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)				Electronică şi informatică industrială Industrial Electronics and Informatics			
2.2 Course Lecturer				Prof. Dr. Constantin Rădoi			
2.3 Instructor for practical activities				Prof. Dr. Adriana FLORESCU			
2.4 Year of studies	3	2.5 Semester	II	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		S	2.9 Course code	04.S.06.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	3	Out of which: 3.2 course	2.00	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	42.00	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.					7
Tutoring					0
Examinations					1
Other activities (if any):					0

3.7 Total hours of individual study	8.00
3.8 Total hours per semester	50
3.9 Number of ECTS credit points	2

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Attend and pass of the following disciplines:Basics of Electrical Engineering 1, Basics of Electrical Engineering 2, Computer Programming, Signals and Systems, Electronic Devices, Fundamental Electronic Circuits

4.2 Results of learning	Accumulation of knowledge about industrial electronics and electrical power conversion. Acquiring practical skills in designing a.c.-dc and a.c.-a.c. converters. using power semiconductor 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 blackboard and a video projector.
5.2 Seminary/ Laboratory/Project	Mandatory attendance at laboratory sessions, according to the current university Regulation of university's undergraduate studies in UNSTPB.

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)*

This discipline is studied within the field of Electronic Engineering, Telecommunications and Information Technologies, the Applied Electronics specialization (ELA) and has as course objectives the study, analysis, design and simulation of a.c.-d.c. and a.c.-a.c. conversion devices and circuits of the electric power, with applications in industry, computing, telecommunications, medicine, etc.

The laboratory related to this discipline has as general objective the acquisition of the knowledge taught in the course as well as its deepening by performing measurements and simulations on the existing circuits and computers in the Laboratory of Applied Electronics and Informati of the ETTI Faculty in the EAII Department, building B Leu, floor 1, room B235.

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	- Use of fundamental elements related to electronic devices, circuits and instrumentation. - Applying, in typical situations, of the basic methods of processing electrical and non-electrical signals; implementing procedures of medium complexity on signal processors. - Understanding and using fundamental concepts in the field of communications and information transmission. - Application of elementary knowledge, concepts and methods regarding the architecture of the computing systems, microcontrollers, programming languages and techniques. - Solving electronic technology problems of production processes, maintenance (adjustment, testing, troubleshooting) of equipmenst and installations in the fields of power electronics, medical electronics, automatic systems and robots and the development of projects of medium complexity in the specialty. - Electrical energy management in electronic apparatus and installations used in industry, transport and medicine.

Transversal (General) Competences	- The ability to communicate and collaborate with specialists from other fields, other than electronics, in the sense of ensuring an interface between the technical problems encountered by them and the solutions to those problems. - The ability to communicate with higher hierarchical structures and with the subordinate team. - The ability to function as a leader of a team that may consist of people with different specializations and skill levels. - The ability to identify and apply the most appropriate and relevant management strategies for the subordinate team. - The ability to take decisions in order to solve current or unpredictable problems that appear in the process of operating electronic apparatus. - The ability to ensure the planning and management of projects in the field of applied electronics. - The ability to permanently inform and document in order to get personal and professional development by reading specialized literature. - The ability to communicate and present technical content both in Romanian and in English. - Flexibility in using new systems and technologies within a team where members together achieve a well-defined goal, while assuming different roles or tasks.

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.* • Lists the most important stages that marked the development of the field. • Defines domain-specific notions. • Describes/classifies notions/processes/phenomena/structures. **• Understands the methods and analysis techniques used in the studied EII field.** **• Knows the operation of a.c.-d.c. and a.c.-a.c. power devices and circuits. and c.a.-c.a., specific to the studied EII field.**
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).* • Experimentally verifies the identified solutions. • Solves concrete practical applications in the studied EII field. • Appropriately interprets and applies mathematical relationships, schematics, waveforms etc. • Analyzes and compares the performances of various similar power converters. • Identifies solutions and develops projects with electronic a.c.-d.c. and a.c.-a.c. power converters. • Formulates conclusions to the simulations carried out. • Argues the identified solutions/methods. • Prepares a scientific report/article

Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Select appropriate bibliographic sources and analyzes them. • Respect the principles of academic ethics, correctly citing the bibliographic sources used. • Demonstrates responsiveness to new learning contexts. • Demonstrates collaboration with other colleagues and teaching staff in carrying out teaching activities • Demonstrates autonomy in organizing the learning situation/context or the problem situation in order to be solved • Demonstrates social responsibility through active involvement in student social life/involvement in academic community events • Promotes/contributes through new solutions related to the specialized field to improve the quality of social life. • Applies principles of professional ethics/deontology in the analysis of the technological impact of the proposed solutions in the specialized field on the environment

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 methods are based on the use of the blackboard and the video projector, both in the course and in the laboratory. The used oral communication methods are the expository method and the problematization method, used head-on. Course materials are: course notes and presentations, collections of proposed problems (theoretical and with computer solutions). In the laboratory, students independently simulate, implement, test and evaluate the same problems through the continuous use of platforms and software environments. The didactic materials are in the laboratory platforms included in the laboratory guide. All course and laboratory materials are available in electronic format, on the Moodle site of the Industrial Electronics and Informatics (EII) course: https://curs.upb.ro/2021/course/view.php?id=9094.

Starting from the analysis of students' learning characteristics and their specific needs, the teaching process explores 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), as well as on action-based methods, such as exercise, practical activities and problems solving. In the teaching activity, lectures are used, based on presentations that use images and diagrams, so that the information presented is easy to understand and to assimilate by the students.

It is considered the practice of active listening and assertive communication skills, as well as feedback construction mechanisms, as ways of behavioral regulation in various situations of adapting the pedagogical approach to students' learning needs. Students' teamwork skills are also practiced to solve different learning tasks.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Introduction to industrial electronics: structure and areas of use	2
2	Power semiconductor devices: static and dynamic characteristics, limit parameters, use, command and control circuits, snubber circuits for optimizing the power dissipative regime of semiconductor devices when switching on complex loads, SPICE simulation of switching devices.	4

3	Functions and Forms of Electronic Circuits for Electrical Power Conversion: Optimized Structures	2
4	Frequency and time analysis methods of switched topologies.	4
5	a.c.-d.c. and a.c.-a.c. conversion structures	12
6	Elements of computer-aided simulation (SPICE, MatLab) of power processors	2
7	Regulation loop command and control systems. Use of dedicated microcomputers in power processor command and control	2
	Total:	28

Bibliography:

1. The course in electronic format from Moodle:
Lecturer: Prof. Dr. Eng. Adriana Florescu, subject name: Electronics and Industrial Informatics, course support and laboratory in electronic format, course link in Moodle:https://curs.upb.ro/2021/course/view.php?id=9094
2. Surugiu, A. Florescu, "Electronica de putere in comutatie (Switching Power Electronics) – vol.I" (195 pages), Editura Printech, ISBN 978-606-23-0280-1 (general for both volumes) and ISBN 978-606-23-0281-8 (specific for vol.I), Bucuresti, 2014
3. A. Florescu, I. Surugiu, "Electronica de putere in comutatie (Switching Power Electronics) – vol.II" (175 pages), Editura Printech, ISBN 978-606-23-0280-1 (general for both volumes) and ISBN 978-606-23-0282-5 (specific for vol.II), Bucuresti, 2014
4. Muhammad H. Rashid, "Power Electronics Handbook", 4th edition, Elsevier Printing House, 2018
5. Fang Lin Luo, Hong Ye, „Power Electronics: Advanced Conversion Technologies", 2nd edition, CRC Press, 2017
6. N. Mohan, T.M. Undeland, W. Robbins, "Power Electronics", John Willey & Sons, Inc., 2003
7. M. S. Teodorescu, S.G. Rosu. A. Florescu, „Analiza asistata de calculator a circuitelor electronice de putere. Indrumar de laborator (Computer-Aided Analysis for Power Electronics Circuits)", cod CNCSIS 54, ISBN 976-606-23-0896-4, Editura Printech, Bucuresti, Romania, 2018 (112 pages)

LABORATORY

Crt. no.	Content	No. hours
1	Introduction to computer-aided analysis of electronic switching circuits. SPICE modeling used in the switching regime study of power bipolar transistors	4
2	Half-controlled regulated bridge rectifier with thyristors	4
3	Single-phase a.c.-a.c. converters. Switching processes.	4
4	Laboratory colloquium	1
	Total:	14

