COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**ENE_APP-205**	**SEMESTER**	**2**
COURSE TITLE	ELECTRIC VEHICLE TECHNOLOGY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	
Tutorial/Practical Exercises	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).	3	6

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	Special Background, Specialised
PREREQUISITE COURSES:	No. Students are advised to have already attended the courses: Power Electronics I, Power Electronics II, Electrical Drive Systems
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.uop.gr/courses/3541/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

and Appendix B

- *Guidelines for writing Learning Outcomes*

The aim of the "Electric Vehicle Technology" course is for postgraduate students to deepen their knowledge of the technology and analysis of electric vehicle systems. An electric vehicle consists of: a) the electric drive system, b) the energy storage, c) the mechanical part (transmission system, steering system, etc.), and d) the information transfer system (computer, information, communication, etc.). a.).

Some of the subjects have been analyzed in previous postgraduate courses. Those systems not analyzed so far, but also the composition of all subsystems in a common system, constitute the basic structure of this course. Thus, the mechanical subsystems of an electric vehicle, the communication and information system within the vehicle, the vehicle communication systems with the IoT and finally the control of the electric motor will be presented.

Learning Outcomes

Upon successful completion of the course the student is in a position to:

At the knowledge level:

1. recognize the basic stuctural componets of the Electrical Vehicls.
2. to understand the overall operation of Electric Vehicles.

3. to be able to recognize and apply the appropriate control methode of the electromechanical system, consisting of an electronic power converter, an electric motor and the vehicle as a mechanical load.
4. to know the interaction of information systems with the electrical drive system.
5. to know the transaction security mechanism when charging the vehicles.
6. to recognize the mechanical systems of an electric vehicle (drive system, steering system, braking system and suspension system) and know their interaction with the electric motor.

At the skill level:

1. to understand the pulse techniques of power electronic converters in order to control the various energy operating states of the system.
2. be able to apply regeneration braking control.
3. To understand and analyze the effect of individual mechanical systems on an electric vehicle.
4. to understand future electric vehicle system technologies.
5. to acquire the foundations to propose new electric vehicle technologies at a research level.

At the level of abilities:

1. be able to repair devices containing Electrical Vehicls.
2. select appropriate systems to improve Electrical Vehicls.
3. to apply techniques and technologies to improve the electric vehicles efficiency.
4. to evaluate and improve the effect of mechanical systems on the performance of electric vehicles
5. communicate with technical subordinates and superiors in a common language.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	……

- Decision making
- Work in an international environment
- Work in an Interdisciplinary environment
- Development of new research ideas
- Respect to the natural environment
- Criticism and self-criticism
- Promotion of free, creative and inductive thinking

(3) SYLLABUS

Lectures:

Presentation – analysis – study and applications of Electrical Vehicls:

1. Analysis of the drive system of an electric vehicle and the transmission system.
2. Different types of car steering systems and steering mechanisms.
3. Braking system and electro-mechanical braking energy recovery system of an electric vehicle.
4. Stability and suspension system of electric vehicles

5. Analysis of mechanical systems of hybrid vehicles and electric vehicles.
6. Four quadrants electrical power control.
7. Structure and control of the electric motor system.
8. Electric drive systems of electric trains.
9. Electric vehicle propulsion system calculation.
10. Electric vehicle electric drive system simulation.
11. Local area networks and communication protocols for monitoring and control of electric vehicle subsystems (Controller Area Network – CAN).
12. Communication standards and protocols of electric vehicles with charging stations (IEC 62196, IEC 61851, ISO 15118, CHAdeMO, Combined Charging System - CCS).
13. Communication standards and protocols of charging infrastructures with the intelligent energy network (Open Charge Point Protocol – OCPP, Open Smart Charging Protocol – OSCP, Automated Demand Response - OpenADR).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In lecture
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Learning process support through the e-class electronic platform (lectures and communication). • Additional video conferences via Teams and Webex Simulation programs (Matlab), through which the structure and operation of electromechanical systems are examined
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	

Activity	***Semester workload***
Lectures	39 hours
Analysis through simulation	37 hours
Oral projects through simulation	37 hours
Lecture & bibliography study (at home)	37 hours
Course Total	***150 hours (5 ECTS)***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	**Examination language:** Greek **Evaluation Method:** I. Theory (70% of grade): - Written final exam (90% of theoretical grade) which involves theoretical questions and exercises. - Weekly, from the student's interest in the lecture (10% of theoretical grade). II. Oral examined project in Simulink/Matlab software (30% of grade).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Σ. Ν. Μανιά, Ηλεκτρονικά ισχύος, Εκδόσεις Συμεών, 2007.

N. Mohan, T. A. Undeland, W. P. Robins, Εισαγωγή στα ηλεκτρονικά ισχύος: Ανάλυση, σχεδίαση και εφαρμογές των ηλεκτρονικών μετατροπέων ισχύος, Εκδόσεις Τζιόλα, 2010.

M. H. Rashid, Ηλεκτρονικά ισχύος: Κυκλώματα, εξαρτήματα και εφαρμογές, Εκδόσεις Ίων, 2011.

Ι. Κιοσκερίδη, Ηλεκτρονικά ισχύος, Εκδόσεις Τζιόλα, 2008.

M. H. Rashid, Power electronics handbook, Academic Press, 2001.

R. W. Erickson, D. Maksimovic, Fundamentals of power electronics, Springer, 2001.

P. T. Krein, Elements of power electronics, Oxford University Press, 1998.

P. C. Sen, Power electronics, McGraw-Hill, 1987.

M. D. Singh, K. B. Khanchandani, Power electronics, McGraw-Hill, 2008.

M. S. J. Asghar, Power electronics, PHI Learning, 2004.

Π. Μαλατέστα, Ηλεκτρική κίνηση, Εκδόσεις Τζιόλα, 2010.

R. Krishnan, Ηλεκτρικά κινητήρια συστήματα, Εκδόσεις Κλειδάριθμος, 2009.

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U. A. Bakshi, M. V. Bakshi, Electrical drives and control, Technical Publications, 2009.

I. Boldea, S. A. Nasar, Electric drives, Taylor & Francis, 2005.

B. K. Bose, Power electronics and motor drives: Advances and trends, Academic Press, 2006

H. W. Beaty, J. L. Kirtley, Electric motor handbook, McGraw-Hill, 1998.