

SYLLABUS ¹

THIS COURSE UNIT IS TAUGHT IN ROMANIAN LANGUAGE

1. Information about the program

1.1 Higher education institution	Politehnica University Timisoara
1.2 Faculty ² / Department ³	Faculty of Electrical and Power Engineering / Electrical Engineering Department
1.3 Chair	—
1.4 Field of study (name/code ⁴)	Electrical Engineering /90
1.5 Study cycle	Bachelor
1.6 Study program (name/code/qualification)	Electrotehnics/30

2. Information about the discipline

2.1 Name of discipline/ formative category ⁵	Electrification and electric/hybrid vehicles						
2.2 Coordinator (holder) of course activities	Associate Professor PhD.Mihaela-Codruța ANCUȚI						
2.3 Coordinator (holder) of applied activities ⁶	Associate Professor PhD.Mihaela-Codruța ANCUȚI						
2.4 Year of study ⁷	IV	2.5 Semester	7	2.6 Type of evaluation	D	2.7 Type of discipline ⁸	DS

3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted) ⁹

3.1 Number of fully assisted hours / week	3 of which:	3.2 course	2	3.3 seminar / laboratory / project	1
3.1* Total number of fully assisted hours / semester	42 of which:	3.2* course	28	3.3* seminar / laboratory / project	14
3.4 Number of hours partially assisted / week	– of which:	3.5 training	–	3.6 hours for diploma project elaboration	–
3.4* Total number of hours partially assisted / semester	– of which:	3.5* training	–	3.6* hours for diploma project elaboration	–
3.7 Number of hours of unassisted activities / week	4 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			1
		hours of individual study after manual, course support, bibliography and notes			2
		training seminars / laboratories, homework and papers, portfolios and essays			1
3.7* Number of hours of unassisted activities / semester	56 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			14
		hours of individual study after manual, course support, bibliography and notes			28
		training seminars / laboratories, homework and papers, portfolios and essays			14
3.8 Total hours / week ¹⁰	7				
3.8* Total hours /semester	98				
3.9 Number of credits	4				

4. Prerequisites (where applicable)

¹ The form corresponds to the Discipline File promoted by OMECTS 5703 / 18.12.2011 and to the requirements of the ARACIS Specific Standards valid from 01.10.2017.

² The name of the faculty which manages the educational curriculum to which the discipline belongs

³ The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.

⁴ The code provided in HG no.140 / 16.03.2017 or similar HGs updated annually shall be entered.

⁵ Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).

⁶ Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).

⁷ Year of studies in which the discipline is provided in the curriculum.

⁸ Discipline may have one of the following regimes: imposed discipline (DI), optional discipline (DO) or optional discipline (Df).

⁹ The number of hours in the headings 3.1 *, 3.2 *, ..., 3.8 * is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.

¹⁰ The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

4.1 Curriculum	•
4.2 Competencies	• the ability to use computing technique and computer software.

5. Conditions (where applicable)

5.1 of the course	<ul style="list-style-type: none"> • computer; • video-projector; • whiteboard.
5.2 to conduct practical activities	<ul style="list-style-type: none"> • computers; • whiteboard; • dedicated software-tools.

6. Specific competencies acquired through this discipline

Specific competencies	<ul style="list-style-type: none"> • Adequate application of basic knowledge of mathematics, physics and chemistry in the field of electrical engineering • Operation with fundamental concepts in electrical engineering • Analysis, modeling and simulation of electrical systems • Use of techniques for measuring electrical and non-electrical quantities and data acquisition systems in electrical systems.
Professional competencies ascribed to the specific competencies	<ul style="list-style-type: none"> • Identifying the objectives to be achieved, the available resources, the conditions for their completion, the working stages, working hours, deadlines and related risks • Operating with fundamental concepts in computer science and information technology • Efficient use of information sources and communication resources and assisted professional training (Internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in a language of international circulation .
Transversal competencies ascribed to the specific competencies	<ul style="list-style-type: none"> • Professional communication, teamwork, scientific research, interdisciplinary cooperation and innovation. •

7. Objectives of the discipline (based on the grid of specific competencies acquired - pct.6)

7.1 The general objective of the discipline	<ul style="list-style-type: none"> • Understanding the main concepts of the hybrid/electric vehicles.
7.2 Specific objectives	<ul style="list-style-type: none"> • Understanding in detail the concepts of the hybrid/electric vehicles.

8. Content¹¹

8.1 Course	Number of hours	Teaching methods ¹²
1. Automotive industry and electrification	2	Lectures and discussions
2. Conventional vehicles and powertrains	2	
3. Fundamentals of electric motor control	4	
4. Hybrid electric powertrains	4	
5. Types of EVs	4	
6. Renewable energy technologies' integration in cities	2	
7. Vehicle-to-grid interface and electrical infrastructure	4	

¹¹ It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(*)".

