## Course guide

**240IEN11 - 240IEN11 - Renewable Energy**

<table>
<thead>
<tr>
<th>Unit in charge:</th>
<th>Barcelona School of Industrial Engineering</th>
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<tbody>
<tr>
<td>Teaching unit:</td>
<td>729 - MF - Department of Fluid Mechanics.</td>
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<tr>
<td>Degree:</td>
<td>MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).</td>
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<tr>
<td>Academic year:</td>
<td>2023</td>
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<tr>
<td>ECTS Credits:</td>
<td>4.5</td>
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<td>Languages:</td>
<td>English</td>
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### LECTURER

- **Coordinating lecturer:** Eduard Egusquiza
- **Others:** Enrique Velo, Josep Bordonau, Oriol Gomis

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
- CEEELEC3. 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**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Self study</td>
<td>72.0</td>
<td>64.00</td>
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<tr>
<td>Hours large group</td>
<td>27.0</td>
<td>24.00</td>
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<tr>
<td>Hours small group</td>
<td>13.5</td>
<td>12.00</td>
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**Total learning time:** 112.5 h

**CONTENTS**

**Introduction**

**Description:**
Demand and generation of electricity. Variation in demand. Types of power plants. Renewable energies, types, advantages.

**Full-or-part-time:** 1h 30m
Theory classes: 1h 30m

**Hydropower**

**Description:**

**Full-or-part-time:** 12h
Theory classes: 12h

**Marine energy**

**Description:**
Ocean energy: tides, waves, currents. Ways to extract energy. Tidal power plants, wave converters, hidromills. Description and operation of the main types. Present Status.

**Full-or-part-time:** 3h
Theory classes: 3h

**Wind power**

**Description:**
Wind energy. Introduction to wind turbines, types, wind farms, components. Airfoils aerodynamics, boundary layer detachment, operating limits. Generators, types of regulation

**Full-or-part-time:** 7h 30m
Theory classes: 7h 30m
### Temperature distribution in the Earth, generating plants. Types, operation

**Full-or-part-time:** 3h  
Theory classes: 3h

### Solar energy

**Description:**  
Solar radiation, solar thermal energy, concentration systems. Description and operation. Photovoltaic power plants

**Full-or-part-time:** 7h 30m  
Theory classes: 7h 30m

### Biomass energy

**Description:**  
Sources of biomass, plant types, description and operation

**Full-or-part-time:** 3h  
Theory classes: 3h

### Integration of new renewables into the electrical grid

**Description:**  

**Full-or-part-time:** 3h  
Theory classes: 3h

### GRADING SYSTEM

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.