Course guide
340101 - LIEL-E5009 - Electrical Power Lines

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR’S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2023 ECTS Credits: 6.0 Languages: Catalan, English

LECTURER
Coordinating lecturer: Josep Font i Mateu
Others: Josep Font i Mateu

PRIOR SKILLS

REQUIREMENTS
Subjects: Fonaments matemàtics, Informàtica, Física 1, Física 2, Anàlisi de circuits.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
1. CE24. Knowledge of electrical power systems and its applications.
2. CE23. Ability to calculate and design power lines and electrical energy transport.

Transversal:
3. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 3. Taking social, economic and environmental factors into account in the application of solutions. Undertaking projects that tie in with human development and sustainability.
4. 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
Theorical class, problem class, practic work, presentations. Problem resolution in group. Especific software applied. Own work.

LEARNING OBJECTIVES OF THE SUBJECT
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>30.00</td>
</tr>
<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>
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</tbody>
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Total learning time: 150 h

CONTENTS

**Unit 1 - Electrical Power Systems, Introduction to the transport and distribution of electrical energy.**

**Description:**
2. Historical evolution of the SEP.
3. Generation systems: Classic. Renewables
4. Evolution of the transmission of electrical energy.
5. DC and AC transmission.
6. Classification of electric lines. Lines with overhead cables and insulated cables.
7. Applications: Aerial, underground and submarine

**Specific objectives:**
- Know the different types of S.E.P., its fundamental parts, its functions and applications. Learn about the historical evolution of S.E.P. Learn how electrical energy is generated, classic non-renewable and renewable systems. Know the definitions and fundamental parameters of electric energy transport.

**Related competencies:**
- CE24. Knowledge of electrical power systems and its applications.
- 02 SCS N3. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 3. Taking social, economic and environmental factors into account in the application of solutions. Undertaking projects that tie in with human development and sustainability.
- 04 COE N3. 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.

**Full-or-part-time:** 6h
- Theory classes: 2h
- Guided activities: 2h
- Self study: 2h
Unit 2 - Modeling of Electric Energy Transport and Distribution Systems.

Description:
Analysis of lines in permanent mode.

1. Per unit method applied to Electrical systems.
2. Models of homogeneous lines with concentrated parameters.
3. Models of homogeneous lines with uniformly distributed parameters.
5. Classification of lines according to their length.
6. Equivalent 4-pole circuits, pi & T models.

Related competencies:
- CE23. Ability to calculate and design power lines and electrical energy transport.

Full-or-part-time: 12h
Theory classes: 6h
Practical classes: 2h
Self study: 4h

Unit 3 - Calculation of the parameters of lines with aerial cables.

Description:
Calculation of airline parameters.
1. Parameters of an airline, definitions.
2. Resistance. Skin and proximity effects.
3. Magnetic field of an electric line
5. DMG, RMG, transpositions.
6. Electric field of a power line.
7. Capacity, with and without the influence of the ground.
8. Conductances, insulation and corona effect.

Full-or-part-time: 12h
Theory classes: 6h
Practical classes: 2h
Self study: 4h

Unit 4 - Calculation of the parameters of lines with insulated cables.

Description:
Topic 4: Calculation of the parameters of lines with underground cables.
1. Insulated cables, definition, types.
2. Isolations. Type and conditions of service.
3. Electrical parameters, in unipolar cables.
4. Electrical parameters in multipolar cables.
7. Comparison between air transport and underground transport.

Full-or-part-time: 12h
Theory classes: 6h
Laboratory classes: 2h
Self study: 4h
Topic 5 - Analysis of the Electrical Systems of Transport and Distribution in a permanent regime.

Description:
Analysis of distribution networks in permanent mode.

1. Distribution networks
2. Radial networks
3. Ring networks
4. Transformers and generators in distribution networks
5. Calculation programs

Related competencies:
- CE23. Ability to calculate and design power lines and electrical energy transport.

Full-or-part-time: 10h
Theory classes: 4h
Practical classes: 2h
Self study: 4h

Unit 6 - Introduction to the project of transport and distribution lines.

Description:
Introduction to the regulations for lines and networks, transport and distribution projects.

1. Low Voltage Electrotechnical Regulations.
   1.1 Safety conditions in low voltage lines
2. Regulation of High Voltage Lines.
   2.1 Safety conditions in high voltage lines
3. Choice of tension.
4. Calculation of the section of the conductors.
5. Mechanical calculation of airline lines. Calculation of chains of insulators.
9. Topography of the line

Full-or-part-time: 29h
Theory classes: 6h
Laboratory classes: 2h
Guided activities: 15h
Self study: 6h

GRADING SYSTEM

Exams.: E1 (PARCIAL), E2 (FINAL)
Practice: PR
Works: TR
QUALIFICACIÓ = MAX{(0.3*E1+0.5*E2+0.15*PR+0.05*TR),(0.8*E2+0.15*PR+0.05*TR)}

EXAMINATION RULES.

Theory: individual writing exam.
Practic work: practic work + report + exam.
Activitat dirigida: presentation + exam.
BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Audiovisual material:
- Canó, projector + Pc aules
- Ordinador PC pràctiques

Computer material:
- Programa-Soft
- Programa
- MATLAB - SIMULINK