¹² Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).

8. Energy Storage Systems. Comparative analysis. Modelling	3	
9. Vehicle dynamics	3	

Bibliography ¹³

1. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, Taylor & Francis Group, 2017
2. Emanuele Crisostomi, Robert Shorten, Sonja Stüdl, Fabian Wirth, Electric and Plug-in Hybrid Vehicle Networks: Optimization and Control, CRC Press, Taylor & Francis Group, 2017
3. Larry E. Erickson, Jessica Robinson, Gary Brase, Jackson Cutsor, Solar Powered Charging Infrastructure for Electric Vehicles: A Sustainable Development, CRC Press, Taylor & Francis Group, 2017
4. Eduardo Rincón-Mejía, Alejandro de las Heras, Sustainable Energy Technologies, CRC Press, Taylor & Francis Group, 2018
5. Alfred Rufer, Energy Storage: Systems and Components, CRC Press, Taylor & Francis Group, 2017
6. Kambiz Ebrahimi, Mehrdad Ehsani, Yimin Gao, Stefano Longo, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, 3rd Edition, CRC Press, Taylor & Francis Group, 2018
7. Kwang Hee Nam, AC Motor Control and Electrical Vehicle Applications, 2nd Edition, CRC Press, Taylor & Francis Group, 2019
8. N. Ramesh Babu, Smart Grid Systems: Modeling and Control, CRC Press, Taylor & Francis Group, 2018.

8.2 Applied activities ¹⁴	Number of hours	Teaching methods
1. AC electrical machines modelling and control	2	Discussions
2. AC electrical machines modelling and control	2	Questioning
3. Battery based systems modelling and smart monitoring	2	Application solving
4. EV motor design and control	2	
5. Powertrain topology modelling and simulation	2	Discussions Questioning Application solving
6. Vehicle dynamics modelling and simulation	2	Discussions Questioning Application solving
7. Energy efficient power converter topologies for microgrids applications	2	Discussions Questioning Application solving

Bibliography ¹⁵

1. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, Taylor & Francis Group, 2017
2. Emanuele Crisostomi, Robert Shorten, Sonja Stüdl, Fabian Wirth, Electric and Plug-in Hybrid Vehicle Networks: Optimization and Control, CRC Press, Taylor & Francis Group, 2017
3. Larry E. Erickson, Jessica Robinson, Gary Brase, Jackson Cutsor, Solar Powered Charging Infrastructure for Electric Vehicles: A Sustainable Development, CRC Press, Taylor & Francis Group, 2017
4. Eduardo Rincón-Mejía, Alejandro de las Heras, Sustainable Energy Technologies, CRC Press, Taylor & Francis Group, 2018
5. Alfred Rufer, Energy Storage: Systems and Components, CRC Press, Taylor & Francis Group, 2017
6. Kambiz Ebrahimi, Mehrdad Ehsani, Yimin Gao, Stefano Longo, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, 3rd Edition, CRC Press, Taylor & Francis Group, 2018
7. Kwang Hee Nam, AC Motor Control and Electrical Vehicle Applications, 2nd Edition, CRC Press, Taylor & Francis Group, 2019
8. N. Ramesh Babu, Smart Grid Systems: Modeling and Control, CRC Press, Taylor & Francis Group, 2018.

9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

- Companies from the automotive industry.

10. Evaluation

¹³ At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.

¹⁴ Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".

¹⁵ At least one title must belong to the discipline team.

Type of activity	10.1 Evaluation criteria ¹⁶	10.2 Evaluation methods	10.3 Share of the final grade
10.4 Course	- knowledge of the theoretical aspects related to hybrid/electric vehicles.	Questionnaire	50 %
10.5 Applied activities	S:		
	L: - the ability to apply the knowledge from the lectures; - the capacity to evaluate and comparative analysis of the results.	Applied exam test within the laboratory	50 %
	P¹⁷:		
	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified ¹⁸)			
<ul style="list-style-type: none"> • to answer at 50 % of the questionnaire; • to model within a software-tool a specific configuration; • to propose and analyze different expansion scenarios for a specific configuration. • The described minimum performance standard is intended to be verified through applied exam test within the laboratory. 			

Date of completion

30.11.2020

**Head of Department
(signature)**

.....

**Course coordinator
(signature)**

.....

**Date of approval in the Faculty
Council ¹⁹**

**Coordinator of applied activities
(signature)**

.....

**Dean
(signature)**

.....

¹⁶ Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)

¹⁷ In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.

¹⁸ It will not explain how the promotion mark is awarded.

¹⁹ The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.