Degree competences to which the subject contributes

Specific:
1. CE21. Ability to design and calculate electrical installations of low or middle tension.
2. CE22. Ability to design and calculate electrical installations of high tension.

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. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

Teaching methodology
- In the lectures will be presented and developed the theoretical foundations of programmed materials. Consist of theoretical explanations complemented by activities to encourage participation, discussion and critical analysis by students.
- In the kinds of problems were raised and solved exercises for the areas covered. Students have to solve, individually or in groups, indicating problems.
- Within hours of laboratory practice, students will take the required and delivered its report of the activity along with appropriate calculations and critical considerations.
- It will realised group work during the year related to a specific topic of the course.

Learning objectives of the subject
- Design of protections for teams and individuals in systems and wiring.
- Analysis of the different types of neutral connection in the systems and facilities power.
- Selecting the necessary switchgear and electrical systems
- Design of electrical installations.
- Calculation of earthing electrical installations.
- Sizing of processing centers.
- Using the rules and regulations in electricity projects.
- Selecting the most appropriate security system to protect people and equipment.
340107 - INEL-E6O09 - Low, Medium and High Voltage Electrical Installations

- Use tools to calculate and electrical systems.

<table>
<thead>
<tr>
<th>Study load</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 150h</td>
</tr>
<tr>
<td>Hours large group:</td>
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<tr>
<td>Hours medium group:</td>
</tr>
<tr>
<td>Hours small group:</td>
</tr>
<tr>
<td>Guided activities:</td>
</tr>
<tr>
<td>Self study:</td>
</tr>
</tbody>
</table>
340107 - INEL-E6O09 - Low, Medium and High Voltage Electrical Installations

Content

**TEMA 1: ELECTRICAL SWITCHGEAR**

**Description:**
- Switchgear: definition, function and classification.
- Characteristic values.
- Problems of electrical switchgear.
- Overview of switches.
- Breaking techniques.
- Breakers: definitions and specifications.
- Fuses: definitions and specifications.
- Contactors: definitions and specifications.
- LV switchgear for maneuver.

**Learning time:** 25h
- Theory classes: 7h 30m
- Laboratory classes: 2h 30m
- Self study: 15h

**TEMA 2: SYSTEM OF NEUTRAL AND PROTECTION OF THE PEOPLE**

**Description:**
- Importance of neutral treatment of electrical systems.
- Types neutral connections.
- Grounding transformers.
- LV distribution schemes.
- Introduction to the protection of individuals. The 5 golden rules.
- Classification of electrical accidents.
- Human body's sensitivity to the passage of electrical current. Physiological effects.
- Protection against direct and indirect contacts.
- The circuit breaker.
- The field and conductor.
- Measurement of ground resistivity and resistance of grounding.
- Ground at low voltage. Usual electrodes.

**Learning time:** 25h
- Theory classes: 7h 30m
- Laboratory classes: 2h 30m
- Self study: 15h
### (ENG) TEMA 3: INSTALLATION AND PROTECTION OF ELECTRICAL SYSTEMS

**Learning time:** 25h  
Theory classes: 7h 30m  
Laboratory classes: 2h 30m  
Self study: 15h

**Description:**  
General.  
Nature and cause of faults.  
Essential qualities required for the protection of electrical systems.  
Elements of a protection system.  
Introduction to transformers of measure.  
Relays: types.  
Selectivity.  
Protection of low voltage installations.  
Calculation of sections. Design criteria.  
Regulations.

### (ENG) TEMA 4: ISOLATION AND COORDINATION OF SURGE PROTECTION

**Learning time:** 25h  
Theory classes: 7h 30m  
Laboratory classes: 2h 30m  
Self study: 15h

**Description:**  
Introduction to the coordination of insulation: voltage-time curve.  
Surge Protection: Lightning.  
Ground wires.  
BT surge protection.
**(ENG) TEMA 5: CENTRES OF TRANSFORMATION**

<table>
<thead>
<tr>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definitions and classification.</td>
</tr>
<tr>
<td>Draft a transformer.</td>
</tr>
<tr>
<td>Power and distribution transformers. Selection criteria.</td>
</tr>
<tr>
<td>Transformer protection.</td>
</tr>
<tr>
<td>Schemes. Prefabricated cabins.</td>
</tr>
<tr>
<td>Overview of low voltage.</td>
</tr>
<tr>
<td>Short circuit currents, ventilation, protection against surges and fire.</td>
</tr>
<tr>
<td>Purpose of the ground.</td>
</tr>
<tr>
<td>Establishment of a ground facility.</td>
</tr>
<tr>
<td>Classification grounded.</td>
</tr>
<tr>
<td>Potential gradient. Step voltages and contact information.</td>
</tr>
<tr>
<td>Introduction to the proposed grounding installations.</td>
</tr>
</tbody>
</table>

**Learning time:** 25h
- Theory classes: 7h 30m
- Laboratory classes: 2h 30m
- Self study: 15h

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**(ENG) TEMA 6: POWER PLANT PROJECT**

<table>
<thead>
<tr>
<th>Description:</th>
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</thead>
<tbody>
<tr>
<td>General. Classification of electrical installations.</td>
</tr>
<tr>
<td>Standards and regulations.</td>
</tr>
<tr>
<td>Parts of a low voltage electrical installation</td>
</tr>
<tr>
<td>Type of low voltage supplies.</td>
</tr>
<tr>
<td>Load forecasting. Coefficients of simultaneity.</td>
</tr>
<tr>
<td>The power project. Methodology.</td>
</tr>
</tbody>
</table>

**Learning time:** 25h
- Theory classes: 7h 30m
- Laboratory classes: 2h 30m
- Self study: 15h

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**(ENG) PRACTICES**

**Degree competences to which the content contributes:**

1. Switchgear protection.
2. Design and facility security (Using spreadsheet software).
3. Design of substations (Using spreadsheet software).
4. Verification of the electrical (insulation resistance, earth ...)

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**Description:**
- General. Classification of electrical installations.
- Standards and regulations.
- Parts of a low voltage electrical installation.
- Type of low voltage supplies.
- Load forecasting. Coefficients of simultaneity.
- The power project. Methodology.
70 % theory
30 % practices.

REEVALUATION:
The reevaluation part of the subject corresponds to the exams (70%).
According to EPSEVG regulations:
- The reevaluation will be possible if the subject with a final grade equal to or greater than 3.0 has been suspended.
- The final grade of the subject after the reevaluation will have a maximum value of 5.0.

Regulations for carrying out activities

- The written tests are classroom and individual.
- In classes of problems and / or laboratory practices will be assessed, where appropriate, prievi work together with presentation of results of the activity.

Bibliography

Basic: