Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

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	**Electronic Devices, Circuits and Architectures**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Microelectronics, Optoelectronics and Nanotechnologies

2. Date despre disciplină

2.1 Course name (ro) (en)				Electronică auto Automotive Electronics			
2.2 Course Lecturer				Prof. Dr. Eng. Alexandru Vasile			
2.3 Instructor for practical activities				Prof. Dr. Eng. Alexandru Vasile			
2.4 Year of studies	4	2.5 Semester	I	2.6. Evaluation type	V	2.7 Course regime	F
2.8 Course type		S	2.9 Course code	04.S.07.L.117		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	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	42	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.					10
Tutoring					10
Examinations					4
Other activities (if any):					4

3.7 Total hours of individual study	33.00
3.8 Total hours per semester	75
3.9 Number of ECTS credit points	3

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Completion and/or passing of the following courses: Physics Fundamentals of Electrical Engineering Electronic Devices and Circuits Digital Integrated Circuits Analog Integrated Circuits

4.2 Results of learning	Acquiring the following knowledge: Knowledge of operation, simulation, and design of electronic circuits.

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 and a computer. For synchronous transmission/recording of lectures, an Internet connection with appropriate speed is required
5.2 Seminary/ Laboratory/Project	The laboratory will take place in a room with equipment specific to a technological power electronics lab; protective equipment provided by the faculty

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 subject is studied within the field of Electronics, Telecommunications and Information Technologies / the Advanced Microelectronics master's program and aims to acquire knowledge related to power circuits specially intended for the control and monitoring of industrial environments. Knowledge of design methodologies for applied electronics systems.

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	C6. Application, in concrete situations, of the basic methods of acquisition and processing of sensor signals and control of actuators:- use of specific methods and instruments for measuring physical quantities;- use of software environments for analysis and digital signal processing and solving control and automation problems
Transversal (General) Competences	Works in a team and communicates effectively, coordinating efforts with others to solve moderately complex problem situations. Autonomy and critical thinking: the ability to think scientifically, to search for and analyze data independently, as well as to extract and present conclusions / identify solutions. Capacity for analysis and synthesis: presents the knowledge acquired in a synthetic manner, as a result of a systematic analysis process. Respects the principles of academic ethics: correctly cites the bibliographic sources used in documentation activity

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.* - for the course: Ensuring general knowledge in the electric domain of the automobile, operating parameters of the combustion engine and of the electric motor; safety parameters while driving according to EU standards, principles of ensuring driver and passenger comfort; multiple supply systems and their reversibility; monitoring and control circuits of the running system, compatibility of operation and maintenance of vehicles with environmental conditions, reduction of maintenance costs, increasing the competitiveness of cars, the special conditions of the automotive field, special electronic circuits intended for this field - for applications: Covering problems from the course domain with verification based on multiple-choice tests grounded in European road safety and environmental pollution standards
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 relevant information in a given context. Uses specific principles with justification for the efficient design of chips and achieving the goal of “success on the first try”. Works productively in a team. Prepares a scientific text. Experimentally verifies identified solutions. Solves practical applications. Properly interprets causal relationships. Analyzes and compares different design styles. Identifies solutions and develops resolution plans/projects. Formulates conclusions for the experiments carried out. Argues the identified solutions/modes of resolution. Designs elementary functional blocks for analog and digital signal processing. Has the ability to adapt to new technologies and to document in Romanian and, at least, in an international language of circulation, for professional and personal development, through continuous training
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Selects appropriate bibliographic sources and analyzes them. Respects the principles of academic ethics, correctly citing the bibliographic sources used. Demonstrates receptivity to new learning contexts. Shows collaboration with other colleagues and teaching staff in carrying out didactic activities. Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved. Shows social responsibility through active involvement in student social life/involvement in events of the academic community. Promotes/contributes with new solutions, related to the field of specialization, to improve the quality of social life. Is aware of the value of their contribution in the field of engineering in identifying viable/sustainable solutions that solve problems in social and economic life (social responsibility). Applies principles of professional ethics/deontology in analyzing the technological impact of proposed solutions in the field of specialization on the environment. Analyzes and capitalizes on business/entrepreneurial development opportunities in the field of specialization. Demonstrates skills d

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 the students’ learning characteristics and their specific needs, the teaching process will explore both expository methods (lecture, presentation) and conversational-interactive ones, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modeling), as well as action-based methods such as exercise, practical activities, and problem solving. During teaching activities, lectures will be used, based on PowerPoint presentations or various short videos that will be made available to students. Each class will begin with a recap of the

chapters already covered, with emphasis on the notions from the last class. The presentations use images and diagrams so that the information presented is easy to understand and assimilate. This subject covers information and practical activities intended to support students in their learning efforts and in developing optimal collaborative and communication relationships in a climate favorable to discovery learning. Practicing active listening and assertive communication skills will be taken into account, as well as feedback construction mechanisms, as ways of behavioral adjustment in various situations and of adapting the pedagogical approach to students' learning needs. Teamwork skills will be practiced for solving different learning tasks. Teaching is based on the use of the video projector (covering the communication and demonstrative function); the oral communication methods used are the expository method and the problematization method, used frontally. The course materials are: course notes and presentations, collections of proposed problems (theoretical and with computer-based solutions). All materials are available in electronic format, through the course site

