Course guide
320172 - DSSE - Design of Solar and Eolic Systems

Last modified: 11/07/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Jesús Alberto López Trujillo

Others:

TEACHING METHODOLOGY

- Presential sessions of exposition of the contents.
- On-site work sessions in the laboratory.
- Autonomous study work and carrying out activities.
- Preparation and implementation of directed activities.

In the presentation sessions of the contents, the teacher will introduce the theoretical bases of the subject, concepts, methods and results, illustrating it with suitable examples to facilitate its understanding.
The laboratory work sessions will serve to see the application of the theoretical concepts introduced in theory. in them the student under the supervision of the teacher must carry out tests under specific conditions and present the report with the results obtained.
The students, in an autonomous way, must study to assimilate the concepts, solve the proposed aspects.
Note:
Lessons will be held in Spanish and/or English.

LEARNING OBJECTIVES OF THE SUBJECT

This course aims to familiarize students with concepts of metrology in general, interpretation of results and quality measures. Later, more specifically, to apply these concepts to magnitudes and measuring electrical parameters. We want the students to know and apply the most common techniques of measurement in electrical systems. Study some of the most common tests of equipment and switchgear, as well as the rules governing these trials. Apply this knowledge of electrical measurement equipment parameters and test techniques to evaluate qualitatively and quantitatively the equipment used in electrical installations form. See how far the electrical parameters may help to assess and quantify the efficient use of electricity. Finally we want to show the procedures, tests, and laboratory standards for validating all the equipment used in the field of electrical engineering.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours medium group	30,0	20.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

SUBJECT 1. INTRODUCTION TO THE SYSTEMS OF GEOGRAPHICAL INFORMATION

Description:
- Basic functions
- Information representation systems
- File types
- Type of data
- Information sources
- Software for GIS

Specific objectives:
- Know the basic concepts for the management of georeferenced information, and elementary tools of the Software used.

Full-or-part-time: 12h
Theory classes: 2h
Practical classes: 2h
Self study : 8h

SUBJECT 2. RESOURCES AND WIND POTENTIAL

Description:
- The atmosphere and the wind
- Wind data and wind characterization
- Weibull distribution law
- Wind potential
- Betz's law and maximum energy
- Methodologies for calculating production
- GIS tools applied to localization

Specific objectives:
- Know the methodologies for estimating the wind potential of a site and the GIS tools for location.

Full-or-part-time: 18h
Theory classes: 1h
Practical classes: 5h
Self study : 12h

SUBJECT 3. SOLAR RESOURCES

Description:
- Position of the sun
- Extraterrestrial solar radiation
- Components of terrestrial solar radiation
- Solar radiation on a sloping surface.
- Evaluation of available resources
- GIS tools applied

Specific objectives:
- Know how to position the sun and estimate its trajectories, know how to evaluate the resources available on an inclined plane, and know the GIS tools to manage georeferenced solar information.

Full-or-part-time: 21h 40m
Theory classes: 4h
Practical classes: 5h 40m
Self study : 12h

SUBJECT 4. DESIGNS. TYPES AND CHARACTERISTICS. MANUFACTURERS

Description:
- Types of wind turbines
- Constitution of a wind turbine
- Technical characteristics
- Manufacturers

Specific objectives:
- Describe and differentiate different types of wind turbines as well as the different parts of a wind turbine and interpret a characteristic sheet.
- Name the main manufacturers, their situation in the market

Full-or-part-time: 4h
Theory classes: 2h
Self study : 2h

UNIT 5. ISOLATED FACILITIES AND LARGE WIND FARMS

Description:
- Project of a wind farm
- Sizing of autonomous systems
- Sizing of networked systems
- Marine parks
- Interconnection problems. Effects on energy quality

Specific objectives:
- Choice of the most suitable machines
- Know the phases of a large wind farm project, including the operation phase
- Acquire the basic notions on current problems of the connection of these infrastructures to the electrical network

Full-or-part-time: 17h
Theory classes: 4h
Practical classes: 2h
Self study : 11h

SUBJECT 6. ELECTRICAL SYSTEMS IN A WIND FARM

Description:
- Generation subsystem
- Transformation subsystem
- Protection subsystem
- Distribution subsystem
- Transport subsystem

Specific objectives:
- Know the constituent parts of electrical subsystems
- Study sizing criteria
- Explain executions of these subsystems

Full-or-part-time: 13h
Theory classes: 4h
Self study : 9h

UNIT 7. INTRODUCTION TO PHOTOVOLTAIC ENERGY

Description:
- Electrical characteristics of photovoltaic cells
- Characterization of photovoltaic modules
- Components of the photovoltaic system
- Rules

Specific objectives:
- Study the characteristics of the components of the photovoltaic system
- To make known the rules, royal decrees and other official specifications that regulate solar technology

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

SUBJECT 8. INSULATED PHOTOVOLTAIC INSTALLATIONS

Description:
- Determination of the energy consumption of the installation
- Battery
- Load controller
- Investor
- Design of an isolated photovoltaic installation

Specific objectives:
- Explain the tools for sizing an isolated installation
- Choose the right items

Full-or-part-time: 14h 40m
Theory classes: 3h
Practical classes: 5h 40m
Self study : 6h

SUBJECT 9. NETWORKED PHOTOVOLTAIC INSTALLATIONS

Description:
- Investors connected to the network
- Protections
- Sizing of a photovoltaic installation
- Programs for the design of photovoltaic installations

Specific objectives:
- Explain the tools for sizing a networked installation
- Choose the right items

Full-or-part-time: 18h
Theory classes: 3h
Practical classes: 3h
Self study : 12h

SUBJECT 10. MAINTENANCE OF PHOTOVOLTAIC PLANT

Description:
- Energy audit.
- Inspection: Visual, thermographic, protections.
- Characteristic I-V of the photovoltaic system.
- Results report. Rules.
- Technical code of buildings.

Specific objectives:
Learn to identify and discover installation defects.
- Introduce the necessary instruments.

Full-or-part-time: 6h 30m
Theory classes: 2h
Self study : 4h 30m

SUBJECT 11. OPERATION OF PHOTOVOLTAIC PLANT

Description:
- Network connection process, requirements.
- Monitoring, operator interface.
- Social and environmental impact.
- AFE investors.

Specific objectives:
- Know the requirements of operation in plant and remote.
- Be aware of the environmental and social impact of the plant.

Full-or-part-time: 5h
Theory classes: 1h
Practical classes: 1h
Self study : 3h

SUBJECT 12. MAINTENANCE AND OPERATION OF WIND GENERATION PLANT

Description:
- Ways of operation, operation, supervision, reliability.
- Passive and active power control systems.
- Maneuvers and continuous operation.
- Quality and corrective measures. Regulations

Specific objectives:
- Identify, prevent and maintain the generation facility
- Make decisions in operation and maintenance.

Full-or-part-time: 13h 10m
Theory classes: 2h
Practical classes: 3h 40m
Self study : 7h 30m

LABS

Description:
Off-grid solar system labs

Specific objectives:
- Grid-of experiements.
- Analysis of the performance of a grid-off solar plant.

Full-or-part-time: 2h
Practical classes: 2h

GRADING SYSTEM

NA = 0.5NE + 0.5NP
NA: Final Grade.
NP: Project grades. Between two and three projects could be developed. All projects represent 50% of the final grade.
NE: Exam grades. Two exams must be taken. Each exam scores 25% of the total grade. Therefore, the exam grades represent 50% of the total grade.

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Basic:

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