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	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Applied Electronics

2. Date despre disciplină

2.1 Course name (ro) (en)				Circuite electronice fundamentale Basic Electronic Circuits			
2.2 Course Lecturer				Prof. Dr. Dragos Dobrescu			
2.3 Instructor for practical activities				Prof. Dr. Dragos Dobrescu			
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	3.00	3.3 seminary/laboratory	3
3.4 Total hours in the curricula	84.00	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.					26
Tutoring					10
Examinations					20
Other activities (if any):					10

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	Electronic Devices

4.2 Results of learning	Electro-technical Fundamentals,Electronic Devices

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 usingMSTeams platform/
5.2 Seminary/ Laboratory/Project	The laboratory will take place in a room with specific equipment, which must include:computers, INTERNET connection, SPICE-type electronic circuit simulator or on theMSTeams platform, students having computers with a SPICE-type 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)*

Study of fundamental analog circuits: non-feedback amplifiers, their frequency behavior, negative feedback amplifiers, oscillators, voltage regualtors, as well as basic cells in the structure of integrated circuits: differential stages, CASCOD configuration, current sources, voltage references.

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	Knowledge of fundamental analogic circuit analysis and design methods. Ability to select the adequate circuit configuration for a specificapplication and optimal bias which guarantees the stability of circuitparameters.
Transversal (General) Competences	Team work, efficient communication: ability to efficient cooperate withthe other member of the team to solve problems of medium complexity. Critical thinking: ability to think scientifically, to inquire and to analyzedata independently and to draw conclusions as well as to identifysolutions. Capacity of analyse and synthesise: ability of presenting the acquiredknowledge following a systematic analysis. Follow the academic ethical principles: during the desk research, citecorrectly the reference sources.

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.* Ability to list and describe the most important properties of the fundamental electroniccircuits. Ability to define specific characteristics of electronic circuits Ability to describe/clasify concepts/fenomena/models for multistage amplifiers, negativefeeback amplifiers, voltage regulators and AF and RF oscillators Ability to define DC biasing modes and AC modes for the studied electronic circuits Ability to develop models for electronic circuits used in aplications
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).* Ability of working in teams. Ability to solve practical exercises using the acquired knowledge. Ability to propose practical schemes for circuits incorporating studies electronic devices. Ability to identify the electrical behaviuor of electron devices within given circuits. Ability to diferentiate between the electron devices behaviour in DC and small-signaldinamic modes. Ability to differentiate between the linear and non-linear behaviour of electron devices Ability to analyse elementary circuits with diodes and transsistors. Ability to acknowledge the importance of model parameters for electrical behaviour ofstudies electron devices.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Ability to undertake a proper desk research and analysis of references. Respect the academic ethical principles, by corrected citing the used references. Prove openess for new learning contexts. Cooperate with other colleagues and academic staff in the implementation of academicactivities. Prove authonomy in setting-up the learning context or of the problem to be solved. Contribute through new solutions related to its field of study pfor the improvement of thequality of life. Conștientizează valoarea contribuției sale în domeniul ingineriei la identificarea de soluțiiviabile/sustenabile care să rezolve probleme din viața socială și economică (responsabilitatesocială). Apply the ethical principles in analysing the impact the proposed solutions on theenvironment. Analise and take advantage of opportunities of personal antrepreneural development. Prove management abilities in real life settings.

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 processwill explore both expository (lecture, exposition) and conversational-interactive teaching methods, based ondiscovery learning models facilitated by direct exploration and indirect of reality (experiment,demonstration, modelling), but also on action-based methods, such as exercise, practical activities andproblem solving.

Lectures will be used in the teaching activity, based on Power Point presentations or different Internet pagesthat will be made available to students. Each course will start with a recap of the chapters already covered,with an emphasis on the concepts covered in the last course.

Presentations use images and diagrams so that the information presented is easy to understand andassimilate.

This discipline covers information and practical activities designed to support students in their learningefforts and the development of optimal collaborative and communicative relationships in a climateconducive to discovery learning.

It will be considered the practice of active listening and assertive communication skills, as well as feedbackconstruction mechanisms, as ways of regulating behavior in various situations and adapting the pedagogicalapproach to the students' learning needs.

Teamwork skills will be practiced to solve different learning tasks.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Introduction Amplifier fundamentals 1.1. Definition 1.2. Parameters 1.3. Amplifier band 1.4. Distortions. Noise in amplifier 1.5. Operation class 1.6. Classification of amplifiers 1.7 Applications	4
2	Fundamental amplifiers 2.1. Compound amplifier stages 2.2. Cascode and super-g configurations 2.3. Differential amplifiers 2.4. Frequency behavior and comparison between different amplifier configurations 2.5 Ideal operational amplifiers	10
3	Negative feedback 3.1 Ideal feedback amplifier topology 3.2. Negative feedback properties 3.3 Feedback amplifier configurations 3.4. Shunt-shunt feedback amplifier 3.5. Series-series feedback amplifier 3.6. Shunt-series feedback amplifier 3.7. Series-shunt feedback amplifier	10

4	Sinusoidal oscillators 4.1. Definition. Parameters 4.2. Linear, cvasilinear and nonlinear theory 4.3.Sinusoidal Oscilators classification 4.4. RC oscillators 4.5 LC oscillators	8
5	Linear voltage regulators 5.1.Definition 5.2.Parameters 5.3.Operation principles 5.4. Classification 5.5. Series and parallel configurations voltage regulators 5.6. Feedback regulators 5.7. Integrated voltage regulators 5.8.Short circuit and overload protection circuits	8
6	Final revision	2
	Total:	42

