340106 - CEER-E6009 - Power Plants and Renewable Energies

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering
Teaching unit: 709 - EE - Department of Electrical Engineering
Academic year: 2018
Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan

Teaching staff
Coordinator: EUSEBIO MARTINEZ PIERA
Others: EUSEBIO MARTINEZ PIERA

Degree competences to which the subject contributes

Specific:
3. CE27. Ability to design power stations.

Transversal:
1. 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.
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.

Teaching methodology
- In the theory classes, will be exposed and develop the theoretical foundations of programmed materials. They consist of theoretical explanations complemented by activities to encourage participation, discussion and critical analysis by students.
- In the classes of problems will arise and solve exercises related to the matters. Students should meet individually or in groups, indicating problems.
Within hours, students will conduct laboratory practices as required and submit the relevant report of the activity along with appropriate calculations and critical considerations.
-Will work in groups during the course of a specific topic related to the subject.

Learning objectives of the subject
To know the different types of conventional power plants and with renewable energy, its main constituent elements and components, as well as energy storage systems more appropriate.
- Dimensioning generation systems from various sources of energy.
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 45h</th>
<th>30.00%</th>
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<tr>
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<td>Hours medium group: 0h</td>
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<td></td>
<td>Hours small group: 15h</td>
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<td>Guided activities: 0h</td>
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<td>Self study: 90h</td>
<td>60.00%</td>
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### 1.- Principles of electric power generation.

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<th>Learning time: 10h</th>
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<tr>
<td>Theory classes: 3h</td>
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<td>Laboratory classes: 2h</td>
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<td>Self study: 5h</td>
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**Description:**
- 1.1.- Energy and society. Energy resources. Primary energy.
- 1.2.- The historical development of power generation.
- 1.3.- General Classification of power plants.
- 1.4.- Environmental considerations of power generation (Electricity and Sustainable Development).

### 2.- Supply and demand of electric energy.

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<th>Learning time: 16h</th>
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<tr>
<td>Theory classes: 4h</td>
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<tr>
<td>Laboratory classes: 2h</td>
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<td>Self study: 10h</td>
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**Description:**
- 2.1.- The production of electricity.
- 2.2.- Legislative framework. The market operator and system operator.
- 2.3.- Control of the power system: frequency and voltage.
- 2.4.- Coverage of the load demand. Generation schedule.

### 3.- Hydraulic power plants.

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<th>Learning time: 33h</th>
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<tbody>
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<td>Theory classes: 10h</td>
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<td>Laboratory classes: 3h</td>
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<td>Self study: 20h</td>
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**Description:**
- 3.1.- Historical of hydroelectric power plants.
- 3.2.- Types of hydropower plants. Damms. General components.
- 3.3.- Hydraulic turbines, types and functions. Selection criteria. Cavitation. Automatic control..
- 3.4.- Central or reversible pump: Type and operation.
- 3.5.- Mini microhidràulica. Feasibility and legislation.
- 3.6.- Environmental aspects of hydroelectric generation.
### 4. Conventional thermal and combined cycle power plants.

**Description:**
- 4.2 - Main components of the powerplant: Preparation of fuel, boilers and emission controls.
- 4.3 - Steam turbines, condensers.
- 4.5 - Cogeneration.
- 4.6 - Combined Cycle Power Plants. Performance analysis.
- 4.7 - Environmental aspects.

**Learning time:** 33h
- Theory classes: 10h
- Laboratory classes: 3h
- Self study: 20h

### 5. Nuclear powerplants.

**Description:**
- 5.1 - Radioactivity. Biological effects. Protection.
- 5.2 - Nuclear reactions. Type reactors. Control and regulation.
- 5.3 - Radioactive Waste. Environmental aspects of nuclear power plants.

**Learning time:** 33h
- Theory classes: 10h
- Laboratory classes: 3h
- Self study: 20h

### 6. Renewable energy powerplants.

**Description:**
- 6.1 - Characteristics of renewable energy. Legislative framework.
- 6.3 - Photovoltaic. Type cells. Stand-alone and grid connected.
- 6.4 - Thermal power stations with biomass. Photosynthesis. Biogas and biofuels.
- 6.5 - Other possibilities of generating electricity with renewable energy: geothermal and marine.
- 6.6 - Environmental aspects.

**Learning time:** 25h
- Theory classes: 8h
- Laboratory classes: 2h
- Self study: 15h

### Qualification system

- Test done during the course (30%)
- Test done at the end (40%)
- Realization of problems, and work practices, group or individual (30%)
Regulations for carrying out activities

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

Bibliography

Basic:

Complementary: