

Course guide

240EI014 - 240EI014 - Electrical Technology

Last modified: 16/05/2023

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

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: ROBERTO VILLAFÁFILA ROBLES

Others:

PRIOR SKILLS

Electrotechnics

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CEMEI08. Ability to design and project automatic production systems and advanced control processes.

CEMEI01. Knowledge and ability to analyse and design the generation, transport and distribution systems in electric energy.

Generical:

CGMEI02. (ENG) Projectar, calcular i dissenyar productes, processos, instal·lacions i plantes.

Transversal:

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

TEACHING METHODOLOGY

Lectures that combine theoretical explanations and exercises. Exercises will be developed in a participatory way. There are also practicing activities in the laboratory.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, the student should be able to:

- * Understand operation of power systems
- * Apply criteria in the selection and sizing of the components of an electrical installation.
- * Learn the basics of automation of industrial processes and know-how simple grafset programs for programmable logic controllers.

STUDY LOAD

Type	Hours	Percentage
Self study	48,0	64.00
Hours large group	17,0	22.67
Hours small group	10,0	13.33

Total learning time: 75 h

CONTENTS

Power system

Description:

- Elements and agents in power system:

Conventional structure

Evolution: smart grids, microgrids, HVDC

- Electrical market and contracting

Specific objectives:

Know technological, technic and economical framework of power systems.

Related activities:

Problem solving

Related competencies :

CEMEI01. Knowledge and ability to analyse and design the generation, transport and distribution systems in electric energy.

Full-or-part-time: 7h

Practical classes: 2h 30m

Self study : 4h 30m

Electrical installations

Description:

- Electrical safety
 - Electric shock
 - Direct and indirect contact
- Neutral connection systems
 - Grounding of reference and protection
- Conductors and electrical cables:
 - General: parts and materials
 - Selection criteria: maximum current, maximum voltage drop, maximum short-circuit current
- Defects and protection of installations:
 - Concepts of: overload, short-circuit, ground fault, overvoltage
 - Calculation of the short-circuit current
 - Overcurrent protections: fuses, thermal relays and circuit breakers
 - Earth leakage protection: differential switches and relays
- Power quality:
 - Causes, effects and solutions

Specific objectives:

Understand the main issues of safety in electrical installations

Learn to determine the required conductors in electrical facilities for different application

Learn to select determining the protection devices against overcurrent and earth leakage

Understand power quality issues and their mitigation

Related activities:

Problems

Related competencies :

CEMEI01. Knowledge and ability to analyse and design the generation, transport and distribution systems in electric energy.

Full-or-part-time: 31h 25m

Practical classes: 10h 30m

Self study : 20h 55m

Static power converters and storage

Description:

- Types of static power converters and uses
- Types of storage systems

Specific objectives:

Know how to identify the different types of static power converters and storage system, and their main characteristics.

Related activities:

Problems

Full-or-part-time: 5h 35m

Practical classes: 2h

Self study : 3h 35m

Industrial automation

Description:

Industry 4.0

Elements of a system to automate
electromechanical automation

PLCs

Programming Languages

Grafcet

Elements of supervision

Specific objectives:

Understanding evolution of productive processes until Industry 4.0

Meet the automation, architecture and applications.

Learn to do basic programming in PLC grafcet

Learn the basic operation of the monitor elements

Related activities:

practices

Related competencies :

CEMEI08. Ability to design and project automatic production systems and advanced control processes.

Full-or-part-time: 31h

Practical classes: 5h

Laboratory classes: 10h

Guided activities: 4h

Self study : 12h

ACTIVITIES

Laboratory practices

Description:

Designing the five simple program to automate processes and program in the PLC

Specific objectives:

Understand the operation of PLCs

Understanding the language and expertise grafcet simple programs with it

Material:

Scripts of practices and laboratory equipment

Delivery:

evidence:

The preliminary design of the programs

Full-or-part-time: 10h

Laboratory classes: 10h

PARTIAL EXAMINATION

Description:

Examination of the first part of the course consisting on solving numerical and writing short questions.

Specific objectives:

See if the knowledge is well acquired.

Material:

Statement, one sheet form and calculator

Delivery:

examination

Full-or-part-time: 1h 15m

Theory classes: 1h 15m

FINAL EXAMINATION

Description:

Review the content of the subject. It consist of two parts: the first one, questions on explanatory section and practices; and the second, problems.

Specific objectives:

See if knowledge are well acquired

Material:

First part: Statement

Second part: Statement, one sheet form and calculator

Delivery:

Exam

Full-or-part-time: 3h

Theory classes: 3h

GRADING SYSTEM

The final mark will be the highest from the following expressions:

$$\text{Grade f1} = 0,5 \times \text{EF} + 0,25 \times \text{Pr} + 0,25 \times \text{EP}$$

$$\text{Grade f2} = 0,7 \times \text{EF} + 0,3 \times \text{Pr}$$

where,

EF: final exam

Pr: practices

EP: mid-term exam

Students that do not attend the practices will be evaluated with NP.

The mark of the practices will be the average of the marks from each of the scheduled practices. The practices which have not been carried out will be punctuated with a zero. No attending 50% or more of the practical sessions will result in a NP grade.

For those who need to attend the reassessment exam, the same expressions apply for the calculation of the final grade but the final exam grade is replaced by the one obtained at the reevaluation exam.

During the fall semester of the 2020-2021 academic year, and as a result of the health crisis due to Covid19, the qualification method will be:

- The number of evaluation tests and their weights are kept in the calculation of the final grade.
- Both partial and final exams will be carried out remotely through the Athena platform in accordance with the calendar of exams defined by the School. The exams will combine theory and problems in test mode, preferably.
- The practices will be evaluated based on the presentation and deliveries of the activities proposed.
- The teaching methodology is adapted to the situation mentioned as follows:
 - Lectures will be held on-line synchronously at defined times.
 - Practices will be held on-line synchronously at defined times.

EXAMINATION RULES.

The exam or midterm and final exams will be conducted on the dates and times designated by the School.

The final exam (like the reassessment exam) consists of multiple choice and/or open theoretical questions and/or exercises on the whole topics covered during the course. Calculator and one paper with formulas can be used.

RESOURCES

Other resources:

NOTES AND VIDEOS OF THE SUBJECT TO BE ACCESSIBLE FROM DIGITAL CAMPUS