



Universidad de Jaén

School of Engineering of Jaén

Electrical technology of photovoltaic systems

2024-2025

Grado en Ingeniería electrónica industrial (E.P.S. Jaén)

Doble Grado en Ingeniería eléctrica e Ingeniería electrónica industrial (E.P.S. Jaén)

Doble Grado en Ingeniería mecánica e Ingeniería electrónica industrial (E.P.S. Jaén)



GRUPO



Acceso Mayores 40

Guías docentes UJA

Horarios de tutorías

Llamamientos PAU

Movilidad (Coordinador)

P.O.D.

Solicitud bilingüismo

Syllabus 2024-25 - 13113014 - Electrical Technology of Photovoltaic Systems (Tecnología eléctrica de los sistemas fotovoltaicos)

Caption

- Level 1: Tutorial support sessions, materials and exams in this language
- Level 2: Tutorial support sessions, materials, exams and seminars in this language
- Level 3: Tutorial support sessions, materials, exams, seminars and regular lectures in this language

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Full version (Spanish)

English

DEGREE: Grado en Ingeniería electrónica industrial (13113014)
 FACULTY: SCHOOL OF ENGINEERING OF JAÉN
 DEGREE: Doble grado en Ingeniería eléctrica e Ingeniería electrónica industrial (13713024)
 FACULTY: SCHOOL OF ENGINEERING OF JAÉN
 DEGREE: Doble Grado en Ingeniería mecánica e Ingeniería electrónica industrial (13913026)
 FACULTY: SCHOOL OF ENGINEERING OF JAÉN
 ACADEMIC YEAR: 2024-25
 COURSE: Electrical Technology of Photovoltaic Systems

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Electrical Technology of Photovoltaic Systems
 CODE: 13113014 (*) ACADEMIC YEAR: 2024-25
 LANGUAGE: English LEVEL: 0
 ECTS CREDITS: 6.0 YEAR: 4 SEMESTER: SC

2. LECTURER BASIC INFORMATION

NAME: CASA HERNÁNDEZ, JESÚS DE LA
 DEPARTMENT: U120 - INGENIERÍA ELÉCTRICA
 FIELD OF STUDY: 535 - INGENIERÍA ELÉCTRICA
 OFFICE NO.: A3 - 237 E-MAIL: jcasa@ujaen.es P: 953212463
 WEBSITE: <http://blogs.ujaen.es/jcasa/>
 ORCID: <https://orcid.org/0000-0001-9117-1689>
 LANGUAGE: - LEVEL: 2

3. CONTENT DESCRIPTION

1. FOUNDATIONS OF PHOTOVOLTAIC ENERGY

Photovoltaic solar cell
 Effects of environmental conditions in photovoltaic
 Determination of parameters of the photovoltaic model
 Photovoltaic module
 Photovoltaic generator
 Photovoltaic system

2. GENERALITIES

Introduction
 The photovoltaic generator: Electric behaviour and connections
 Connection to the electric grid
 Electric risk in DC and AC
 Protection

Earthing

3 LEGAL ASPECTS OF THE PHOTOVOLTAIC GENERATION

Introduction

Directive 2009/28/ce of the European Parliament

Plan of renewable energy 2011-2020.

Self-consumption

Evolution of the Spanish regulatory mark

Current legal Marco

Technical norms for the connection to grid.

Basic demand HAS 5 of the technical code of the construction, minimum photovoltaic contribution of electric power.

UNE Norms

4. CONDUCTOR SIZING

Structure of an isolated electric cable

Approaches of conductor sizing

Conductor sizing

Technical characteristics and selection of DC conductors

5. EQUIPMENT PROTECTION. OVERCURRENT PROTECTION

Possible electric faults in PV generators

Operation of PV generator under conditions of electric fault

Protection measures adapted for the PV generators against overcurrents

6. EQUIPMENT PROTECTION. LIGHTING AND SURGES PROTECTION

Origin of the surges

Equipment withstand to surges

Measures and design of the protection in DC

Measures and design of the protection in AC

7. PERSONAL SAFETY

Electric risk for direct and indirect contact

Measures and design of the protection in DC

Measures and design of the protection in AC

8. CONNECTION TO THE ELECTRIC GRID

Interconnection outlines

Connection conditions

Protection of the interconnection

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

Face-to-face 100% Theory and practices ().** The Center may establish rotating attendance depending on the number of students and capacity of the classroom/laboratory (class in the schedule and classroom/laboratory assigned to one part of the group and broadcast by videoconference to the rest, with periodic rotation of students, as determined by the Center).

