

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	ENE_APP-102	SEMESTER	1
COURSE TITLE	SPECIAL CHAPTERS OF ELECTRICAL MACHINES		
INDEPENDENT TEACHING ACTIVITIES <i>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</i>		WEEKLY TEACHING HOURS	CREDITS
Lectures		2	
Seminars / Practice exercises		1	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).</i>		3	6
COURSE TYPE <i>general background, special background, specialised, general knowledge, skills development</i>	Special Background. Specialization.		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.uop.gr/courses/3472/		

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 course "Special Chapters of Electric Machines" is for postgraduate students to deepen their knowledge in the theory of electromechanical energy conversion as well as in the operation of two fundamental electric machines that find application in electric vehicles, the three-phase synchronous and asynchronous machines, both in steady state and transient state.

Within the framework of the course, the required theory is presented for the study of the operation of the specific machines. Related subjects such as the magnetomotive force, the rotating magnetic field, the development of voltage and torque in electric machines and the equivalent circuits are also presented. AC machines are analyzed based on the generalized theory of electric machines, and an introduction to the dynamic analysis of AC electric machines and an introduction to the transformation of stator and rotor windings in the (d,q,γ) axis system is presented.

The analysis and study of the operation of the machines in the permanent and transient state is realized with the help of specialized software (Matlab/Simulink).

Learning outcomes

On course completion students are able to

In terms of Knowledge:

1. Understand fundamental concepts of electric machines, such as magnetomotive forces inside a machine, rotating electric field and the induction of voltage and torque.
2. Understand the structure and the operational characteristics of alternating current electric machines (three-phase synchronous & asynchronous).
3. Know the equivalent circuits of synchronous and asynchronous machines.
4. Know the basic techniques of dynamics simulation of electrical machines.

At the skill level:

1. Calculate various electrical and mechanical quantities of electrical machines like voltage, current, power, torque, and speed in steady state.
2. Study the transient state of electrical machines by simulating their operation using software.
3. Predict the changes in the operational characteristics and performance of the machines when their manufacturing characteristics are changed.

At the level of abilities:

1. Understand and solve complex problems related to the operational of electrical machines.
2. Generalize the knowledge they acquired and use it to solve problems they are not familiar with.

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

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- Work independently
- Teamwork
- Search for, analyse and synthesize data and information, with the use of appropriate technology.
- Production of free, creative, and inductive thinking

3. SYLLABUS

1. Introduction to electromechanical energy conversion.
2. Single excitation-single output systems. Multiple excitation-single output systems.
3. Dynamic modelling of a single excitation-single output system.
4. Magnetomotive force, rotating electric field, induction of voltage and torque, power losses of electrical machines.
5. Basic principles of three phase asynchronous machines, basic structure, windings, operational characteristics.
6. Basic principles of three phase synchronous machines, basic structure, windings, operational characteristics.
7. Generalized theory of electrical machines.
8. Introduction to dynamic simulation of electrical machines. Transformation of d-q axis.
9. Dynamic simulation of three phase asynchronous motor.
10. Basic principles of dynamic simulation of electrical machines using Matlab/Simulink.
11. Simulation of three phase asynchronous motor in transient and steady state using Matlab/Simulink.
12. Simulation of three phase permanent magnet synchronous motor in transient and steady state using Matlab/Simulink..
13. Comparative study of operational characteristics of three phase asynchronous motor and three phase permanent magnet synchronous motor using Matlab/Simulink.

4. TEACHING and LEARNING METHODS-EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face in classroom and lab	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Teaching using ICT, Use of Matlab/Simulink/Simscape software. Learning process support through the e-class electronic platform.	
TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>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.</i> <i>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</i>	Activities	Semester course load
	Theorylectures	39
	Report writing	61
	Independent study of lectures and bibliography	50
	Total <i>(25 hours course load per credit)</i>	150
STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i> <i>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</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	Evaluation Language: Greek Evaluation Method: Short answer questions, problem solving: 50% Written reports: 50%	

5. RECOMMENDED BIBLIOGRAPHY

<p>Chee-Mun Ong ,<i>Dynamic Simulation of Electrical Machinery using Matlab/Simulink</i>, Prentice Hall, 1997.</p> <p>S. Chapman, <i>Electric Machinery Fundamentals</i>, McGraw-Hill, 2011.</p> <p>A. E. Fitzgerald, C. Kingsley, S. Umans, <i>Electric machinery</i>, McGraw-Hill, 2013.</p> <p>I. Boldea, L. Tutelea, <i>Electric Machines</i>, CRC Press, 2021.</p> <p>S.Vukosavic, <i>Electrical Machines</i>, Springer New York, 2014</p> <p>C. I. Hubert, <i>Electric Machines</i>, Pearson India, 2003.</p> <p>J. J. Cathey, <i>Electric machines</i>, McGraw-Hill, 2001.</p> <p>J. Hindmarsh, <i>Electrical machines and their applications</i>, Elsevier, 1995.</p>
