



## Course guide

### 240IEN11 - 240IEN11 - Renewable Energy

**Last modified:** 16/05/2023

**Unit in charge:** Barcelona School of Industrial Engineering  
**Teaching unit:** 729 - MF - Department of Fluid Mechanics.

**Degree:** MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 4.5    **Languages:** English

#### LECTURER

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**Coordinating lecturer:** Eduard Egusquiza

**Others:** Enrique Velo  
Josep Bordonau  
Oriol Gomis

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**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

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

#### LEARNING OBJECTIVES OF THE SUBJECT

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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

Type	Hours	Percentage
Self study	72,0	64.00
Hours large group	27,0	24.00
Hours small group	13,5	12.00

**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:**

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.

**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, hydromills. 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

#### title english

**Description:**

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 newrenewables into the electrical grid

**Description:**

Stability of the grid. Integration of intermittent renewable energy into the electrical grid. Transients and grid response.

**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.