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	**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)				Modelarea şi simularea vehiculelor electrice Electric Vehicle Modelling and Simulation			
2.2 Course Lecturer				Conf. Dr. Octaviana DATCU			
2.3 Instructor for practical activities				Conf. Dr. Octaviana DATCU			
2.4 Year of studies	1	2.5 Semester	1	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		F	2.9 Course code	1		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	1	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	28	Out of which: 3.5 course	14	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.					39
Tutoring					0
Examinations					8
Other activities (if any):					0

3.7 Total hours of individual study	47.00
3.8 Total hours per semester	75
3.9 Number of ECTS credit points	3

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Students must have knowledge about Matlab-Simulink.
4.2 Results of learning	Students must know basic notions of mathematics and dynamic modeling.

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.

5.2 Seminary/ Laboratory/Project	The laboratory will take place in a room with specific equipment and licences (Matlab-Simulink).

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/ complementary master's specialization - Electric Vehicle Propulsion and Control, and aims to familiarize students with the main approaches, models and explanatory theories of the field, used in solving the practical applications and problems, with relevance for stimulating student learning. At the end of the course the students will be able to: * Modeling and simulating electric vehicle components; * Design models of electric vehicles and simulate them on Matlab-Simulink. * Design models electric vehicle and simulate them on the industrial tool AMESIM.

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	The students must: • correlate knowledge specific to the field of electric vehicle propulsion and control with those of the other disciplines belonging to the area of electronic engineering, telecommunications and information technology. • apply knowledge, methods, standards and tools in practical situations specific to the field for carrying out the evaluation and diagnosis process of a situation, depending on the problems reported, and identify solutions. • argue and analyze coherently and correctly the context of application of the knowledge of basis of the field, using key concepts of the discipline and specific methodology. • use scientific vocabulary specific to the field, in order to communicate effectively, in writing and orally.
Transversal (General) Competences	Students must: • work in a team and communicate effectively, coordinating efforts with others to solving problematic situations of medium complexity. • have the ability to think in scientific terms, to search and analyze data independently, as well as extract and present conclusions / identify solutions. • have the ability to analyze and synthesize: present the acquired knowledge in a synthetic way, following a systematic analysis process. • respect the principles of academic ethics, correctly citing in the documentation activity the bibliographic sources used. • put into practice elements of emotional intelligence in socio-emotional management appropriate to real-life/ academic/ professional situations, demonstrating mastery of self and objectivity in decision-making or in stressful situations.

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.* Students: • list the most important stages that marked the development of the field. define domain-specific notions. • describe/ classify notions/ processes/ phenomena/ structures. • highlight consequences and relationships
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).* Students: • Model and simulate electric vehicle components; • Design models of electric vehicles and simulate them on Matlab-Simulink. • Design models electric vehicle and simulate them on the industrial tool AMESIM.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Students: • select appropriate bibliographic sources and analyze them. respect the principles of academic ethics, correctly citing the bibliographic sources used. • demonstrate responsiveness to new learning contexts. demonstrates collaboration with other colleagues and teaching staff in carrying out teaching activities demonstrate autonomy in organizing the learning situation/ context or problem situation to solve. • demonstrate social responsibility through active involvement in student social life/involvement in the events of the academic community. • promote/ contribute new solutions related to the field of expertise to improve the quality of social life. • realize the value of its engineering contribution to identifying solutions viable/ sustainable to solve problems in social and economic life (social responsibility). • apply principles of professional ethics/ deontology in analyzing the technological impact of solutions proposed in the specialized field on the environment. • analyze and capitalizes on business/ entrepreneurial development opportunities in the field of specialty. • demonstrate real-life situation management skills (time management collaboration vs. conflict).

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 students' learning characteristics and their specific needs, the process of teaching will explore teaching methods both expository (lecture, exposition) and conversational-interactive, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modeling), but also on action-based methods, such as exercise, practical activities and problem solving. In the teaching activity, lectures will be used, based on Power Point presentations or different videos which will be made available to students. Each course will begin with the recapitulation of the chapters already covered, with emphasis on the concepts covered in the last course. Presentations use images and diagrams so that the information presented is easy to understand and assimilate. This subject covers information and practical activities designed to support students in their endeavors to learning and the development of optimal collaboration and communication relationships in a climate conducive to learning by discovery. It will be considered to practice the skills of active listening and assertive communication, as well as a feedback construction mechanisms, as ways of behavioral regulation in various situations and adapting the pedagogical approach to the students' learning needs. Teamwork skills will be practiced to solve different learning tasks.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Students: * install Matlab and Simulink using [2]. * get familiar with the vehicle dynamics and control, theory from [1], practical part from [3]. * read the paper and implement their own Matlab-Simulink version of the experiments presented in [3], using the template from [4].	4
2	Brief recall on different electric vehicle components. Introduction to the electric vehicle components modelling [2].	5
3	Introduction to industrial simulation tool AMESIM [6]. Electric vehicle propulsion chain simulation using AMESIM [7].	5
	Total:	14

Bibliography:
[1] Prototyping an Electric Vehicle in MATLAB Simulink, Published January 12, 2022, Sharad Bhowmick, online at https://circuitdigest.com/article/prototyping-an-electric-vehicle-in-matlab-simulink on the 17th of November 2023.
[2] How Stuff Works, Auto, How Four-Wheel Drive Works, Karim Nice, Updated: Feb 9, 2021, available October 2024.
[2] How Stuff Works, Auto, How Four-Wheel Drive Works, Karim Nice, Updated: Feb 9, 2021, available October 2024 at https://auto.howstuffworks.com/four-wheel-drive. htm.
[3] Build a 21 Car Building Plans – How To Build You Own Car At Home, by Smart Motorist https://www.smartmotorist.com/how-to-build-a-car, October 2024.
[4] Template to be used: English version: ETTI Regulations on the preparation of the graduation thesis - PDF , 'doc' version, on http://www.electronica.pub.ro/index.php/studenti/absolvire/absolvire-informatii-generale, October 2024.
[5] Hussar C., Grovu M., Irimia C., Desreveaux A., Bouscayrol A., Ponchant M, Magnin P., Comparison of Energetic Macroscopic Representation and structural representation on EV simulation under Simcenter AMESim. IEEE-VPPC'19, Hanoi (Vietnam), October 2019.
[6] Siemens PLM Software, Simcenter Amesim, Delivering engineering innovation with system simulation, online at https://www.techsim.cz/content/files/Siemens-PLM-Simcenter-Amesim-eb-72523-A20-2.pdf, October 2024.

LABORATORY

Crt. no.	Content	No. hours
1	Studying a preexistent .slx model [1].	6
2	Implement the student's own .slx model.	6
3	Colloquium.	2
	Total:	14

Bibliography:
[1] Electric vehicle database, available online on October 2024.

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade

11.4 Course	Students' ability to apply theoretical notions in a different context, but tangential to the one in which they acquired the respective knowledge.	Written test.	20 %
	Students' ability to apply theoretical notions in a different context, but tangential to the one in which they acquired the respective knowledge.	Final exam.	40 %
11.5 Seminary/laboratory/project	The student has the ability to implement a vehicle model, applying the theoretical knowledge in practical situations.	Laboratory sheets fulfilling the requirements - Moodle Assignments.	20 %
	Ability to implement a vehicle model, applying the theoretical knowledge the operation of the in implemented model and practical situations.	Final laboratory colloquium, in which the student discusses with the teaching staff, applying demonstratingthe operation of the implemented model and explaining the concepts framework of the problems involved by it.	20 %
11.6 Passing conditions			
• Obtaining 50% of the total score. • Obtaining 50% of the score related to the activity per semester.			

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)

Through the activities, students develop skills to offer solutions to problems and propose ideas of improving the situation of existence in the field of electronic engineering, telecommunications and informational technologies, targeting the development of the content of the discipline, knowledge, aspects and phenomena described by specialty literature. Through laboratory and course activities, the development of the graduate's management skills is considered, in practical situations that she can face in real life in order to increase his

contribution to improving the socioeconomic environment.

Date	Course lecturer	Instructor(s) for practical activities
21.09.2026	Conf. Dr. Octaviana DATCU	Conf. Dr. Octaviana DATCU

Date of department approval	Head of department
22.09.2026	Conf. Dr. Serban Georgica Obreja

Date of approval in the Faculty Council	Dean
22.09.2026	Prof. Dr. Mihnea Udrea