Wind and photovoltaic generation

Academic Year: (2022 / 2023) **Review date: 20/06/2022 10:23:58**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: CHINCHILLA SANCHEZ, MONICA

Type: Electives ECTS Credits : 6.0

Year : Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electrical Fundamentals, Electrical machines

DESCRIPTION OF CONTENTS: PROGRAMME

MODULE 1: PHOTOVOLTAIC (PV) SYSTEMS
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

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,¿
WIND 4. 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
WIND 5. 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- Hybrid systems.
3.1-Microgrids with photovoltaic generation, wind and accumulation systems. Types and functions.
3.2- Regulations.
3.3- Dimensioning with specific software (Homer Pro).

MODULE 4. SUSTAINABILITY
4.1- Sustainability.
4.2-RREE. Summary by technologies.
4.3- Energy efficiency
4.4-Energy from the sea.

LEARNING ACTIVITIES AND METHODOLOGY

AF1. THEORETICAL-PRACTICAL CLASSES. Knowledge and concepts students mustacquire. Receive course notes and will have basic reference texts.Students partake in exercises to resolve practical problems
AF2. TUTORING SESSIONS. Individualized attendance (individual tutoring) or in-group (group tutoring) for students with a teacher.Subjects with 6 credits have 4 hours of tutoring/ 100% on- site attendance.
AF3. STUDENT INDIVIDUAL WORK OR GROUP WORK.Subjects with 6 credits have 98 hours/0% on-site.
AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.
AF9. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course. It entails 4 hours/100% on-site
AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.
MD1. THEORY CLASS. Classroom presentations by the teacher with IT and audiovisual support in which the subject`s main concepts are developed, while providing material and bibliography to complement student learning
MD2. PRACTICAL CLASS. Resolution of practical cases and problem, posed by the teacher, and carried out individually or in a group
MD3. TUTORING SESSIONS. Individualized attendance (individual tutoring sessions) or in-group (group tutoring sessions) for students with teacher as tutor. Subjects with 6 credits have 4 hours of tutoring/100% on-site.
MD6. LABORATORY PRACTICAL SESSIONS. Applied/experimental learning/teaching in workshops and laboratories under the tutor's supervision.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

Continuous evaluation based on assignments, tests and assessment of skills and knowledge.
FIRST PART (50%) (Photovoltaic and Self-consumption)
PV plant dimensioning project connected to the network. Exercise with PVSyst (40 out of 100 points for this part)
Practices 1 and 2 (compulsory)
FV exam (60 out of 100). Theory questions, test, practice and problems. Minimum mark: 4 points. If >5 is obtained Free matter, for the ordinary and extraordinary call.
Questions and tests during classes (to raise grades)

SECOND PART (50%) (Wind, sustainability, hybrid systems)
Project with Wind Turbines (40 out of 100).
Review of this part Wind (60 out of 100). Theory questions, test and problems.
Minimum exam mark: 4 points out of 10.
Practices 3 and 4 (compulsory)
Other tests (to raise grade)

Total assessment of the evaluation system:
50% continuous evaluation
50% final exam (in ordinary call).
Final exam minimum mark: 4 points out of 10.

In short, naming:
A= Photovoltaic Project
B= Midterm exam Part 1 (Fv) (Minimum grade: 4)
C= Wind Project
D= Wind and Photovoltaic Practices (see explanatory Note)
E= Exam of part 2 (Wind and hybrid systems) (the day of the ordinary exam (Minimum mark: 4))
F= Test and short questions in class (to raise grade: 0.1 each test or question)
G= Fv exam (on the day of the ordinary or extraordinary exam (*)):
Final mark of the subject:
- For those who have released the First part:
0.2*A+0.3*B+0.2*C+0.3*E+F
- For those who have not released the First part:
0.3*G+0.2*A+0.2*C+0.3*E+F
- June session, extraordinary: examination of the Modules that have not been approved (Be careful, there is a minimum mark (4) in each part):
30% exam of each part, 20% each work