Bibliography:

1.D Dobrescu, curs CEF, MOODLE,https://archive.curs.upb.ro/2022/enrol/index.php?id=9928
2.D. Dobrescu , Analiza circuitelor Electronice, de la functie catre dispozitiv , Ed. Printech, CodCNCSIS 54, ISBN 973-652-985-1, 170 pg., Bucuresti, 2005
3.L. Dobrescu, D.Dobrescu, "Rezolvarea si simularea in SPICE a circuitelor electronice ", Ed.Politehnica Press, ISBN 978-606-9608-26-5, 2022
4.D.Dobrescu, L. Dobrescu, “Dispozitive si Circuite Electronice-Caiet de Activitate”, Ed. Printech,ISBN 973-652-829-4, 158 pg., Bucureşti, 2003;
5.L. Dobrescu, D.Dobrescu, "Basics of the Semiconductor Devices Physics", 142 pg., Ed. Printech,ISBN 973-718-364-9, Bucuresti, 2005;
6.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
7.L. Dobrescu, D. Dobrescu, „Modele avansate ale dispozitivelor MOS”, Editura Printech, Bucuresti,2002;
8.A. Rusu, D. Dobrescu, L. Dobrescu, “Dispozitive si Circuite Electronice note de curs si problemerezolvate”, Ed. Printech, ISBN 973-652-828-6, 90 pg, Bucuresti, 2003

LABORATORY

Crt. no.	Content	No. hours
1	The differential amplifiers	3
2	Negative feedback amplifier. Configurations and measurements.	3
3	Low frequency oscillators	3
4	The simulation of the Wien bridge oscillator	3
5	Final quiz.	2
	Total:	14

SEMINARY

Crt. no.	Content	No. hours

1	1+2 Amplifiers with bipolar transistors - main floors, different constant current sources	4
2	3+4 – Multistage amplifiers with bipolar transistors and field effect transistors (TMOSFET and JFET)	4
3	5+6 – Amplifiers – frequency behavior (bottom, top, band) with field-effect transistors – main floors	4
4	7+8+9 – Amplifiers with different topologies of negative feedback	6
5	10+11– RC Oscillators, Positive feedback	4
6	12-LC oscillators, oscillation amplitude limitation	2
7	13- Voltage regulators	2
8	Revision	2
	Total:	28

Bibliography:

1.D Dobrescu, curs CEF , MOODLE,https://archive.curs.upb.ro/2022/enrol/index.php?id=9928
2.D. Dobrescu , Electronic Circuits Analysis fron function towards device , Ed. Printech, CodCNCSIS 54, ISBN 973-652-985-1, 170 pg., Bucuresti, 2005
3.L. Dobrescu, D.Dobrescu, "Electronic Circuits solving and SPICE ", Ed.Politehnica Press, ISBN 978-606-9608-26-5, 2022

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; - differential analysis of theoretical techniques and methods	A written test of verification in the middle of the semester, taken on a date fixed by the dean's office. The topics cover 50% of the subject, making a synthesis between the comparative theoretical passage of the subject matter and the explanation, through exercises and problems, of the application models.	30%
	Problems and applications	Written exam	30%

11.5 Seminary/laboratory/project	Laboratory: - knowledge ofthe measurement methodsand characterization offundamental analog circuits:amplifiers, oscillators, linearvoltage regulators. - knowledge of both analogand digital electronic circuitsimulation software.	Oral examination	20%
	Seminaryknowledge of how to apply theoretical knowledge on electronic circuits and accuracy of calculations.	Oral examination during semester	20%
11.6 Passing conditions			
Obtaining 50% of the total score of the laboratory; Obtaining 50% of the total score during the semester; Exact calculation of amplification, input and output resistors of amplifiers, oscillation condition and oscillation frequency of oscillators, stabilized voltage, stabilization factor and output resistance of voltage regulators 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)

Fundamental Electronic Circuits studies the basic blocks of analogic circuits, typical products ofmicroelectronics. This field has known explosive advancements, especially after the year 2000, followingbold and spectacular developments of CMOS nanometer technologies. The microelectronics has a nearencyclopedic trait, by the multifunctional circuits and systems it has come to incorporate, offering a widehorizon of applications in many domains for students and specialists alike. Multinational microelectronicscompanies, well-known producers of integrated circuits (Infineon, Microchip, ON Semiconductor), withstrong branches in Romania, have considerably increased the demand for qualified engineers, with solidknowledge and competences in the field of analog and mixed signal. The course familiarizes the studentswith the fundamental concepts of modelling and design in microelectronics, including original ideas andmethods of the specialized Romanian school. Based on the MOS and bipolar models, analysis and designtechniques for basic analog circuits – amplifiers, regulators, oscillators – are studied and exemplified. Theoperation, performances, limitations and typical applications of these circuits are demonstrated throughnumerical data and comments. Thus, the policy of promoting subjects strongly correlated with therequirements of present top industry such as electronics, is followed.

Date	Course lecturer	Instructor(s) for practical activities
09.09.2024	Prof. Dr. Dragos Dobrescu	Prof. Dr. Dragos Dobrescu

Universitatea Națională de Știință și Tehnologie Politehnica București
Facultatea de Electronică, Telecomunicații și
Tehnologia Informației

Date of department approval

Head of department

Conf. Dr. Bogdan Cristian FLOREA

Date of approval in the Faculty Council

Dean

25.10.2024

Prof. Dr. Mihnea Udrea