COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_ENE750**	**SEMESTER**	**7**
COURSE TITLE	ELECTRICAL MACHINES II		

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	3	
Laboratory	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).	4	5

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	Specialized, Skills Development
PREREQUISITE COURSES:	No. It is suggested that students have already attended: Electrical Circuits I & II, Electromagnetism, Electrical Machines I
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://www.ece.uop.gr/

(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 main goal of the course is to introduce the students to the basic principles of dc machines, single phase asynchronous machines and special types of electrical machines such as universal motors, step motors etc.

Learning Outcomes

After the successful completion of the course, the students will be able to:

At the knowledge level:

1. Understand the basic principles of dc machines and their structure and distinguish the different types of dc machines.

2. Understand the equivalent circuits, the static behavior and the characteristics curves of the various types of DC generators.
3. Understand the equivalent circuits the static behavior and the characteristics curves of the various types of DC motors.
4. Understand the structure, the constructional features and the static behavior of single phase asynchronous motors.
5. Formulate the steady state equivalent circuits of the above mentioned machines and to know their calculation methodology.
6. Understand the structure, the basic structure and the static behavior of special types of electrical machines.

<u>At the skill level:</u>

1. Calculate the electrical and mechanical quantities (such as voltage, current, power, torque and speed), in steady state operation in systems that include the above mentioned machines.
2. Operate safely dc machines, single phase asynchronous motors and special types of electrical machines.
3. Construct systems which include dc machines, single phase asynchronous motors and special types of electrical machines and to use the appropriate measurement devices in order to carry out measurements of electrical and mechanical quantities.

<u>At the level of abilities:</u>

1. Construct and operate safely, eletromechanical energy conversion systems.
2. Understand, analyze and solve complicated problems related to the subject of electrical machines.
3. Adopt and apply methodologies for solving problems beyond the taught material.
4. Collaborate for solving problems related to the field of electrical machines or to an interdisciplinary field.

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…*
	…….

1. Search for, analysis and synthesis of data and information, with the use of the necessary technology
2. Working independently
3. Team work
4. Decision – making
5. Working in an interdisciplinary enviroment
6. Production of new research ideas

(3) SYLLABUS

Theory

1. Basic principles of dc machines, basic structure, windings, winding connections.
2. Induced voltage, electromagnetic torque, armature reaction, commutation, compensating windings, commutating poles.
3. Generator operation of dc machines, equivalent circuits, winding connections.
4. Load behavior of dc generators, voltage regulation, power losses, efficiency.
5. Motor operation of dc machines, equivalent circuits, winding connections.
6. Load operation of dc motors, torque-speed characteristics, startup, speed control, braking, applications.
7. Basic principles of single phase asynchronous motors, basic structure, windings, winding connections.
8. Equivalent circuit of single phase asynchronous motors, load behavior, torque-speed characteristics, startup, speed control, braking, applications.
9. Basic principles of Universal motors, basic structure, torque-speed characteristics, applications.
10. Basic principles of step motors, basic structure, applications.
11. Basic principles of reluctance motors, basic structure, applications.
12. Basic principles of AC Hysterisis motors, basic structure, applications.
13. Basic principles of ultrasonic motors, basic structure, applications.

Laboratory

1. The equivalent circuit of seperately excited dc generator – Load behavior of seperately excited dc generator.
2. Load behavior of shelf excited (shunt wound) dc generator.
3. Load behavior of shelf excited (compound wound) dc generator.
4. Load behavior of seperately excited dc motor. Torque speed characteristic, speed control.
5. Operating principles of single phase asynchronous machines. Startup, load behavior, torque speed characteristics.
6. Operating principles of step motor.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face in-class lecturing, Laboratory exercises
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Slides (ppt) of the presentation of the theoretical part of the course, which will be available from the beginning of semester through e-Class. • Guidelines for the laboratory exercises (one per exercise), which will be available from the beginning of the semester through e-Class. • Support of teaching procedure through the e-Class platform (notification of the teaching procedure, distribution of slides, supplementary material,

	announcements, relative links and literature, provision of test and the final examination)
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*	
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.*	Evaluation language: Greek **Theory Grade** Final exams grade (short answer questions, problem solving): 60% Intermediate exams grade (short answer questions, problem solving): 40% **Laboratory Grade** Final laboratory exam grade: 40% Laboratory oral examination grade: 40% Laboratory report grade: 20% The final grade is the weighted result of the grades of theory and Laboratory. Minimum pass grade 5/10.

Activity	***Semester workload***
Lectures	39
Laboratory practice	13
Laboratory reports	26
Study and analysis of bibliography	47
Course Total	***125 hours (5 ECTS)***

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

1. S. Chapman, *Ηλεκτρικές μηχανές*, Εκδόσεις Τζιόλα, 2009.
2. C. I. Hubert, *Ηλεκτρικές μηχανές*, Εκδόσεις Ίων, 2008.
3. G. Rizzoni, *Ηλεκτρομηχανική - Τόμος 3*, Εκδόσεις Παπαζήση, 2006.
4. Α. Σαφάκα, *Ηλεκτρικές μηχανές - Τόμος Α*, Εκδόσεις Πανεπιστημίου Πατρών, 2007.
5. Π. Μαλατέστα, *Ηλεκτρικές μηχανές*, Εκδόσεις Τζιόλα, 2012.
6. Α. Γούτη, *Ηλεκτρικές μηχανές*, Εκδόσεις Ίων, 2006.
7. Δ. Ψωμιάδη, *Ηλεκτρικές μηχανές - Τόμος Ι*, Εκδόσεις Ίων, 2004.
8. Δ. Ψωμιάδη, *Εφαρμογές ηλεκτρικών μηχανών - Τόμος Ι*, Εκδόσεις Ίων, 2004.

9. Π. Βερνάδου, Η. Βυλλιώτη, Π. Μαλατέστα, *Εργαστηριακές ασκήσεις ηλεκτρικών μηχανών*, Εκδόσεις Τζιόλα, 2008.
10. Β. Στεργίου, *Ηλεκτρικές μηχανές συνεχούς ρεύματος*, Εκδόσεις Ίων, 1999.
11. Σ. Τουλόγλου, *Ηλεκτρικές μηχανές συνεχούς και εναλλασσόμενου ρεύματος*, Εκδόσεις Ίων, 1999.
12. Σ. Ν. Βασιλακόπουλου, *Ηλεκτρικές μηχανές*, Ίδρυμα Ευγενίδου, 2006.
13. Ι. Ξυπτερά, *Ηλεκτρικές μηχανές*, Εκδόσεις Ζήτη, 1997.
14. Β. Σαμοΐλη, *Μετασχηματιστές*, Τεχνικό Επιμελητήριο Ελλάδας, 2007.
15. G. Haberle, *Μετασχηματιστές και ηλεκτρικές μηχανές*, Ευρωπαϊκές Τεχνολογικές Εκδόσεις, 1994.
A. E. Fitzgerald, C. Kingsley, S. Umans, *Electric machinery*, McGraw-Hill, 2003.
16. J. J. Cathey, *Electric machines*, McGraw-Hill, 2001.
17. J. Hindmarsh, *Electrical machines and their applications*, Elsevier, 1995.

- *Related academic journals:*

1. IEEE Transactions on Energy Conversion
2. IEEE Transactions on Magnetics
3. IET Proceedings – Generation Transmission and Distribution
4. IET Proceedings – Electric Power Applications
5. Electric Power Systems Research, Elsevier
6. Applied Energy, Elsevier
7. Energy Systems, Springer