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

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	
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)				Analiza asist. de calculator a circ. electr. de putere Computer Aided Analysis of Power Electronic Circuits			
2.2 Course Lecturer				S.l./Lect. Dr. Mihail Ștefan TEODORESCU			
2.3 Instructor for practical activities				S.l./Lect. Dr. Mihail Ștefan TEODORESCU			
2.4 Year of studies	4	2.5 Semester	II	2.6. Evaluation type	V	2.7 Course regime	Ob
2.8 Course type		S	2.9 Course code	04.S.08.O.114		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	4	Out of which: 3.2 course	2.00	3.3 seminary/laboratory	2
3.4 Total hours in the curricula	56.00	Out of which: 3.5 course	28	3.6 seminary/laboratory	28
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.					37
Tutoring					0
Examinations					7
Other activities (if any):					0

3.7 Total hours of individual study	44.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Industrial electronics Signal processing

4.2 Results of learning	Knowledge about power electronic converters, control systems

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

5.1 Course	no
5.2 Seminary/ Laboratory/Project	Mandatory presence at laboratory (accordiong to UPB studies regulations)

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 course familiarizes students with analysis and design techniques and methods, using simulation tools. The specific applicability of different simulation platforms for power electronic converters and systems are studied, generally and detailed.

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	C5 Applying of basic knowledge, concepts and methods regarding ; power electronics, automated systems, electrical energy management, electromagnetical compatibility Use of simulation platforms (PSpice, PSIM, MatLab) for solving power electronics specific problems.
Transversal (General) Competences	Methodical analysis of the encountered problems.

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.* - Designs the basic elements including the control loop of a power electronic system - Models the components of a power electronic system - Selects the most appropriate models for the intended purpose - Simulates system operation - Makes the necessary adjustments and corrections to achieve the desired result

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 information relevant to non-linear systems - Uses specific principles argumentatively to model and simulate power electronic systems - Works productively in teams. - Interprets appropriately causal relationships between chosen solutions and obtained results - Analyses and compares different types of solutions chosen for modelling and simulation - Identifies solutions and develops solution/project plans. - Draws conclusions from experiments. - Argues the identified solutions/solutions.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* - Selects suitable literature sources and analyses them. - Respects the principles of academic ethics by correctly citing the bibliographical sources used. - Demonstrates receptiveness to new learning contexts. - Demonstrates collaboration with other colleagues and teachers in carrying out teaching activities. - Demonstrates autonomy in organising the learning situation/context or problem situation to be solved

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 teaching process will explore both expository (lecture, exposition) and conversational-interactive teaching methods, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modelling), as well as action-based methods such as exercise, hands-on activities and problem solving.

Lectures will be used in the teaching activity, based on Power Point presentations or various videos that will be made available to students. Each course will begin with a review of the chapters already covered, with emphasis on the concepts covered in the last course.

The presentations use pictures 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 in developing optimal collaborative and communicative relationships in a climate conducive to discovery learning.

It will focus on practising active listening and assertive communication skills, as well as mechanisms for constructing feedback, as ways of regulating behaviour in different situations and adapting the pedagogical approach to students' learning needs.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Power electronics system components and their interaction	2

2	Simulation methods for a power electronics system	4
3	PES linearisation and design of self-regulating systems	4
4	Component simulation and analysis of power electronics systems with specific simulation software. Comparative study.	10
5	Co-simulation methods.	4
6	Typical applications.	4
	Total:	28

Bibliography:

Bibliography
1) Muhammad H. Rashid, Hasan M. Rashid, SPICE for Power Electronics and Electric Power, 2006 by Taylor & Francis Group, LLC.
2) Christophe P. Basso, Switch-Mode Power Supplies, Spice Simulations and Practical Designs - 2008 The McGraw-Hill Companies
3) Luis Castan˜er and Santiago Silvestre: Modelling Photovoltaic Systems using PSpice 2002 John Wiley & Sons Ltd, Spain
4) PSIM® User's Guide, 2001-2014 Powersim Inc.

LABORATORY

Crt. no.	Content	No. hours
1	L1. Introduction in computer aided analysis. ORCAD platform	4
2	L2. PSpice modeling of power electronic switches. Parameters and switching characteristics.	4
3	L3. Creation of new models in PSpice and applications.	4
4	L4. Analysis of power electronics circuits with PSIM	4
5	L5. Subcircuit simulation in PSIM. Compoarative study PSIM-PSpice.	4
6	L6. Matlab-SIMULINK for power electronics. MatLab-PSIM co-simulation.	4
7	L7. Switching power supplies controlled with specialized circuit MC34063	4
	Total:	28

Bibliography:

1) Muhammad H. Rashid, Hasan M. Rashid, SPICE for Power Electronics and Electric Power, 2006 by Taylor & Francis Group, LLC.
2) Christophe P. Basso, Switch-Mode Power Supplies, Spice Simulations and Practical Designs - 2008 The McGraw-Hill Companies
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11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	Partial exam	Written test	25%
	Final exam	Written test	25%
	Home assignment	Written test	25%

11.5 Seminary/laboratory/project	Laboratory paper	written and oral	25%
11.6 Passing conditions			
50% of passing grade			

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 design and implementation power electronic systems implies nowadays the mandatory stage of simulation. The available simulation platforms are different, being specialized on certain components of the power system, but working together of the platforms is beginning to be implemented by means of co-simulation.

The course covers the simulation of the entire power electronics system, including electrical energy transmission, renewable generators, power energy conversion, electrical energy storage, different power loads, control of power electronic convertors, data acquisition, power quality, smart metering.

Adequate competences are thus ensured for the students, compatible with today`s qualification requirements, together with a modern technical and scientific preparation, which allows employment after graduation. This suits perfectly the UPB policy, regarding both structure and contents and also aptitudes and competence offered to the students

Date	Course lecturer	Instructor(s) for practical activities
13.11.2024	S.l./Lect. Dr. Mihail Ștefan TEODORESCU	S.l./Lect. Dr. Mihail Ștefan TEODORESCU

Date of department approval	Head of department
Date of approval in the Faculty Council	Dean