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			
2.2 Course Lecturer				Prof. Dr. Dan Neculoiu, Lecturer Dr. Ovidiu Profirescu			
2.3 Instructor for practical activities				Lecturer Dr. Ovidiu Profirescu			
2.4 Year of studies	2	2.5 Semester	II	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		D	2.9 Course code	04.D.04.O.016		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	6	Out of which: 3.2 course	3	3.3 seminary/laboratory	3
3.4 Total hours in the curricula	84	Out of which: 3.5 course	42	3.6 seminary/laboratory	42
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.					60
Tutoring					0
Examinations					6
Other activities (if any):					0

3.7 Total hours of individual study	66.00
3.8 Total hours per semester	150
3.9 Number of ECTS credit points	6

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Completion and passing of the following courses: Basics of Electrotechnics Electronic Devices

4.2 Results of learning	Acquisition of the following knowledge: Electronic Devices Electric Circuit Analysis

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

5.1 Course	Classroom equipped with whiteboard, video projector and internet connection
5.2 Seminary/ Laboratory/Project	Seminar and laboratory rooms equipped with video projector and internet connection. At least 15 laboratory platforms equipped with general-purpose measuring equipment and setups for measuring and characterizing electronic circuits, 15 computers with simulation software dedicated to electronic circuits.

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)*

Study of fundamental analog circuits: amplifiers, stabilizers, oscillators, as well as basic cells in the structure of integrated circuits: differential stages, cascode configuration, current sources, voltage references, etc.

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	Mastering methods for analysis and design of fundamental analog circuits. The ability to select the appropriate circuit configuration for a concrete application and the optimal biasing that guarantees the stability of circuit parameters.
Transversal (General) Competences	Teamwork to coordinate efforts with others to solve special situations with various degrees of difficulty Autonomy and critical thinking: the ability to think in engineering terms, to search for and analyze data independently, as well as to derive and present new solutions. Capacity for analysis and synthesis: presents the acquired knowledge in a synthetic manner, as a result of a systematic analysis process. Respects the principles of academic ethics: correctly cites bibliographic sources used as references in one’s own works.

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.* Describes and explains the most important properties of fundamental electronic circuits Defines concepts specific to electronic circuits Describes/classifies concepts/processes/phenomena/models for amplifiers, stabilizers and oscillators Defines DC biasing regimes and AC operating regimes for the studied electronic circuits Develops behavioral models for electronic circuits used in various applications
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).* Teamwork Solves practical problems using theoretical knowledge Proposes practical applications for the studied electronic circuits Identifies the limitations imposed on the circuit by the behavior of electronic devices Distinguishes between linear and nonlinear operating modes of circuits Analyzes fundamental electronic circuits Defines the transfer function for an electronic circuit Identifies the importance of model parameters in the electrical operation of devices and circuits
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Selects appropriate bibliographic sources and analyzes them. Respects the principles of academic ethics, correctly citing the bibliographic sources used. Demonstrates receptiveness to new circuit architectures. Collaborates 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 Contributes with new solutions related to electronic circuits to improve the quality of social life. Becomes aware of the value of one’s contribution in the field of engineering to identify 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 capitalizes on entrepreneurial development opportunities in the specialty area. Demonstrates skills in managing 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.)*

The course is taught using a chapter-by-chapter presentation (respecting the contents from point 10.) with a PowerPoint slideshow via video projector. The content of the presentation is explained in detail and discussed in front of the students. A series of more complex concepts and problems are demonstrated on the board. The PowerPoint course support is available on Moodle.
At the seminar, the problematization method is used. Concrete problems with electronic circuits are presented and solved on the board. Direct student involvement in solving the problems is the basic rule of the seminar.
The main materials for the seminar are the course notes. The seminars are available on the Moodle platform.
The laboratory is organized in dedicated rooms equipped with 15 measurement stations that include: a set of

standard measuring instruments, setups with the circuits to be characterized, and computers for data processing and for simulating various processes that describe the electrical behavior of the circuits. All these systems are presented to students at the first laboratory session.
At each laboratory session, the teaching staff gives a brief presentation of the concepts that will be used in that laboratory, after which students are guided to carry out measurements on the setup intended for each circuit.
The documentation necessary for carrying out the laboratory work is included in the laboratory guide "Electronic Circuits—Laboratory Guide".

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	1. Amplifiers. General notions 1.1. Definition 1.2. Electrical parameters 1.3. Amplifier bandwidth 1.4. Distortions. Noise in amplifiers 1.5. Classes of operation 1.6. Classification of amplifiers 1.7 Applications	3
2	2. Fundamental amplifiers 2.1. Amplification stages 2.2. CASCODE and para-phase amplifiers 2.3. Differential amplifiers (DA) 2.4. Ideal operational amplifiers (Op-Amps) 2.5 Applications	6
3	3. Feedback amplifiers 3.1 Structure of feedback amplifiers (FA) 3.2. Characteristics of negative feedback 3.3 Feedback topologies 3.4. Parallel–parallel feedback amplifier (FA p–p) 3.5. Series–series feedback amplifier (FA s–s) 3.6. Parallel–series feedback amplifier (FA p–s) 3.7. Series–parallel feedback amplifier (FA s–p) 3.8 Applications	12
4	4. Oscillators 4.1. Definition. Parameters 4.2. Classification of oscillators 4.3. RC harmonic oscillators 4.4. LC harmonic oscillators 4.5 Relaxation oscillators 4.6 Applications	9

