COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	Politehnica University of Bucharest
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Department of Applied Electronics and Information Engineering
1.4 Domain of studies	Electronic Engineering, Telecommunications and Informational Technologies
1.5 Cycle of studies	License (engineering)
1.6 Program of studies/Qualification	Applied Electronics

2. Course identification information

2.1 Name of the course				Power Electronics Processors			
2.2 Lecturer				Prof. Constantin RADOI, Ph.D.			
2.3 Instructor for practical activities				Prof. prof. Adriana FLORESCU, Ph.D.			
2.4 Year of studies	IV	2.5 Semester	I	2.6 Evaluation type	Examination	2.7 Course choice type	Mandatory subject ELA

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

3.1 Number of hours per week, out of which	3	3.2 course	2	3.3 practical activities	1
3.4 Total hours in the curricula, out of which	42	3.5 course	28	3.6 practical activities	14

Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	10
Supplemental documentation (library, electronic access resources, in the field, etc)	20
Preparation for practical activities, homework, essays, portfolios, etc.	20
Tutoring	0
Examinations	12
Other activities	0

3.7 Total hours of individual study	62
3.9 Total hours per semester	104
3. 10 Number of ECTS credit points	4

4. Prerequisites (if applicable)

4.1 curricular	Basics of Electrical Engineering, Programmable Techniques, Fundamental electronics circuits, Signals and systems, Industrial Electronics and Informatics
4.2 competence-based	Knowledge about industrial electronics and electrical DC/DC and DC/AC power conversion.

5. Requisites (if applicable)

5.1 for running the course	Not applicable
5.2 for running of the applications	Compulsory attendance at laboratories (according to regulations governing the Masters Study in PUB).

6. Specific competences

Professional competences	C5 (according to ACPART-ELA list of competences) Apply the knowledge, concepts and basic methods from: power electronics, automatednsystems, electrical energy management, EMI.
Transversal competences	CT3 (according to ACPART-ELA list of competences) Adapt to the new technologies, professional and personal development, by a continuous training using printed documents, dedicated software and electronic resources in romanian language and, at least, in another agreed international language.

7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	The subject Power Electronics Processors studies using temporal and frecvential methods DC/DC and DC/AC power systems, as well as their main applications in industry.
7.2 Specific objectives	The Power Electronics Processors' laboratory is mainly focused on learning the basic knowledge teached and its assimilation using practical experiments and simulations on the circuits and computers that exists in PEP's lab from ETTI, Department EAII, Leu building, 2nd floor, room B235.

8. Content

8.1 Lectures	Teaching techniques	Remarks
1. DC/DC power conversion elements.	Teaching is based on the use of the blackboard and projector. The oral communication methods used are the expository method and the problem-based method. Course materials are: lecture notes and presentations, exercise book with solved and proposed problems (theoretical and solved using a computer). All materials are available electronically on the course website.	2h
2. DC/DC conversion: analysis of open loop PWM (pulse width modulation) Buck, Boost, Buck-Boost and Cuk converters, galvanicaly isolated converters, converter topologies with optimized operating parameters. Case study: design of a DC/DC converter.		4h
3. Switching power sources, system conversion dynamics, analysis and synthesis, time invariance in state-space, SPICE simulation. Case study: determining the transfer function and the design of the feedback loop for a DC/DC converter. Stability region.		2h
4. DC/AC converters: conventional and matrix conversion using PWM command and control methods.		4h
5. Modern approaches in systems and topologies for optimal DC/DC and DC/AC conversion. Zero Voltage Switching (ZVS) and Zero Current Switching (ZCS). Case study: design of a ZVS power converter.		12h
6. Applications of DC/AC and DC/DC converters in UPS		2h

