Electrical machines and installations

Academic Year: (2022 / 2023) **Review date: 27-04-2022**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: MARTINEZ TARIFA, JUAN MANUEL

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electric Power Engineering Fundamentals

OBJECTIVES

By the end of this subject, students will be able to have:

1. coherent knowledge of their branch of engineering including some at the forefront of the branch in electrical machines and installations.
2. the ability to apply their knowledge and understanding of electrical machines and installations to identify, formulate and solve engineering problems using established methods.
3. workshop and laboratory skills.
4. the ability to combine theory and practice to solve engineering problems regarding electrical machines and installations.
5. an understanding of applicable techniques and methods in electrical machines and installations, and of their limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Fundamentals of electromagnetics applied to ferromagnetic materials.
1.1. Electromagnetic theory review.
1.2. Hopkinson's Law and limitations. Coil inductances.
1.3. Saturation and hysteresis at ferromagnetic materials.
1.4. Eddy current losses. Power dissipation at ferromagnetic materials.
2. Transformers.
2.1. Principles about the ideal transformer.
2.2. Construction.
2.3. Equivalent circuit of a real transformer.
2.4. Voltage drop and efficiency.
2.5. Three phase transformers. Phase angle between windings.
2.6. Measurements and protection transformers.
2.7. Variacs.
3. Introduction to rotating machines.
3.1. Principles about rotating machines
3.2. Magnetic fields in the air gap.
3.3. Ferraris' Theorem.
3.4. Construction issues at AC machines.
4. The syncronous Machine.
4.1. Fundamentals. Applications.
4.2. Rotor with windings and permanent magnets.
4.3. General structure issues.
5. The asyncronous machine.
5.1. Fundamentals. Applications.
5.2. Equivalent circuit.
5.3. Torque-speed characteristics. Start-up.
6. Low-voltage (LV) facilities: cables and conductors.
6.1. Introduction to power distribution.
6.2. Conduction cross section calculations.
7. Internal and Linking facilities.
7.1. General sketches and definitions.
7.2. Shortcircuit currents calculations.
8. LV protection devices.
8.1. Protection against electrical shocks.

8.2. Automatic switches and fuses.
8.3 Ground connection schemes.
9. LV electrical facilities: Spanish regulations.

Practical sessions:

1.- The three phase transformer: connections, tests for equivalent circuit.
2.- The asycronous motor: start-up and current consumption. Power factor, rotating speed and efficiency for different loads.
3.- Ground resistance measurements: connections, calculations.

LEARNING ACTIVITIES AND METHODOLOGY

- Learning in big groups (theoretical approach), learning in small groups (solving doubts), to solve doubts (ask for them by email), individual student work. Theoretical knowledge

- Laboratory learning (3 sessions), learning in small groups (solving practical problems), to solve problems (ask for them by email), individual student work. Practical knowledge

ASSESSMENT SYSTEM

EVALUATION CRITERIA
All examinations will be based on problems and theoretical questionnaires .The subject can be passed in the ordinary call or in the extraordinary call following next criteria.

ORDINARY CALL

Partial exam of electric machines (Block 1, October)	20%	
Partial exam of electrical installations (Block 2, December)		20%
Final exam of electric machines (ordinary call-January)	25%	
Final exam of electrical installations (ordinary call-January)		25%
Laboratory (mandatory)	10%	

There is a minimum mark in each of the blocks of the ordinary call (January) of 3/10.

It is possible to discard one block from the final examination (January call) if its partial evaluation is above 6 out of 10. In addition, it is possible to pass the subject if both blocks are above 6 out of 10 and practical evaluation (lab sessions) is above 5 out of 10.

EXTRAORDINARY CALL

Final exam of electric machines (extraordinary call-June)		45%
Final exam of electrical installations (extraordinary call-June)		45%
Laboratory (mandatory)	10%	

The calculation formula for the mark could be the same as in ordinary call if is beneficial for the student. It is possible to discard one block from the final examination (June call) if its partial evaluation and/or final evaluacion (january call) is above 6 out of 10. There is a minimum mark in each of the blocks of the extraordinary call (june) of 3/10.

In the event that the 3 compulsory laboratory sessions have not been carried out, the student who wants to pass the subject in the extraordinary call must pass a specific laboratory test that will be eliminatory. In the case of passing the test, the qualification will have a weight of 10%.

% end-of-term-examination:	55
% of continuous assessment (assigments, laboratory, practicals…):	45

BASIC BIBLIOGRAPHY

- A.J.Conejo, J.M. Arroyo, F.Milano, N.Aguacil, J.L.Polo, R.García Bertrand, J.Contreras, A.Clamagirand, L.López; ¿Instalaciones Eléctricas¿;, Mc. Graw-Hill..
- Antonio Colmenar y Juan Luis Hernández Instalaciones Eléctricas en Baja Tensión, Editorial Ra-Ma, 2007

- Fraile Mora J., "Máquinas eléctricas",, , Mc-Graw-Hill..

- Fraile Mora J., Fraile-Ardanuy J.; "Problemas de Máquinas eléctricas";, Mc-Graw-Hill..

- Guirado R., Asensi R., Jurado F., Carpio J.; ¿Tecnología Eléctrica¿;, Mc Graw Hill..

- José García Trasancos Instalaciones Eléctricas en Media y Baja Tensión, Paraninfo, 2016

- Sanz Feito J.; "Máquinas eléctricas";, Prentice Hall..

ADDITIONAL BIBLIOGRAPHY

- Chapman, Stephen C.; "Máquinas Eléctricas";, Mc.Graw Hill..

- Fraile Mora, J; ¿Electromagnetismo y circuitos eléctricos ¿;, Servicio de publicaciones E.T.S. de Ingenieros de Caminos de Madrid..

- Sanjurjo Navarro, R.; "Máquinas eléctricas",, Mc.Graw Hill..