5	5. Linear voltage stabilizers 5.1. Definition 5.2. Electrical parameters 5.3. Operating principles 5.4. Classification of stabilizers 5.5. Parametric stabilizers 5.6. Feedback stabilizers 5.7. Integrated stabilizers 5.6 Switching stabilizers	12
	Total:	42

Bibliography:

1. Dan Neculoiu, Circuite electronice fundamentale, prezentari Power point, Moodle,https://archive.curs.upb.ro/2024/course/view.php?id=8552
2. Dan Neculoiu, Amplificatoare de semnal mic, prezentari Power point, Moodle https://archive.curs.upb.ro/2024/course/view.php?id=8552
3. P. R. Gray, P. J. Hurst, S. H. Lewis, R. G. Meyer, Analysis and Design of Analog IC's, ediţia a IV-a,J. Whiley & Sons, 2001.
4. K. R. Laker,W. M. C. Sansen, Design of Analog IC's and Systems, McGrawHill, 1994.
5. A. Sedra, K. C. Smith, Microelectronic Circuits, ediţia a V-a,Oxford University Press, 2004

LABORATORY

Crt. no.	Content	No. hours
1	Differential amplifiers	3
2	Negative feedback amplifiers. Configurations.	3
3	Simulation of the operation of the negative feedback amplifier using the PSPICE program.	3
4	Simulation of the operation of the linear voltage stabilizer	3
5	Low-frequency oscillators	3
6	Simulation of the Wien bridge oscillator	3
7	Final laboratory colloquium	0
	Total:	21

SEMINARY

Crt. no.	Content	No. hours
1	Small-signal amplifiers	8
2	Negative feedback amplifiers	8
3	RC oscillators	4
4	LC oscillators	4
5	Voltage stabilizers	4
	Total:	28

Bibliography:
1. D.Neculoiu, O.Profirescu, Probleme, Moodle https://archive.curs.upb.ro/2024/course/view.php?id=8552
2. P. R. Gray, P. J. Hurst, S. H. Lewis, R. G. Meyer, Analysis and Design of Analog IC's, ediţia a IV-a,J. Whiley&Sons, 2001.
3. R. Muller, T. Kamins, Devices Electronics for Integrated Circuits, Wiley and Sons, New York, 1988.
4. Indrumar de laborator, Foi de platforma de laborator

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, of how to apply theory to the analysis of small-signal amplification circuits and negative feedback amplifiers.	Written verification work, theory and problems.	30
	Knowledge of fundamental theoretical notions, of how to apply theory to the analysis of stabilizers and RC and LC oscillators	Final exam held in the session with the possibility of retaking the continuous assessment. Theoretical topics and problems.	30

11.5 Seminary/laboratory/project	Seminar. Analysis with numerical data of practical multi-stage amplifier schemes, feedback amplifiers, voltage stabilizers and harmonic oscillators	Two written verification tests, of equal weight, given on dates set at the beginning of the semester. Grading of students who actively participate (at the board) in solving the proposed problems.	20
	Laboratory: Knowledge of the methods for measuring and characterizing fundamental analog electronic circuits such as amplifiers, oscillators or linear voltage sources Knowledge of how to use software programs for characterization and analysis of electronic circuits	Continuous assessment during the semester of practical activities regarding the application of measurement methods for electronic circuits. Interpretation of results to highlight the main electrical characteristics of the fundamental electronic circuits studied. Final laboratory colloquium, including a theoretical component and a practical component. The theoretical component is verified by multiple-choice test; the practical component is evaluated by checking how the student solves (implementation, testing, operation) a practical problem.	20
11.6 Passing conditions			
Obtaining 50% of the total score related to the activities carried out during the semester (seminar/laboratory/course) Obtaining 50% of the total score related to the continuous assessment and, respectively, the final exam.			

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)

Fundamental electronic circuits study the basic building blocks of analog circuits, typical products of microelectronics, a field that has exploded especially after the year 2000, following the bold and spectacular development of nanometric CMOS technologies. Microelectronics has an almost encyclopedic character, through the multifunctional circuits and systems it designs and builds, through the openness and horizon it offers to students and specialists in many fields. Multinational microelectronics companies, established global manufacturers of integrated circuits (Infineon, Microchip, ON Semiconductor), with strong subsidiaries in Romania, have substantially increased the demand for qualified engineers with solid competencies and knowledge of analog and mixed-signal circuits. The course familiarizes students with the fundamental concepts of modeling and design in microelectronics, including original ideas and methods of the Romanian school in the field. Based on models for MOS and bipolar transistors, analysis and design techniques are studied and exemplified for basic analog circuits: amplifiers, stabilizers, oscillators. Using numerical data and commentary, the operation, performance, limitations, and typical applications of these circuits are demonstrated. Thus, the policy of promoting disciplines closely linked to the requirements of a cutting-edge industry such as electronics is respected.

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Date	Course lecturer	Instructor(s) for practical activities
29.09.2025	Prof. Dr. Dan Neculoiu	Lecturer Dr. Ovidiu Profirescu

Date of department approval	Head of department Prof. Dr. Claudius Dan
Date of approval in the Faculty Council	Dean Prof. Mihnea UDREA