Last update: 23-04-2019

320026 - IEBT - Low Tension Industrial Installations

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 709 - EE - Department of Electrical Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6 Teaching languages: Catalan

Teaching staff

Coordinator: Jaume Saura Perisé

Opening hours

Timetable: Wednesday from 10am to 12pm
Friday from 12:00 a.m. to 2:00 p.m. with appointment

Prior skills

Students who take this subject are expected to have a basic understanding of the following topics: short-circuit current calculation in electrical networks, neutral conductors in electrical installations, electric arc control and interruption devices, calculation of electrical power line parameters, behaviour and parameters of electric machines.

Degree competences to which the subject contributes

Specific:
1. ELE: Applied knowledge of power electronics.

Teaching methodology

The activities of the subject will be included in:
· Theoretical sessions (T) Classroom activities dedicated to exposing and discussing theoretical contents. They can be developed by the teacher, the students or in a mixed way.
· Problem sessions (P) Activities dedicated to solving problems. This activity will be essentially carried out by students individually or in groups.
· Laboratory sessions (L) Activities dedicated to the development of experiences or the development of projects. This activity will be developed by students, usually in groups.

· Individual work (YOU) Individual activity, is carried out outside the classroom. It is dedicated to the student's autonomous learning (study of notes, recommended readings, books, articles, etc.) or to carry out tasks that the student must develop individually, from which he must present result (presentation of works, exercises, comments, etc.)
· Cooperative work (TC) Group activity evaluated to develop outside the classroom. It refers to the activities that require the collaboration of several students (discussion of materials, solving exercises, development of dynamics, preparation of works, etc.).

Learning objectives of the subject

In this subject, students will acquire fundamental knowledge of the design of low-voltage installations and learn about the basic instruments used for this purpose. Specifically, students will acquire a good command of the criteria for selecting electrical conductors in radial or ring circuits. They will learn to take into consideration the restrictions imposed by voltage drops, environmental installation conditions, thermal stress under fault conditions, and the various service regimes

320026 - IEBT - Low Tension Industrial Installations

corresponding to different consumption levels, as well as economic criteria, with a view to optimising the investment in economic terms. They will also learn to select control and protection devices on the basis of service requirements and to assess the risks associated with the selection of ground connection schemes in low-voltage installations.

Study load

Total learning time: 150h	Hours large group:	15h	10.00%
	Hours medium group:	30h	20.00%
	Hours small group:	15h	10.00%
	Guided activities:	6h	4.00%
	Self study:	84h	56.00%

Last update: 23-04-2019

320026 - IEBT - Low Tension Industrial Installations

Content

TOPIC 1: IN-SERVICE POWER CABLES

Learning time: 20h

Theory classes: 7h
Practical classes: 4h
Laboratory classes: 4h
Self study : 5h

Description:
- Introduction to cables and distribution systems.
- Voltage drops and sections.
- Short-circuit stresses.
- Cables in intermittent service.
- Thermal circuit.
- Cable thermal resistance.
- Ground thermal resistance.
- Correction coefficients in overhead conductors.
- Correction coefficients in underground conductors.
- Ventilation of electrical conduits.
- Most economical section.

Laboratory sessions
- Design of an installation.
- Selection of sections.
- Calculation of voltage drops.
- Calculation of short-circuit currents.

Specific objectives:
- The ability to interpret and use the information provided in manufacturers' catalogues.
- The ability to calculate maximum expected voltage drops in radial and ring systems, and to select conductor sections accordingly.
- The ability to verify that lines are able to withstand the thermal stress generated by their location within a distribution system.
- The ability to redefine a line's load capacity on the basis of the service type of the loads it carries.
- The ability to calculate the correction coefficient of an overhead or underground conductor's load capacity for a given set of installation conditions.
- The ability to carry out a thermal analysis for underground cables or electrical conduits.
- The ability to carry out economic feasibility studies and select the most cost-effective sections.
- The ability to assess the energy consumption and emissions associated with energy distribution.

320026 - IEBT - Low Tension Industrial Installations

TOPIC 2: OVERLOAD AND SHORT-CIRCUIT PROTECTION IN LOW-VOLTAGE INSTALLATIONS	Learning time: 24h 30m Theory classes: 9h Practical classes: 5h Laboratory classes: 6h Self study : 4h 30m

Description:
- Low-voltage electricity distribution networks. Structure and functions.
- Characteristics of interruption and protection devices.
- Fuses.
- Current limiting.
- Back-up.
- Amperometric, time-graded and logical selectivity.
- Safety distances.

Laboratory sessions
- Selection of control devices.
- Selection of protection devices.
- Critical paths.
- Device adjustment.
- Trip curves and selectivity.

Specific objectives:
- The ability to select control devices on the basis of the installation conditions and the required service level.
- The ability to select protection devices on the basis of the required performance level.
- The ability to coordinate the action of back-up protection devices.
- The ability to coordinate the action of selective protection devices.
- The ability to evaluate the general operation of an installation and identify critical points.

Last update: 23-04-2019

320026 - IEBT - Low Tension Industrial Installations

TOPIC 3: PROTECTION AGAINST INSULATION DEFECTS IN LOW-VOLTAGE INSTALLATIONS	Learning time: 15h 30m Theory classes: 5h Practical classes: 4h Laboratory classes: 2h Self study : 4h 30m

Description:
- Risks of insulation defects
- Grounding systems and personal protection.
- Connection to neutral: TN system.
- Grounded neutral: TT system.
- Insulated neutral: IT system
- Influence of medium voltage on low voltage.
- Selection of a grounding system.
- Functions of differential protection.
- Uses and applications of differentials.
- Coordination of differential devices.

Laboratory sessions
- Placement of differential devices.
- Coordination of devices.
- Action of devices.

Specific objectives:
- The ability to understand an installation's behaviour in the event of insulation failure on the basis of different grounding systems.
- The ability to evaluate the risks associated with the selection of different grounding systems in low-voltage installations.
* Familiarity with the protection requirements associated with each grounding system.
- Familiarity with different protection devices, their operation and their limitations.
- The ability to establish the appropriate safety measures in any situation.
- The ability to select protection devices on the basis of the installation conditions and the required service level.

Qualification system

The evaluation of the subject will be done with two written tests one in each partial, laboratory reports, and exercises delivered to ATENEA

The weights in the evaluation are the following:

First partial assessment 40%
Assessment 2nd partial 40%
Practical reports 10%
Exercises delivered Atenea 10%

With the second partial you can retrieve or better note of the first partial as a reversal for all students without qualification limit.

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320026 - IEBT - Low Tension Industrial Installations

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Complementary:

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