

Course Unit	Option 1 - Photovoltaic Systems		Field of study	Energy/Informatics	
Master in	Electrical and Computers Engineering		School	School of Technology and Management	
Academic Year	2023/2024	Year of study	1	Level	2-1
Type	Semestral	Semester	2	ECTS credits	6.0
Workload (hours)		162	Contact hours	T -    TP 30    PL 30    TC -    S -    E -    OT -    O -	
Code 5070-792-1202-02-23					

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Jose Santos Teixeira Batista, Orlando Manuel de Castro Ferreira Soares

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Understand the basic power topologies and fundamentals of control of power converters used in photovoltaic systems;
2. Undertake projects, analytically and using software, for isolated and grid-tied photovoltaic systems based on the technology available on the market;
3. Undertake projects of microgrids for houses, isolated or grid connected, with integration of photovoltaic systems and other renewable sources, using technology available on the market.

### Prerequisites

Before the course unit the learner is expected to be able to:

1. Understand the basic concepts of the photovoltaic systems;
2. Understand the basic principles of the electric and electronic circuits.

### Course contents

Types of photovoltaic systems. Technologies. Power converter topologies and control strategies of photovoltaic systems. Sizing and installation of photovoltaic plants. Microgrids for houses, isolated or grid connected, with integration of photovoltaic systems and other renewable sources. Design of systems for real case studies.

### Course contents (extended version)

1. Types of photovoltaic systems: Off-grid and grid-connected.
2. Technology of the photovoltaic systems:
  - Components of grid connected systems: Photovoltaic modules, sun trackers and inverters;
  - Components of off-grid systems: Batteries, charge regulators and inverters;
  - Power converter topologies and control strategies of photovoltaic systems;
  - Power control in grid connected photovoltaic systems: examples.
3. Undertake projects, using the technology available on the market, for:
  - Standalone photovoltaic systems;
  - Grid-connected photovoltaic systems.
4. Design of small microgrids based on photovoltaic energy and other renewable sources.

### Recommended reading

1. Curso Técnico Instalador de Energia Solar Fotovoltaica, Filipe Alexandre de Sousa Pereira, Manuel Ângelo Sarmento de Oliveira, Publindústria, Edições Técnicas, 2015.
2. Photovoltaics for Professionals: Solar Electric Systems Marketing, Design and Installation, Falk Antony, Christian Dürschner, Karl-Heinz Remmers, Earthscan Publications Ltd., June 2007.
3. Applied Photovoltaics, Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish, Earthscan Publications Ltd, 2007;
4. Planning and Installing Photovoltaic Systems: A Guide for Installers, Architects and Engineers, German Solar Energy Society, Earthscan, 2005;
5. Photovoltaic Power Systems: Modeling, Design and Control, Weidong Xiao, John Wiley & Sons, 2017.

### Teaching and learning methods

Learning outcome 1: Lectures and problem-solving sessions with simulation. Learning outcomes 2 and 3: practical and laboratory lessons; Project Based Learning.

### Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Practical Work - 50% (Practical laboratory activities and carrying out a project.)
  - Case Studies - 50% (Activities with case studies carried out in theoretical classes.)
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
  - Practical Work - 50% (Practical laboratory activities and carrying out a project.)
  - Final Written Exam - 50% (Minimum score of 7 in the exam (on a scale of 20) to obtain approval for the course.)
3. Alternative 3 - (Regular, Student Worker) (Supplementary, Special)
  - Final Written Exam - 100%

### Language of instruction

Portuguese, with additional English support for foreign students.

### Electronic validation

Jose Santos Teixeira Batista, Orlando Manuel de Castro Ferreira Soares	José Luís Sousa de Magalhaes Lima	João Paulo Ramos Teixeira	José Carlos Rufino Amaro
29-02-2024	06-03-2024	13-03-2024	16-03-2024