

Course Unit	Electrical Machines		Field of study	Physics/Chemistry	
Bachelor in	Renewable Energy Engineering		School	School of Technology and Management	
Academic Year	2021/2022	Year of study	2	Level	1-2
Type	Semestral	Semester	2	ECTS credits	6.0
Code	9910-743-2203-00-21				
Workload (hours)	162	Contact hours	T 30	TP -	PL 30
			TC -	S -	E -
			OT -	O -	

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Ângela Paula Barbosa da Silva Ferreira, Susana Sofia Alves Freitas

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. describe the operation of various types of electrical machines;
2. understand and interpret the operating characteristics of static and rotating electrical machines;
3. select and proceed to dimensioning of electrical machines within their applications.

Prerequisites

Before the course unit the learner is expected to be able to:

1. use complex numbers;
2. analyse single and three phase AC electrical circuits.

Course contents

Basic operating principles of static and rotating electrical machines (electromagnetic induction and rotating magnetic field). Losses and efficiency of energy conversion processes. Operating characteristics of transformers and rotating electrical machines induction and synchronous (conventional and permanent magnet). Selection and dimensioning of electrical machines.

Course contents (extended version)

1. Introduction to static and rotating electric machinery fundamentals
 - The electromagnetic induction
 - The rotating magnetic field concept
2. Losses, efficiency, power and torque
3. Electrical transformers
 - Operating characteristics
 - Selection and dimensioning of single-phase, three-phase and transformers banks
 - Instrument transformers
4. Three-phase induction machines
 - Operating characteristics
 - Speed control
 - Selection and dimensioning of three-phase induction motors
5. Synchronous machines
 - Operating characteristics (motor and generator)
 - Exciters
6. Permanent magnet machines
 - Operating characteristics (motor and generator)
 - Trends in permanent magnet machinery design

Recommended reading

1. Electric Machinery Fundamentals, S. J. Chapman, 5th Ed., McGraw Hill, 2011
2. Electrical Transformers and Rotating Machines, S. L. Herman, 4th Ed., Cengage Learning, 2016
3. Electric Machines and Power Systems, Volume 1 - Electric Machines, S. A. Nasar, McGraw Hill, 1995
4. Permanent Magnet Motor Technology, J. F. Gieras, M. Wing, 2.ª Edição, Marcel Dekker, 2002
5. Reluctance Synchronous Machines and Drives, I. Boldec, Oxford University Press, 1996

Teaching and learning methods

Tutorial classes: presentation of the course contents; problem solving to support the expected learning outcomes and laboratory experiments to realize in practice some issues treated analytically.

Assessment methods

1. Distributed assessment - (Regular, Student Worker) (Final, Supplementary)
 - Practical Work - 25%
 - Final Written Exam - 75%
2. Global assessment - (Regular, Student Worker) (Final, Supplementary, Special)
 - Final Written Exam - 100%

Language of instruction

Portuguese

Electronic validation

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02-03-2022	02-03-2022	03-03-2022	20-03-2022