



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	Applied Electronics and Information Engineering
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)	Dispozitive electronice Electronic Devices						
2.2 Course Lecturer	Prof. Dr. Lidia Dobrescu						
2.3 Instructor for practical activities	Prof. Dr. Lidia Dobrescu						
2.4 Year of studies	2	2.5 Semester	1	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type	D	2.9 Course code	04.D.03.O.002	2.10 Tipul de notare	Nota		

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

3.1 Number of hours per week	5	Out of which: 3.2 course	2	3.3 seminary/laboratory	3
3.4 Total hours in the curricula	70	Out of which: 3.5 course	28	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.					40
Tutoring					10
Examinations					20
Other activities (if any):					10
3.7 Total hours of individual study	80.00				
3.8 Total hours per semester	150				
3.9 Number of ECTS credit points	6				

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Basics of Electrotechnics, Physics
4.2 Results of learning	Knowledge of physics, electricity, mathematics, analysis of electric circuits

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



5.1 Course	The course will take place in a special room equipped with a video projector or using MSTeams platform
5.2 Seminary/ Laboratory/Project	The course will take place in a classroom or using MSTeams platform

6. General objective (*Referring 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 curricula of the study programme, etc. will be described in a general manner*)

Physical phenomena, electrical behavior, steady state and dynamic regime models are studied for the basic semiconductor devices: semiconductor

diodes, the bipolar transistor (BJTs), the MOS transistor(MOSFET) and the junction field effect transistor(JFET).

7. Competences (*Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and professional growth. They reflect the employers requirements.*)

Specific Competences	<ul style="list-style-type: none">• Familiarizing students with the operation of various families of diodes and transistors and with the use of these devices in the circuit.• Creating the skills to use model equations and equivalent circuits established for each device studied in the analysis and design of analog and digital circuits; The possibility of selecting devices with optimal parameters for specific circuit structures;• Use of fundamental elements related to devices, circuits, systems, instrumentation and electronic technology;• Design, measurement, simulation and testing of devices, IC circuits and modern software tools;• Modeling and processing of devices and integrated circuits using advanced technologies;
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<p>Transversal (General) Competences</p>	<p>Honorable, responsible, ethical behavior, in the spirit of the law to ensure the reputation of the profession; Adapt new technologies, professional and personal development, continuous training using printed documentation sources, specialized software and electronic resources in Romanian and, at least, in an international language.</p>
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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 accomplishments 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.*)

<p>Knowledge</p>	<p><i>The result of knowledge acquisition through learning. The knowledge represents the totality of facts, principles, theories and practices for a given work or study field. They can be theoretical and/or factual.</i></p> <ul style="list-style-type: none"> • Identify and describe basic concepts, principles and methods in physics (electricity) • Explains and interprets theoretical and experimental results from physics (electricity) • Describes, identifies, summarizes, processes, concepts and elementary notions related to principles, laws, basic notions in the field of fundamental sciences, analyzes and processes their application in concrete problems from the study program. • Describes, identifies, summarizes engineering concepts and notions and their application in concrete general-purpose problems specific to the study program. • Modeling by equivalent circuits, analytical equations of devices; • Establishing simple formulas, with direct physical interpretation, for model parameters; • Methods for determining the static operating point; • Techniques for using equivalent device diagrams in practical circuits; • Ability to analyze in stationary and dynamic regime diode circuits and amplifier stages with bipolar transistors and field-effect transistors; • Characterization of experimental of semiconductor electronic devices.
<p>Skills</p>	<p><i>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 instrumentation).</i></p> <p>Select and groups together relevant information about constructive types of diodes, bipolar transistors and MOS; Uses specific principles in order to preserve or neglect the influence of circuit elements; Working productive in the team for conducting laboratory reports; Experimentally verifies the solutions of a problem through simulation in a program dedicated to the simulation of electronic circuits; Solves practical applications within the laboratory, processing measured data sets; Interprets adequate causal relationships between extracted values; Analyzes and compares the values obtained in solving seminar problems; Formulates conclusions on the experiments carried out in the laboratory.</p>



Responsibility and autonomy	<p><i>The student's capacity to autonomously and responsibly apply their knowledge and skills.</i></p> <p>Select suitable bibliographic sources and analyzes them; Complies with the principles of academic ethics, correctly citing the bibliographic sources used; Demonstrate responsiveness for new learning contexts; Collaborate with other colleagues and teachers in carrying out teaching activities; Demonstrate autonomy in organizing the learning situation/context or problem situation to be solved; Promotes/contributes through new solutions, related to the specialty field; Realize the value of his contribution to engineering to identify viable/sustainable solutions; Apply first University ethics principles.</p>
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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 process will explore both expository (lecture, exposition) and conversational-interactive teaching methods, based on discovery learning models facilitated by direct exploration and indirect of reality (experiment, demonstration, modelling), but also on action-based methods, such as exercise, practical activities and problem solving.

Lectures will be used in the teaching activity, based on Power Point presentations or different Internet pages that 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 and assimilate.

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

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

Teamwork skills will be practiced to solve different learning tasks.

10. Contents

COURSE		
Chapter	Content	No. hours



1	<p>0. Introduction to course topics</p> <p>1. Notions of semiconductor materials physics</p> <p>1.1 Semiconductors. Insulators. Metals</p> <p>1.2 Pregnancy carriers</p> <p>1.3 Intrinsic and extrinsic semiconductors</p> <p>1.4 Fermi-Dirac statistics</p> <p>1.4 Transport phenomena in semiconductors, field currents and diffusion currents, electrical resistivity,</p> <p>1.5 Generation and recombination</p> <p>1.6 Basic equations of semiconductors</p>	4
2	<p>2. Semiconductor diodes</p> <p>2.1 Semiconductor diodes and p-n junctions</p> <p>2.2 Junction pn at equilibrium and polarized</p> <p>2.3 Currents at the p-n junction</p> <p>2.4 Series resistors</p> <p>2.5 Breaking diodes through the pn junction</p> <p>2.6 Dynamic mode</p> <p>2.7 Types of diodes</p> <p>2.8 Temperature dependence</p> <p>2.9 Applications</p>	4
3	<p>3. Bipolar Transistor (BJT)</p> <p>3.1 TB structure. npn and pnp transistors</p> <p>3.2 Operating modes</p> <p>3.3 Transistor currents, amplification factors</p> <p>3.4 Mathematical model</p> <p>3.5 Early, Late effect</p> <p>3.6 The Ebers-Moll model</p> <p>3.7 Static characteristics</p> <p>3.8 Dynamic mode</p> <p>3.8 Common characteristic</p> <p>3.9 Circuit equivalent to parameters h</p> <p>3.10 Applications, problems</p>	8
4	<p>4. MOS transistor</p> <p>4.1 Induced and initial channel MOS transistor</p> <p>4.2 Construction, operation, polarization principles</p> <p>4.3 Operating modes</p> <p>4.4 Static characteristics</p> <p>4.5 Real and ideal MOS capacitor</p> <p>4.6 MOS transistor threshold voltage</p> <p>4.7 Applications</p>	8
5	<p>5. Junction Field-Effect Transistor (JFET)</p> <p>5.1 Introduction</p> <p>5.2 Structure, principles of polarization, functioning</p> <p>5.3 Threshold voltage. Channel conductance</p> <p>5.4 Static characteristics</p> <p>5.5 Dynamic mode</p> <p>5.6 Apps</p>	2



6	Revision	2
		Total:
		28

Bibliography:

- 1.L. Dobrescu, curs Dispozitive Electronice , platformaMOODLE, <https://curs.upb.ro/2023/course/view.php?id=10376>
- 2.L. Dobrescu, D.Dobrescu, "Rezolvarea si simularea in SPICE a circuitelor electronice ", Ed.Politehnica Press, ISBN 978-606-9608-26-5, 2022
- 3.D.Dobrescu, L. Dobrescu, “Dispozitive si Circuite Electronice-Caiet de Activitate”, Ed. Printech,ISBN 973-652-829-4, 158 pg., București, 2003;
- 4.L. Dobrescu, D.Dobrescu, "Basics of the Semiconductor Devices Physics", 142 pg., Ed. Printech,ISBN 973-718-364-9, Bucuresti, 2005;
- 5.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
- 6.L. Dobrescu, D. Dobrescu, „Modele avansate ale dispozitivelor MOS”, Editura Printech, Bucuresti,2002;
- 7.A. Rusu, D. Dobrescu, L. Dobrescu, “Dispozitive si Circuite Electronice

LABORATORY

Crt. no.	Content	No. hours
1	Semiconductor diode and pn junction	4
2	Bipolar Transistor	4
3	MOS Transistor	4
4	Verification	2
		Total:
		14

SEMINARY

Crt. no.	Content	No. hours
1	Circuits with semiconductor diodes	6
2	Circuits with bipolar transistors	6
3	Circuits with MOS transistors	6
4	Circuits with JFET transistors	2
5	Circuitsincluding all types of transistors + Revision	8
		Total:
		28

Bibliography:

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- 2.L. Dobrescu, D.Dobrescu, "Rezolvarea si simularea in SPICE a circuitelor electronice ", Ed.Politehnica Press, ISBN 978-606-9608-26-5, 2022
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11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
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Universitatea Națională de Știință și Tehnologie Politehnica București
Facultatea de Electronică, Telecomunicații și
Tehnologia Informației



Date of approval in the Faculty Council Dean

26.09.2025

Prof. Dr. Mihnea Udrea