Bibliography:
1. The course in electronic format from Moodle:
Lecturer: Prof. Dr. Eng. Adriana Florescu, subject name: Electronics and Industrial Informatics, course support and laboratory in electronic format, course link in Moodle:https://curs.upb.ro/2021/course/view.php?id=9094
2. C.Radoi, V.Drogoreanu, V.Grigore, A.Florescu ș.a. - Electronică și informatică industrială. Aplicații practice (Industrial Electronics and Informatics. Practical Applications), Editura Tehnică, București, 1997.
3. Surugiu, A. Florescu, "Electronica de putere in comutatie (Switching Power Electronics) – vol.I" (195 pages), Editura Printech, ISBN 978-606-23-0280-1 (general for both volumes) and ISBN 978-606-23-0281-8 (specific for vol.I), Bucuresti, 2014
4. A. Florescu, I. Surugiu, "Electronica de putere in comutatie (Switching Power Electronics) – vol.II" (175 pages), Editura Printech, ISBN 978-606-23-0280-1 (general for both volumes) and ISBN 978-606-23-0282-5 (specific for vol.II), Bucuresti, 2014
5. Muhammad H. Rashid, "Power Electronics Handbook", 4th edition, Elsevier Printing House, 2018
6. N. Mohan, T.M. Undeland, W. Robbins, "Power Electronics", John Willey & Sons, Inc., 2003
7. M. S. Teodorescu, S.G. Rosu. A. Florescu, „Analiza asistata de calculator a circuitelor electronice de putere. Indrumar de laborator (Computer-Aided Analysis for Power Electronics Circuits)", cod CNCSIS 54, ISBN 976-606-23-0896-4, Editura Printech, Bucuresti, Romania, 2018 (112 pages)

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;	Verification test during the semester	25%
	- knowledge about how to apply the theory to specific problems;	Partial test during the semester, with the possibility of retaking in the session	25%
	- analysis of techniques and theoretical methods specific to the field of electronics and industrial informatics.	Final test in the session	25%

11.5 Seminary/laboratory/project	- knowledge the working method of a given problem;	Final laboratory colloquium type grid test, which contains theoretical questions presented in the laboratory platforms.	5%
	- demonstration of the functioning of an implemented system through simulation.	Final laboratory colloquium type grid test, which contains questions from the simulations performed or given as homeworks in the laboratory platforms.	10%
	- knowledge about the operation of the proposed power circuits;	Final laboratory colloquium type grid test, which contains questions about the functioning of the power circuits presented in the laboratory platforms.	10%
11.6 Passing conditions			
• Obtaining 50% of the total score awarded to the laboratory, according to the current ETTI's Undergraduate Studies Regulations. • Obtaining 50% of the exam score (partial plus final exam). Pay attention to the applicable study regulations, references can be included here!			

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 discipline of Electronics and Industrial Informatics (EII) includes the switching, control, regulation and conversion of electricity from alternating current to direct current or also to alternating current but with other parameters, using electronic devices together with their measurement and control circuits. Rectifiers (a.c.-d.c. converters) and a.c.-a.c. converters are the fundamental building blocks in modern electronic applications.

The course and laboratory curriculum content meet the requirements of this modern and current field of industrial electronics and informatics, which gathers and promotes the information available in electrical power conversion electronics, so that the future electronics engineer can have immediate access to the basic knowledge, concepts and methodologies of this domain. In this way, graduates of the National University of Science and Technology Politehnica Bucharest, Faculty of Electronics, Telecommunications and Information Technology, the field of Electronic Engineering, Telecommunications and Information Technologies, the Applied Electronics specialization, are provided with the appropriate skills correlated with the needs of current qualifications and a scientific and technical modern training, of quality and competitive, which will allow to be quickly employed after graduation, being perfectly aligned with the policy of the National University of Science and Technology Politehnica Bucharest both from the point of view of content and structure, as well as from the point of view of skills and international openness offered to students willing to work in the field of applied electronics.

Date	Course lecturer	Instructor(s) for practical activities
09.10.2024	Prof. Dr. Constantin Rădoi	Prof. Dr. Adriana FLORESCU

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

Date of department approval	Head of department Conf.dr.ing. Bogdan Cristian FLOREA
Date of approval in the Faculty Council	Dean Prof.dr.ing. Radu Mihnea UDREA