

Course guide

240053 - 240053 - Electrotechnics

Last modified: 15/06/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Arnau Dòria Cerezo

Others: Mònica Aragüés, Josep Font, Vinícius Lacerda, Joaquín Pedra, Eduard Prieto, Luis Sainz

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge and use of electric machines and circuit theory principles.

TEACHING METHODOLOGY

The total teaching load of the subject is 60 hours: 46 hours are taught in slate classrooms and 14 hours are dedicated to lab practices. The weekly distribution is:

- Two weekly work sessions in a class (with a duration between one hour and a half and two hours, until the total load of 46 hours), which outlines the basic theory aspects with the support of teaching material and many practical examples.
- Six practical lab sessions of two hours each session (approximately, one session every two weeks), and a laboratory exam.

An additional dedication of one hour and a half for every hour of class is expected from the student, with a slight increase in the last themes.

LEARNING OBJECTIVES OF THE SUBJECT

The overall objective of the subject is providing students with the basic skills which are necessary for the electrical circuit analysis in sinusoidal steady-state.

The specific objectives are:

- knowledge of the models for the active and passive components of the electrical circuits,
- Kirchoff's laws,
- electrical circuits general solution,
- ability of analysis and solution of electrical circuits in direct current and sinusoidal steady-state, the latter using the phasor domain technique,
- learn the notion of instantaneous, active, reactive and apparent power associated with electrical circuits in sinusoidal steady-state,
- use the Node Analysis (NA) for electrical circuit analysis,
- (grounded and isolated) wye and delta connections,
- power measurement in three phase systems,
- choose the capacitor to improve the installation power factor,
- analyze the distribution system configurations more common (radial and meshed), and
- model transformers as components of the distribution networks, with preferable use of pu values.



STUDY LOAD

Type	Hours	Percentage
Hours large group	50,0	33.33
Hours small group	10,0	6.67
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

Analysis of electrical circuits

Description:

- 1.1. Kirchhoff's laws
- 1.2. Active and passive elements
- 1.3. Analysis of electrical circuits
- 1.4. Equivalent circuits: definition, Thévenin and Norton Theorems

Full-or-part-time: 8h

Theory classes: 8h

Alternating current circuits

Description:

- 2.1. AC current justification
- 2.2. Periodic signals
- 2.3. Circuits in permanent sinusoidal regime
- 2.4. Magnetic coupling

Full-or-part-time: 8h

Theory classes: 8h

Electric power in alternating current circuits

Description:

- 3.1. Instant power
- 3.2. Powers in alternating current circuits
- 3.3. Power factor improvement

Full-or-part-time: 8h

Theory classes: 8h

Three-phase systems

Description:

- 4.1. Justification of three-phase systems
- 4.2. Definitions of symmetrical and balanced voltage / current systems
- 4.3. Three-phase loads
- 4.4. Electrical power in three-phase systems: powers per phase, total powers

Full-or-part-time: 8h

Theory classes: 8h



Electrical transformers

Description:

- 5.1. Ideal single phase transformer
- 5.2. Non-ideal single-phase transformer: equivalent circuits
- 5.3. Reduced models: pu model, reduction to primary / secondary
- 5.4. Three-phase transformer
- 5.5. Plate features of a transformer
- 5.6. Cascading and parallel transformers

Full-or-part-time: 8h

Theory classes: 8h

Analysis of distribution lines

Description:

- 6.1. Neutral phase equivalent
- 6.2. Calculation of voltage drops, losses / performance and conductor cross section
- 6.3. Study of networks with P-Q loads

Full-or-part-time: 6h

Theory classes: 6h

GRADING SYSTEM

In the case of ordinary assessment, the grade of the subject will be

$$N_FINAL = 0,1 * N_Lab + 0,1 * N_ExLab + 0,8 * N_E$$

$$N_E = \text{MAX} (0.35 * N_P + 0.65 * N_F, N_F)$$

where N_Lab is the lab grade, N_ExLab is the grade of the laboratory exam, N_E is the exam grade, N_P is the midterm grade, and N_F is the final exam grade.

There will be an act of re-evaluation of the subject to which all students who, having enrolled in one or both semesters, have suspended the subject will be able to present themselves. In this case, the grade for the subject will be

$$N_FINAL = 0.15 * N_L + \text{MAX}(N_R, N_E)$$

where N_R is the grade for the reassessment exam.

It is not necessary to take the partial and final exams to be entitled to the reassessment exam, it is only necessary to have a grade of laboratory practice (N_L).

BIBLIOGRAPHY

Basic:

- J. Pedra. Circuitos monofásicos y trifásicos [on line]. 2a. edición. Barcelona: Edicions UPC, 1999 [Consultation: 08/09/2020]. Available on: <http://hdl.handle.net/2099.3/36269>. ISBN 8483013134.
- Córcoles, Felipe ; Pedra, Joaquim ; Salichs, Miquel. Transformadores. Barcelona: Edicions UPC, 2004. ISBN 8483017792.