SUBJECT TEACHING GUIDE

G874 - Design and Calculation of Electrical Machines

Degree in Electrical Engineering

Academic year 2023-2024

1. IDENTIFYING DATA				
Degree	Degree in Electrical Engineering		Type and Year	Compulsory. Year 3
Faculty	School of Industrial Engineering and Telecommunications			
Discipline	Subject Area: Machines and Electrical Switches Module: Electrical Technology			
Course unit title and code	G874 - Design and Calculation of Electrical Machines			
Number of ECTS credits allocated	6	Term	Semester based (2)	
Web				
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA ELECTRICA Y ENERGETICA
Name of lecturer	ALFREDO ORTIZ FERNANDEZ
E-mail	alfredo.ortiz@unican.es
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 2. DESPACHO PROFESOR (S2029)
Other lecturers	JAIME PEREDO ARGOS

3.1 LEARNING OUTCOMES
- Ability to understand a winding scheme and calculate its basic parameters.
- Select the type of service that should work an electric motor and its rated power.
- Make a rough calculation of magnetic field in the air gap, leakage fluxes and induced e.m.f.s in an electrical machine.
- Understanding the standards of electrical machines testing.
- Carry out the initial sizing of an asynchronous motor.

4. OBJECTIVES

Knowledge of the elements of the electrical machines and their most important physical and chemical properties.
Provide the basics about the calculation, design and selection of electric machines.
Knowledge of tests for determining the characteristics of an electric machine and their standards.

6. COURSE ORGANIZATION

CONTENTS	
1	Constructive aspects.
1.1	Magnetic, insulating and conductor materials. Magnets.
1.2	Description of the constitutive elements of a electric machine. Electrical angles. Principle of reversibility.
1.3	Windings. Description and calculus.
2	Power, losses and heating. Electrical machines characterization. Transformers. Tests.
2.1	Powers, losses and heating. Cooling systems.
2.2	Load and service. Rated power. Service types. Standards.
2.3	Other specification codes. Standards.
2.4	Measurement of mechanical quantities. Efficiency tests. Standards.
2.5	Overvoltages on transformers. Insulation tests. Standards.
3	Basic quantities calculation.
3.1	Air-gap magnetic field.
3.2	Electromotive forces.
3.3	Leakage magnetic fields. Leakage reactances.
3.4	Additional torques in asynchronous machines.
4	Electrical machines calculation.
4.1	Parametric calculation.
4.2	Calculation of an asynchronous motor.
4.3	Transformer calculation process

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Laboratory evaluation.	Laboratory evaluation	Yes	Yes	30,00
Homework to solve individually by every student.	Work	Yes	Yes	10,00
Written partial exam for the first part of the course (chapters 1 and 2).	Written exam	Yes	Yes	30,00
Written partial exam for the second part of the course (chapters 3 and 4).	Written exam	Yes	Yes	30,00
TOTAL				100,00

Observations

The course has two parts:
- First part: chapters 1 and 2.
- Second part: chapters 3 and 4.
There are partial exams (one for every part of the course) and final exams (every of them are divided in two parts). (Final exams are official exams).
Final grade of the course N is the highest of these two grades:

* $N = 40\% \ P1 + 40\% \ P2 + 10\% \ L + 10\% \ E$
* $N = 45\% \ P1 + 45\% \ P2 + 10\% \ L$

P1 is the best grade for first part obtained among partial and final exams.
P2 is the best grade for second part obtained among partial and final exams.
L is laboratory grade.
E is homework grade.
All of these grades are specified within a maximun of 10 points.
To pass the course, N must be not lower than 5 and both, P1 and P2, must be not lower than 4.
When a student obtain a grade P1 equal or higher than 4 in an exam, he do not need to made more exams of the first part.
Similarly for P2 and the second part of the course.

Observations for part-time students

Part-time students will be assessed on the same basis as full-time students.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

CORRALES MARTIN, JUAN "Cálculo industrial de máquinas eléctricas". Marcombo. Barcelona.

Normas U.N.E.

PYRHÖNEN, J. Y OTROS. "Design of Rotating Electrical Machines". John Wiley & Sons, Ltd.

RAPP, J. "Teoría y cálculo de los bobinados eléctricos". J. Rapp Editor. Bilbao.

GUIONES DE CLASE Y DE PRÁCTICAS DE LABORATORIO. Miguel Angel Rodríguez Pozueta.