Wind and photovoltaic generation

Academic Year: (2019 / 2020) **Review date: 12-04-2019**

Department assigned to the subject: Department of Electrical Engineering

Coordinating teacher: CHINCHILLA SANCHEZ, MONICA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester : 1

STUDENTS ARE EXPECTED TO HAVE COMPLETED

Electric Engineering Fundamentals

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

The student must be able to:
- select and analyze so wind energy isolated systems as photovoltaic autonomous systems.
- also the student will learn both grid connected systems.

The student will be able to make a project related to those areas: he will make the component selection, use of catalogs and technical documentation.

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 (3 ECTS credits).
- Experimental lessons in the Laboratory, exercise classes in reduced groups, students presentations, individual mentorship and student work to acquire experimental concepts (3 ECTS credits).

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

- E. Lorenzo Energía Fotovoltaica, Progensa, 2014

- Jose M. Fernandez Salgado Guia Completa de la Energía Solar Fotovoltaica, AMV Ediciones, 2007

- Rodríguez Amenedo, José Luis Sistemas eólicos de producción de energía eléctrica , Rueda, 2003

ADDITIONAL BIBLIOGRAPHY

- Ecofys Planning and Installing Photovoltaic Systems: A Guide for Installers, Architects and Engineers, Earthscan, London, , 2005

BASIC ELECTRONIC RESOURCES

- IRENA . International Renewable Energy Agency: http://www.irena.org/

- NASA . NASA Surface meteorology and Solar Energy - Location: https://eosweb.larc.nasa.gov/cgi-bin/sse/grid.cgi?email=skip@larc.nasa.gov

- PVGIS . Photovoltaic Geographical Information System: http://re.jrc.ec.europa.eu/pvgis/