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	1. General notions and technical parameters of a car's subassemblies. General operating conditions of the electrical and electronic equipment on vehicles. Mechanical-climatic conditions specific to the automobile. Technical parameters of a spark-ignition engine, physical quantities existing in the automotive field, primary sensors, intelligent sensors	4
2	2. The automobile's electrical power supply system. 2.1. Primary sources of electrical power supply on vehicles. Electronic circuits for measuring and monitoring them. 2.2. Power generators, electronic voltage regulators, switching adapters of the vehicle's electrical power supply system	4
3	3. Electronic circuits specific to the automotive field. 3.1. Starting systems: classification, components, characteristic quantities, calculation elements, testing and checking of these. 3.2. Lighting, signaling and warning systems: components, specific electronic circuits, operation, maintenance. 3.3. Dashboard indicators. 3.4. Equipment dedicated to the automotive environment. 3.5. Actuators in automotive electronics. 10 hours	10
4	4. Classical electronic ignition systems: components, characteristics, advantages and disadvantages.	2
5	5. Principles and methods of electronic control of engine operation	2
6	6. Modern electronic systems (based on microprocessors, microcontrollers) for command and control of an engine's operation: types, advantages, disadvantages, operating limits.	2
7	7. Testing and checking equipment for the vehicle. 7.1. Checking and diagnostic equipment for the engine and the on-board computer. 7.2. Verification equipment	4
	Total:	28

Bibliography:
1.VASILE Alexandru, Prezentările de la cursul de PEC, actualizat anual, https://curs.upb.ro/2021/mod/folder/view.php?id=240285
2.Alexandru Vasile, Industrial electronics, published by Cavallioti, ISBN 973-9463-75-4, Bucharest 2014
3.Infineon Technologies AG "Semiconductors – Technical information, technologies and characteristic data" Publics Corporate Publishing 2004 Munchen
4.Manea C, Manea A, Mechatronics of the modern vehicles, vol. I, vol. II, published, Bucharest 2000 Mohan Tore M. Undeland
5.Power Electronics John Wiley &Sons New York 1995 Ali Emadi, Handbook Automotive Power Electronics and Motor Drivers, Taylor & Francis, USA 2007

LABORATORY

Crt. no.	Content	No. hours
1	Use of primary sensors, intelligent sensors: temperature; humidity; flow rate; RPM (partners - Infineon)	2
2	Electronic voltage regulators, switching adapters of the vehicle's electrical power supply system	2
3	Lighting, signaling and warning systems: components	2
4	Operation of dashboard indicators	2
5	Operation of the air-conditioning system	2
6	Electronic ignition systems	2
7	Final laboratory colloquium	2
	Total:	14

Bibliography:
1) Al. VASILE, Irina BACIS, Bazele electronicii auto, Editura Cavallioti, Bucureşti 2013
. 2) P. SVASTA, Al. VASILE, Componente Electronice Pasive, Ed.Cavallioti, Bucureşti 2011
3) "Bringing theory into Practice: Fundamentals of Power semiconductors for Automotive applications", Infineon Technologies AG, September 2006

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 concepts	Final written multiple-choice exam	20%
	Presentation of specific homework topics during the semester.	.ppt presentation	30%
	Presentation of specific homework topics during the semester.	Presentation and analysis of patents in the field	20%
11.5 Seminary/laboratory/project	Seminar/laboratory/project	Translating the operation of a system into a "flow chart	30%
11.6 Passing conditions			

Obtaining 50% of the total score. Obtaining 50% of the score related to the activity during the semester . Pay attention to the applicable Study Regulations; references in this regard may 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)

Covering power supply systems gives graduates the possibility to have a broad view and expertise in the design and realization of industrial automation Through the activities carried out, students develop skills to analyze and design integrated circuits, which represents a field of great interest in the recent period, with a significant demand for engineers in the field of analog, digital and mixed-signal integrated circuit design. The types of circuits studied are constantly used in all commercial companies in the field. The Cadence design environment used in the laboratory is used in all commercial companies in the field that operate in Romania. The course curriculum concretely meets current requirements and technological evolution trends. The course and its related applications provide students with knowledge and skills that give them the opportunity for rapid employment after graduation in a prestigious company in the field. The current situation in the semiconductor market has revealed major imbalances that exist between the demand and supply of products in this field, which has generated active and decisive measures at all decision levels, including state and European Union levels. In developing the course content, both knowledge, aspects, phenomena described in the specialized literature and the lecturers' own published research as well as their industrial experience were taken into account. The course has content similar to courses conducted by Lodz University of Technology in Poland, THE UNIVERSITY of EDINBURGH and Newcastle in Great Britain, etc. Through the laboratory activities, the development of the graduate's ability to manage practical situations that they may face in real life is envisaged, in order to increase their contribution to improving the socio-economic environment. The discipline was developed in agreement with microelectronics companies operating in Romania such as Infineon Technologies, Romania, Microchip Romania and On Semiconductor.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Prof. Dr. Eng. Alexandru Vasile	Prof. Dr. Eng. Alexandru Vasile

Date of department approval	Head of department Prof. Dr. Claudius Dan
Date of approval in the Faculty Council	Dean

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Prof. Dr. Eng. Radu Mihnea Udrea