(Uninterruptable Power Supplies) used in computer industry, medical electronics and other areas.		
Bibliography: (1) C.Rădoi, A.T.Murgan, V.Lăzărescu s.a. - Circuite si echipamente electronice industriale, Editura Tehnică, Bucuresti, 1986, (2) C.Rădoi, V.Grigore, V.Drogoreanu - SPICE – Simularea si Analiza Circuitelor Electronice, Editura Amco Press, Bucuresti, 1994, (3) C.Rădoi - Electronică Industrială, Lito UPB, Bucuresti, 1994, (4) S. Bârcă-Gălăteanu, D.A.Stoichescu, P.Constantin - Electronică de putere. AplicaŃii, Editura Militară, Bucuresti, 1991, (5) C.Rădoi, V.Drogoreanu, V.Grigore, A.Florescu s.a. - Electronică si informatică industrială. AplicaŃii practice, Editura Tehnică, Bucuresti, 1997, (6) M.H.Rashid - Power Electronics: Circuits, Devices and Applications, Prentice Hall, 1992, (7) N.Mohan s.a.- Power Electronics: Converters, Applications and Design, John Willey&Sons, SUA, 1995		
8.2 Practical applications	Teaching techniques	Remarks
SPICE modelling of DC switching power sources.Switching voltage regulator.	Teaching is based on the use of the projector (covering the communication and demonstrative functions); the oral communication methods used are the expository method and the problem based method, involving all of the students. Students simulate, implement, test and evaluate independently the same problems through the continuous use of laboratory platforms and of the software environment. The teaching materials and laboratory platforms are included in the laboratory guide book.	4 hours
First quadrate operation Thyristor chopper		4 hours
Inverter with synthesized waveform controlled by a n IBM-PC.		4 hours
Final laboratory evaluation		2 hours
Bibliography 1. C.Radoi, V.Drogoreanu, V.Grigore, A.Florescu s.a. - Electronica si informatica industriala. Aplicatii practice (Industrial Electronics and Informatics. Practical Applications), Editura Tehnica, Bucuresti, 1997. 2. C.Radoi, V.Grigore, V.Drogoreanu, SPICE – Simularea si Analiza Circuitelor Electronice (SPICE-Modelling and simulation of electronic circuits), Ed. Amco Press, Bucuresti, 1994 3. EII department site: www.eii.pub.ro		

9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program

Power Electronics Processors discipline Industrial Electronics and Informatics domain includes commutation, command, regulation and conversion of the electrical energy from DC to DC or AC with other parameters forms, using electronic devices with their specific measurement and control circuits. Inverters (DC/AC converters) and DC/DC converters represent one of the fundamental blocks in modern electronics applications such as communications and mobile cells, media equipments, computers, medical technique and so on.

The course syllabus is adequate to this modern and actual domain of industrial electronics, that gathers and promotes the information available in the electric power conversion of energy in such a manner that the next electronics engineer should have an unlimited access to the

knowledge, concepts and basic methodologies in the field.
This provides graduates with the appropriate skills required by current industry demands on electrical power processing and with a modern scientific and technical training, both from a qualitative point of view as well as from a competitive one, enabling rapid employment after graduation. This is perfectly framed in the educational policy of Politehnica University of Bucharest, both in terms of content and structure as well as in terms of skills and international openness for students willing to work in the applied electronics industry.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures	- Basic knowledge of theoretical concepts; - Knowledge of the application of the theory to solve specific problems; - analysis techniques and theoretical methods specific to the electronic power processors' field.	Two written test examination during the semester at fixed dates at the beginning of the course; the topics cover the whole field, providing a synthesis between comparative theoretical browsing of the subject and exemplification through exercises and problems of application models.	75%
10.5 Practical applications	- knowledge concerning the working of a given problem; - Knowing how to transpose the functioning of the proposed power electronics circuits; - demonstrate the operation of an implemented system.	Final verification comprising using a multiple choice test that contents theoretical, simulation and functioning questions from the power circuits presented in the laboratory etc.	25%
10.6 Minimal performance standard			
- design, implementation, and functionality demonstration of a simple solution for a circuit from electronic power processors' domain; - to be able to apply the obtained competences and abilities in the industrial power systems equiped with power electronics processors (switching power supplies, UPS, single phase and 3-phase PWM inverters etc).			

Date	Lecturer,	Instructor for practical activities
18.10.2015	Prof. Constantin RADOI, Ph.D.	Prof. Adriana FLORESCU, Ph.D

Date of department approval

Director of Department,

21.10.2015 Prof. Sever PAŞCA Ph.D