Class to all the students of the group in the assigned time and classroom.

Methodology: Participation during regular classes (theoretical or practical lessons, technical visits, and through Ilias Platform (University of Jaén virtual campus-online) will be taken into account. At the beginning of our course, students must incorporate into a team group (3 or 4 persons per group) and argue with professor the aim of their personal or teamwork, of course refers to one of the topic of our course. Finally, students will expose their own research and teamwork. One final exam will be done at the end of the semester about theoretical and practical aspect defined. Besides, during the semester are

arranged several technical visits. In order to enroll the students in this course, all students must be register inside Ilias Platform as soon as possible.

Hours per week

Lecture (Theory)	3h
Lecture (Practice):	2h each two week (10 h for the whole course)
Seminars:	5 h for the whole course
Homework:	6h

Students with special educational needs should contact the Student Attention Service (Servicio de Atención y Ayudas al Estudiante) in order to receive the appropriate academic support

5. ASSESSMENT METHODOLOGY

Written exam (40%), individual practice work (20%), colective practice work (20%), and course attendance (20%)

6. BOOKLIST [f5 WWgg'h Y VjV'c\[fUd\ mj'b'h Y '@VfUfmWUJc\[Ł](#)

MAIN BOOKLIST:

- Photovoltaics : system design and practice. Edition: -. Author: Häberlin, Heinrich ([Library](#))

7. SUSTAINABLE DEVELOPMENT GOALS

Energía asequible y no contaminante

Ciudades y comunidades sostenibles

DETAILED INFORMATION

Goal 7. Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable, and modern energy for all.

Goal 11. Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

1. TEACHING METHODOLOGY AND TRAINING ACTIVITIES

Training Activities	Format (classroom /online)	Teaching Description methodology
A1	Face -to-face 50%, online 50%	Classes in the schedule and classroom assigned to a part of the group and video conference broadcast to the rest, with periodic rotation of students, as determined by the Center.
A2	Face -to-face 50%, Online 50%	5 practical sessions (2h) in laboratory using software available ONLINE to a part of the group. Retransmission by videoconference to the rest, with periodic rotation of students, as determined by the Center.

Tutorial lesson	Online 100%	Online via GOOGLE MEET upon request by the student.
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2. EVALUATION

Ordinary call

Assessment test	Format (face-to-face / online synchronous or asynchronous)	Description	Percentage
Active participation in the class	Face-to-face	Assessment of active participation in the class	20%
ILIAS exam	Face-to-face	Theoretical exam (objective test with a short answer)	40%
Assessment works and practices	Face-to-face	Evaluation of laboratory practices and practical cases	40%

Extraordinary call

Assessment test	Format (face-to-face / online synchronous or asynchronous)	Description	Percentage
Active participation in the class	Face-to-face	Assessment of active participation in the class	20%
ILIAS exam	Face-to-face	Theoretical exam (objective test with a short answer)	40%
Assessment works and practices	Face-to-face	Evaluation of laboratory practices and practical cases	40%

3. RESOURCES

Since the group has been below 15 students, the theory classes can be given in a classroom with sufficient capacity where there are means of videoconferencing. The practical sessions will be held in the laboratory in D264 of the A3 and will be transmitted by videoconference.

The GOOGLE MEET tool will be used for the videoconferences. In addition, the tools integrated in the UJA platform, ILIAS (contents, forums, delivery of work and/or practices) will be used, as well as the possibility of using the Google DOCs tool.

The electronic bibliographic resources will be those available in BUJA and in interesting web pages.

9. VIRTUAL TEACHING SCENARIO

1. TEACHING METHODOLOGY AND TRAINING ACTIVITIES

Training Activities	Format (online)	Teaching methodology Description
A1	Online 100%	Classes on the assigned schedule and video conference broadcast.

