Course guides
320025 - EQSE - Efficiency and Quality in Electrical Systems

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.
Degree: BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
Academic year: 2020 ECTS Credits: 6.0 Languages: Catalan, Spanish

LECTURER
Coordinating lecturer: Emiliano Aldabas
Others: Juan Ramón Hermoso

DEGREE COMPETENCES TO WHICH THE SUBJECT CONtributes

Transversal:
1. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
2. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

TEACHING METHODOLOGY
All available documentation to begin the course in Digital Campus: Timed detailed programming and activities to develop, readings and class presentations, articles and technical documentation, web’s interest to conduct practices, etc.

LEARNING OBJECTIVES OF THE SUBJECT
Recognize and quantify the importance of rational and efficient use of energy, focusing on electric power applications, both from the standpoint of economic and legal environment.
Assess and quantify the quality of electric power, as long as it is a ‘product’ we buy and use.
Providing knowledge and information that will enable studies on quantitative and qualitative aspects above.
Know the organizations, businesses, institutions, etc., Which are related to the topic.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
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Total learning time: 150 h
**TOPIC 1: EFFICIENT USE OF ELECTRICAL ENERGY**

**Description:**
1.1. Introduction
1.2. Inefficiencies in electrical systems.
1.2.1. Power in electrical systems.
1.2.2. Performance, power factor and efficiency factor.
1.2.3. Load inefficiencies.
1.2.4. Installation inefficiencies.
1.2.5. Supply inefficiencies.
1.3. Legal references and regulations.
1.4. Improving the efficiency of electrical systems.
1.5. Applying reactive power compensation in non-distorted networks.
1.6. Electricity rates and demand management.

**Laboratory sessions**
Practical P1. Efficiency analysis of loads and installations.
Practical P2. Efficiency analysis of generation and transport systems.

**Full-or-part-time:** 24h
Theory classes: 12h
Practical classes: 8h
Laboratory classes: 4h

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**TOPIC 2: ELECTROMAGNETIC COMPATIBILITY, QUALITY AND EFFICIENCY**

**Description:**
2.1. Introduction to the problem of interference. Definitions. Symbols used. Relationship between levels of emission and immunity. EMI generation of propagation.
2.2. Disturbances.
2.2.2. Disturbance sources.
2.2.3. Coupling.
2.3. Shielding
2.4. Earth and ground.
2.5. Cables
2.6. Solutions to electromagnetic compatibility problems.
2.7. Electromagnetic compatibility regulations.

**Laboratory sessions**
Practical P3. Design of an installation according to electromagnetic compatibility criteria.

**Full-or-part-time:** 16h
Theory classes: 10h
Practical classes: 4h
Laboratory classes: 2h
TOPIC 3: QUALITY OF ELECTRICAL ENERGY

Description:
3.1. Introduction
3.2. Disturbances in electrical networks: types, definitions and effects.
3.2.1. Frequency variations.
3.2.2. Voltage fluctuations.
3.2.3. Imbalances in three-phase systems.
3.2.4. Harmonics.
3.2.5. Oscillatory transients.
3.2.6. Impulsive transients caused by lightning.
3.2.7. Flicker.
3.3. Legal references and regulations.
3.4. Quality of service
3.4.1. Continuity of supply. Indicators (ASIDI, ASIFI).
3.4.2. Product quality.
3.4.3. Customer information.
3.5. Measuring and recording electrical quantities.
3.6. Disturbance compensation and filtering.
3.7. Electrical installations and ground connection.
3.8. Emergency systems.

Laboratory sessions
Practical P6. Implementation of corrective systems.

Full-or-part-time: 26h
Theory classes: 14h
Practical classes: 6h
Laboratory classes: 6h

GRADING SYSTEM

There will be a continuous assessment model for the basic purpose of weighing both self-employment as teamwork of students.

First test: 35%
Second test: 35%
Other reports and papers presented: 10%
Laboratory: 10%
Effective oral and written communication: 10%

Unsatisfactory results from the examination of the first test may be redirected by a written test to be carried out on the day set for the examination of the second test. Students with a score lower than 5.0 will be able to access this test. The qualification mark will be between 0 and 5 points. The score obtained by the renewal will replace the initial result as long as it is higher than the one before.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

EXAMINATION RULES.

The evaluations consist of the evaluation followed by acts of face and / or other measurable activities that are part of continuous assessment. Failure to perform any acts or activities, shall be deemed qualified to zero.
BIBLIOGRAPHY

Basic:

Complementary: