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	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Masters
1.6 Programme of studies	Electric Vehicle Propulsion and Control

2. Date despre disciplină

2.1 Course name (ro) (en)				Proiect: sisteme embedded Project: Embedded Systems			
2.2 Course Lecturer							
2.3 Instructor for practical activities				Conf. Dr. Bogdan Cristian FLOREA			
2.4 Year of studies	1	2.5 Semester	I	2.6. Evaluation type	V	2.7 Course regime	Ob
2.8 Course type		DS	2.9 Course code	UPB.04.M1.O.24-06		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	2	Out of which: 3.2 course	0.00	3.3 seminary/laboratory	2
3.4 Total hours in the curricula	28.00	Out of which: 3.5 course	0	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.					18
Tutoring					2
Examinations					2
Other activities (if any):					0

3.7 Total hours of individual study	22.00
3.8 Total hours per semester	50
3.9 Number of ECTS credit points	2

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	• Computer programming • Data structures and algorithms • Microcontrollers • Digital integrated circuits
4.2 Results of learning	General knowledge of programming, algorithms and microcontrollers in Python/C/C++ language. General knowledge of finite state machines and digital integrated circuits

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

5.1 Course	Not applicable
5.2 Seminary/ Laboratory/Project	Room equipped with computer systems and video projector

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)*

Students receive a project to implement an OBD-II interface using the ELM327 emulator and the Python or C/C++ programming language.

All the design and implementation steps necessary to carry out the activities are presented, the system simulation and analysis mode is presented, as well as the elements necessary for its implementation.

The project aims to familiarize students with the method of executing a project, from the phase of defining the specifications, to its technical documentation. Each stage has a teaching deadline, so a very important component is time management and the distribution of activities.

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	C2. Application of basic methods for signal acquisition and processing C2.3. Use of simulation environments for signal analysis and processing C2.5. The design of elementary functional blocks of digital signal processing with hardware and software implementation C3. Application of basic knowledge, concepts and methods regarding the architecture of computing systems, microprocessors, microcontrollers, programming languages and techniques C3.1. Description of the operation of a computer system, the basic principles of the architecture of general purpose microprocessors and microcontrollers, the general principles of structured programming C3.2. The use of programming languages of general use and specific to applications with microprocessors and microcontrollers; explaining the operation of some automatic control systems that use these architectures and interpreting the experimental results C3.3. Solving concrete practical problems that include elements of data structures and algorithms, programming and use of microprocessors or microcontrollers C3.4. The development of programs in a general and/or specific programming language, starting from the specification of the requirements and up to the execution, debugging and interpretation of the results in correlation with the processor used C3.5. Realization of projects involving hardware (processors) and software (programming) components
Transversal (General) Competences	CT2. Defining the activities by stages and assigning them to subordinates with a complete explanation of duties, depending on the hierarchical levels, ensuring the efficient exchange of information and interpersonal communication.

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.* Familiarization with the OBD-II protocol and the various diagnostic and control elements. Using the Python or C/C++ programming language to create a communication interface based on the ELM327 module.

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).* Understanding and using fundamental concepts in the field of programming, development of algorithms specific to automotive electronics. The ability to communicate and collaborate with specialists from other fields, in the sense of ensuring an interface between the technical problems encountered and the solutions found. Ability to function as a leader of a team that may consist of individuals with different specializations and skill levels. The ability to inform and document for personal and professional information by reading specialized literature. Flexibility in using new elements and technologies within a team where members together achieve a well-defined goal while assuming different roles or tasks.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Select appropriate bibliographic sources and analyze them. Respect the principles of academic ethics, correctly citing the bibliographic sources used. Demonstrates responsiveness to new learning contexts. Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved. Apply principles of professional ethics/deontology in the analysis of the technological impact of the solutions proposed in the specialized field on the environment. Analyzes and capitalizes on business/entrepreneurial development opportunities in the specialty area.

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 is based on the use of the video projector/online communication channels (covering the communication and demonstration function). The oral communication method used is the problematization method, used head-on. Students implement, test and evaluate independently the same problems or problems specific to individual assignments, through continuous use of the computer and software environments. The didactic materials are the presentation slides and the design and implementation demonstration sessions of the concepts presented.

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**
1	Introducing the OBD-II protocol	4
2	Presentation and use of the ELM327 emulator	4
3	Integration of the ELM327 emulator in new applications	8
4	Development of the OBD-II interface	8
5	Evaluation	4
	Total:	28

Bibliography:

1. D.A. Stoichescu, B.C. Florea, R.C. Constantinescu, "Echipamente Electronice pentru Reglaj Automat", Editura Printech (Cod CNCSIS 54), București 2014, ISBN 978-606-23-0200-9, 111 pagini
2. D.A. Stoichescu, B.C. Florea, R.C. Constantinescu, "Sisteme Automate Numerice", Editura Printech (Cod CNCSIS 54), București 2022, ISBN 978-606-23-1366-1, 144 pagini
3. Documentatia emulatorului ELM327 (https://github.com/Ircama/ELM327-emulator)

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course			
11.5 Seminary/laboratory/project	Understanding the OBD-II protocol and the services available for diagnosis and control.	Presentation of the project and the documentation	100%
11.6 Passing conditions			
Obtaining at least 50% of the subject points			

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)

Job market requirements include not only a good knowledge of programming techniques, but also a strong foundation in hardware design and implementation of specific requirements.

The curriculum covered by the discipline effectively addresses the development requirements encountered within the profile companies in the field of Auto Electronics.

Thus, the graduates are provided with competences appropriate to the current qualifications and a modern and competitive scientific training, which will allow them to be employed quickly after graduation, being perfectly framed in 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 the national and international skills and openness offered to students.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2024		Conf. Dr. Bogdan Cristian FLOREA

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Date of department approval	Head of department
27.10.2024	Conf. Dr. Serban Georgica Obreja
Date of approval in the Faculty Council	Dean
25.10.2024	Prof. Dr. Mihnea Udrea