A2	Online 100%	Development of 5 practical sessions (2h) using software available ONLINE Retransmission by videoconference to all students.
Tutorial lesson	Online 100%	The tutoring will be done online (synchronously via GOOGLE MEET upon request by the student and asynchronously via email.

2. EVALUATION

Ordinary call

Assessment test	Format (face-to-face / online synchronous or asynchronous)	Description	Percentage
Active participation in the class	On-line 100%	Assessment of active participation in the class	20%
ILIAS exam	On-line 100%	Theoretical exam (objective test with a short answer)	40%
Assessment works and practices	On-line 100%	Evaluation of laboratory practices and practical cases	40%

Extraordinary call

Assessment test	Format (face-to-face / online synchronous or asynchronous)	Description	Percentage
Active participation in the class	On-line 100%	Assessment of active participation in the class	20%
ILIAS exam	On-line 100%	Theoretical exam (objective test with a short answer)	40%
Assessment works and practices	On-line 100%	Evaluation of laboratory practices and practical cases	40%

3. RESOURCES

The GOOGLE MEET tool will be used for video conferences. In addition, the tools integrated in the UJA platform, ILIAS (contents, forums, delivery of work and/or practices) will be used, as well as the possibility of using the Google DOCs tool.

The electronic bibliographic resources will be those available in BUJA and in interesting web pages.

The practical sessions called TECHNICAL VISITS will be replaced by other guided works and recorded sessions by the teacher in situ.

DATA PROTECTION CLAUSE (on line exams)

Institution in charge of data processing: Universidad de Jaén, Campus Las Lagunillas, s/n, 23071 Jaén

Data Protection Delegate: dpo@ujaen.es

Purpose: In accordance with the Universities Law and other national and regional regulations in force, carrying out exams and assessment tests corresponding to the courses students are registered in. In order to avoid frauds while sitting the exam, the exam will be answered using a videoconference system, being able the academic staff of the University of Jaén to compare and contrast the image of the person who is answering the exam with the student's photographic files. Likewise, in order to provide the exam with evidential content for revisions or claims, in accordance with current regulation frameworks, the exam will be recorded and stored.

Legitimacy: compliance with legal obligations (Universities Law) and other national and regional regulations currently in force.

Addressees: service providers who are the owners of the platforms where the exams are carried out and with whom the University of Jaén has signed the corresponding data access contracts.

Storage periods: those established in current in force regulations. In the specific case of exam videoconference recordings, not before the examination records and transcripts are closed or the exam can still be reviewed or challenged.

Rights: you can exercise your right of access, amendment, cancellation, opposition, suppression, limitation and portability by sending a letter to the postal or electronic address indicated above. In the event that you consider that your rights have been violated, you may submit a complaint to the Andalusian Council for Transparency and Data Protection www.ctpdandalucia.es

CLASS RECORDING CLAUSE PERSONAL DATA PROTECTION

Person in charge: Universidad de Jaén, Paraje Las Lagunillas, s/n; Tel.953 212121; www.ujaen.es

Data protection delegate (DPO): TELEFÓNICA, S.A.U. ; Email: dpo@ujaen.es

Procedure aim: To manage proper recordings of teaching sessions with the aim of facilitating learning process under a multimodal and/or online teaching

Period for record storage: Images will be kept during legal term according to regulations in force

Legitimacy: Data will be managed according to legal regulations (Organic Law 6/2001, December 21, on Universities) and given consent provided by selecting corresponding box in legal admission documents

Data recipients (transfers or assignments): Any person allowed to get access to every teaching modality

Rights: You may exercise your rights of access, rectification, cancellation, portability, limitation of processing, deletion or, where appropriate, opposition. To exercise these rights, you must submit a written request to the Information, Registration and Electronic Administration Service of the University of Jaen at the address above, or by e-mail to the address above. You must specify which of these rights you are requesting to be satisfied and, at the same time, you must attach a photocopy of your ID card or equivalent identification document. In case you act through a representative, legal or voluntary, you must also provide a document that proves this representation and identification. Likewise, if you consider that your right to personal data protection has been violated, you may file a complaint with the Andalusian Data Protection and Transparency Council www.ctpdandalucia.es