Wind and Photovoltaic Generation

Academic Year: (2019 / 2020) **Review date: 17-12-2019**

Department assigned to the subject: Department of Electrical Engineering

Coordinating teacher: CHINCHILLA SANCHEZ, MONICA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

STUDENTS ARE EXPECTED TO HAVE COMPLETED

Electrical Power Egineering Fundamentals

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

Upon successful completion of this subject, students will be able to:
1. Have cutting-edge knowledge of current wind and photovoltaic generation systems
Information on the latest materials in the formation of the components of a wind turbine or of a photovoltaic system, such as the latest generation solar cells, control systems of ared connection converters and use of the latest software for the location of the resource and the analysis of renewable energy systems and their integration into a network.
2. The ability to apply their knowledge and understanding to identify, formulate and solve problems of analysis of wind and photovoltaic generation systems using established methods. To do this, problems of sizing of grid-connected photovoltaic systems, isolated and hybrid systems with different requirements and in different locations.
3. Technical and laboratory skills. Three practices will be carried out, two of them to know and manage the specialized sw and a practice in the laboratory to measure the current voltage behavior in various irradiance conditions on photovoltaic cells.
4. The ability to combine theory and practice to solve problems of dimensioning and analysis of wind and photovoltaic generation systems.
5. Understanding of methods and techniques applicable to the sizing and analysis of wind and photovoltaic generation systems and their limitations based on data and restrictions

DESCRIPTION OF CONTENTS: PROGRAMME

MODULE 1. SUSTAINABILITY
1.1-Introduction. Sustainability.
1.2-RREE. Summary by technologies.
1.3- Energy efficiency
1.4-Energy from the sea.

MODULE 2. WIND POWER
WIND 1. Wind Energy. Current status and resources.
1.1- Current status of wind power around the world
1.2- Wind resource. Factors affecting wind production.
1.3-Models of assessing wind potential in a wind site.Atlas IDAE.

WIND 2. Energy Production
2.1- Power curve. Defining FC, HE.
2.2- Basic exercise for energy calculation (programs and web Alwin IDAE)
2.3- Energy calculation; project focused to a wind generator and site (selected by the student)
2.4- Project for a wind park electric energy production.

WIND 3 Wind Technology
3.1- Wind turbine. Types. Components: turbine, tower, hub, generator, gearbox, converter, protections.
3.2- Wind turbine. Sizing wind generators.
3.3- Wind generators.Miniwind.Wind energy from the sea.
3.4- Wind generators. Speed variation associated with the variation of the blade pitch of the turbine.
3.5- Energy calculation as a function of wind speed, blade pitch,¿

4. WIND Wind energy systems connected to the grid .
4.1 Evolution of the control systems: fixed speed and speed. Tracking the maximum power point with maximum efficiency at part load. Speed control systems and power at part load and full load.

4.2- Wind farms.Sizing. Network Attached Project wind farm. Using specific software (RETScreen).
4-3. Network integration
4.4- Voltage Dips. Stability. Regulations.
4.5-Exercise voltage network nodes

5. WIND. Autonomous wind systems.
5.1-Types and functions.
5.2-Windpumps.
5.3- Selection.

WIND 6. Regulation
6.1-Regulation in the field of renewable energies.
6.2-Spanish case.

MODULE 3: PHOTOVOLTAIC
PV 1-Introduction to solar energy
1.1- Solar energy all over the world
1.2-Resource

PV 2. Basic Technology.
2.1- Solar cell. Basic principles and current technology.
2.2- Characteristic of the solar cell. Exercises solar cell, cell temperature.

PV 3. Solar panels
3.1- Solar panels.
3.2-Generators electrical characteristic of photovoltaic solar panels. Varying voltage of the photovoltaic panels. Testing.Characteristic curve with variation of irradiance and cell temperature.
3.3 Architectural integration.
3.4 Solar tracking

PV 4-Inverters.
4.1-Types and functions. Performance.
4.2-Regulation
4.3- Tracking the maximum power point of photovoltaic generrador (MPPT)

PV 5- Autonomous photovoltaic systems.
5.1 -Components. Batteries. Charge regulators. Inverters.
5.2- Autonomous photovoltaic systems: and dimensioning schemes.
5.3-Sizing exercises depending on the location and energy requirements.
5.4- Project; complete sizing

PV 6. Photovoltaic Systems PV grid connected.
6.1 Schemes
6.2-Photovoltaic systems connected to the grid. Protections.
6.3-Regulations.
6.4- Sizing with specific software (PVSYST).

PV 7 Net balance.
7.1- Schemes
7.2- Characteristics. Examples

PV 8- Hibryd systems.
8.1-Microgrids with photovoltaic generation, wind and accumulation systems. Types and functions.
8.2- Regulations.
8.3- Dimensioning with specific software (Homer Pro).

LEARNING ACTIVITIES AND METHODOLOGY

- Teacher lessons, doubts resolution classes -in reduced groups-, students presentations, individual mentorship and student work to acquire theoretical concepts ¡.
- Experimental lessons in the Laboratory, exercise classes in reduced groups, students presentations, individual mentorship and student work to acquire experimental concepts.

ASSESSMENT SYSTEM

A continuous assessment based on the completion of several tasks, students participation and tests that value both skills and general knowledge.
FIRST PART (50%)

Exercise with Wind Turbines (2 in 10)
ExAM: Sustainability and Wind (8 of 10). If obtained> 5 Releases matter, but only for the first ordinary session.
LAB 1 (obligatory)

PART TWO (50%)
PV plant connected to the grid. PVSYST exercise (4 in 10)
FV examination (6 of 10). Rating min: 4 points.
LAB 2 (obligatory)

Test (for up note)
So from 60% continuous assessment, 10% will be evaluated in the laboratoy. 40 %Final exam. Min 4 points (max. 10 points assigned to final exam)

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- Deutsche Gesellschaft Für Sonnenenergie Planning and Installing Photovoltaic Systems, EarthScan, 2008