Electronică, Telecomunicații și

Tehnologia Informației