240IEN11 - Renewable Energy

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics
Academic year: 2019
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Teaching unit Optional)
ECTS credits: 4,5

Teaching staff
Coordinator: Eduard Egusquiza
Others: Enrique Velo
Josep Bordonau
Oriol Gomis

Degree competences to which the subject contributes

Specific:
CEELEC3. Project conventional and non-conventional electrical facilities (renewable energies).
CEMEI01. Knowledge and ability to analyse and design the generation, transport and distribution systems in electric energy.
CEMEI05. Knowledge and ability for the design and analysis of thermal machines and engines, hydraulic machines and heating and cooling plants.

Teaching methodology

Lectures, exercises in class with professor assistance and conducting exercises outside the classroom individually.

Learning objectives of the subject

Provide the students with a theoretical/practical background on:
- Demand and generation of electricity
- Operation of power plants using Hydraulic, marine, wind, geothermal, solar and biomass renewable energy.
- Integration of renewable energy into the electrical grid

Acquisition by the student of the basic phenomena that occur during plant operation

Provide tools for basic calculations
## Study load

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<tr>
<td><strong>Total learning time</strong></td>
<td>112h 30m</td>
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<tr>
<td>Hours large group:</td>
<td>27h</td>
<td>24.00%</td>
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<tr>
<td>Hours small group:</td>
<td>13h 30m</td>
<td>12.00%</td>
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<td>Guided activities:</td>
<td>0h</td>
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<td>Self study:</td>
<td>72h</td>
<td>64.00%</td>
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## Content

| **Introduction** | **Learning time:** 1h 30m  
Theory classes: 1h 30m |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Demand and generation of electricity. Variation in demand. Types of power plants. Renewable energies, types, advantages.</td>
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| **Hydropower** | **Learning time:** 12h  
Theory classes: 12h |
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<tr>
<td><strong>Description:</strong></td>
<td>Review of basic concepts of fluid dynamics. Types of hydraulic systems. Hydroelectric units description and components. Types of hydraulic turbines: action and reaction. Principles of operation, fluid dynamics, regulation. Phenomena associated with the operation: cavitation, water hammer, runaway speed.</td>
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| **Marine energy** | **Learning time:** 3h  
Theory classes: 3h |
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<tr>
<td><strong>Description:</strong></td>
<td>Ocean energy: tides, waves, currents. Ways to extract energy. Tidal power plants, wave converters, hidromills. Description and operation of the main types. Present Status.</td>
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| **Wind power** | **Learning time:** 7h 30m  
Theory classes: 7h 30m |
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<tr>
<td><strong>Description:</strong></td>
<td>Wind energy. Introduction to wind turbines, types, wind farms, components. Airfoils aerodynamics, boundary layer detachment, operating limits. Generators, types of regulation</td>
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| **title english** | **Learning time:** 3h  
Theory classes: 3h |
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<tr>
<td><strong>Description:</strong></td>
<td>Temperature distribution in the Earth, generating plants. Types, operation</td>
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Continuous evaluation: Two midterm exams with theory and exercises (40%) will be carried out during the course (40%).
The final examination will consist of a theoretical part (50%) and problems (50%).
Final marks: 0.6 final exam marks + 0.4 continuous evaluation marks
Re-evaluation exam: For attending the re-evaluation exam the students must have attended the final exam or the two midterm exams.

Bibliography