320133 - CDLEAT - Calculus and Design of High Voltage Power Lines

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 Optional)
ECTS credits: 6

Teaching staff
Coordinator: Ricard Horta Bernús
Others: Santiago Bogarra Rodriguez

Prior skills
Students may have passed the course Transport of Electric Power

Degree competences to which the subject contributes
Specific:
CE29. (ENG) ELE: Coneixements i capacitats per aprofundir en tecnologies específiques de l’àmbit.

Teaching methodology
- Sessions of theoretical content.
- Sessions of practical work.
- Independent work and study exercises and case studies.
- Preparation and evaluated in group activities.

The professor will introduce the theoretical foundations of the subject, concepts, and methods illustrating them with appropriate examples to facilitate their understanding.
There will be 4 types of working sessions:
a) session that the teacher guides students in data analysis and problem solving using techniques, concepts and theoretical results.
b) Sessions of presentations made by the student group
c) Examination Session

Students will have all documents at digital campus: theoretical presentations made by the professor, solved exercises...
Students must study independently to assimilate the concepts, solving exercises
Students prepare to work in groups of five publicly presented in sessions of application.

Learning objectives of the subject
It introduces the student to the principles of calculating mechanical and electrical parameters required to the design of aerial or subterranean electric lines.
To know the necessary tools to perform the correct sizing of conductors and its mechanical support.
Being able to do a project. Application of specific rules and regulations. Understand and be aware of the environmental and social impacts of these infrastructures. Using commercial catalogs.
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group:</td>
<td>30h</td>
<td></td>
<td>20.00%</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>90h</td>
<td></td>
<td>60.00%</td>
</tr>
</tbody>
</table>
## Content

### TOPIC 1: Electrical dimensions of a high voltage line

**Learning time:** 52h 30m  
Theory classes: 21h  
Self study: 31h 30m

**Description:**
- Introduction
- Calculation of physical and electrical constants
- Impact drivers crown
- Propagation equations
- Vector Graphics
- Method of electricity moment
- Insulation level
- Distances up and crossovers
- Ground
- Regulation of high voltage power lines: electric calculation

**Related activities:**
- Establish calculation of the conductors sections to carry out the criteria of optimized design.
- Be able to select conductors and their spatial distribution design.
- Be able to measure the ground
- Become familiar with applicable regulations

### TOPIC 2: Mechanical dimensions of an overhead power line

**Learning time:** 37h 30m  
Theory classes: 15h  
Self study: 22h 30m

**Description:**
- Regulation
- Project
- Conductors and ground wires
- Loads and overloads
- Distances between elements and surfaces
- Supports
- Foundations
- Insulators
- Conductor support hardware
- Calculations
- Regulation of high voltage power lines: mechanical calculation

**Related activities:**
- To know the mechanical calculation methods for conductors, isolators and supports in order to carry out the criteria of optimized design.
- Be able to select conductors, insulators and supports.
- Become familiar with applicable regulations
### TOPIC 3: Dimensions of a subterranean high voltage line

**Description:**
- Calculation of conductors
- Ditches and pipes
- Ground

**Related activities:**
- To know the mechanical calculation methods for conductors sections in order to carry out the criteria of optimized design.
- Be able to select conductors and their spatial distribution.
- Be able to measure the ground.

**Learning time:** 37h 30m  
- Theory classes: 15h  
- Self study: 22h 30m

### TOPIC 4: Structure of power high voltage line project

**Description:**
- Regulation of high voltage power lines  
- Report  
- Calculations  
- Specification  
- Budget  
- Plans  
- Health and safety study  
- Instructions for use and maintenance  
- User scrapping

**Related activities:**
- Become familiar with applicable regulations

**Learning time:** 3h  
- Theory classes: 2h  
- Self study: 1h
TOPIC 5: Climate Change on global governance

Learning time: 7h 30m
- Theory classes: 5h
- Self study: 2h 30m

Description:
- Impacts on flora (forests)
- Impacts on wildlife (birds)
- Impacts on people (C.E.Ms)
- Other impacts

Related activities:
- To know the different social and environmental impacts that may occur in the construction of this kind of infrastructure.
- Be aware of the environmental and social implications of a proposed power line
- Take personal opinion

Qualification system
- Exam 1: 20%
- Exam 2: 20%
- Exam 3: 20%
- Exam 4: 20%
- Delivery 1: 5%
- Delivery 2: 5%
- Delivery 3: 5%
- Delivery 4: 5%

Bibliography

Basic:


Complementary:
Ras Oliva, E. Teoría de líneas eléctricas: de potencia, de comunicación, para transmisión en continua. 2a ed. Barcelona: UPC: Marcombo, 1985-