Study Plan

School: School of Sciences and Technology
Degree: Master
Course: Solar Energy Engineering (cód. 442)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10368M	The Solar Resource	Renewable Energy Engineering	6	Semester	156
FIS10369M	Electricity as an Energy Carrier	Electrotechnical Engineering	6	Semester	156
FIS10370M	Conversion and Storage Technologies	Renewable Energy Engineering	6	Semester	156
FIS10371M	Thermal Solar Energy Technologies	Renewable Energy Engineering	6	Semester	156
FIS10372M	Management and Energy Planning. Projects.	Renewable Energy Engineering	6	Semester	156

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10373M	Power Electronics	Electrotechnical Engineering	6	Semester	156
FIS10374M	Solar Concentration Technologies	Renewable Energy Engineering	6	Semester	156
FIS10375M	Solar Photovoltaic Energy Technologies	Renewable Energy Engineering	6	Semester	156
FIS10376M	Special Topics - Other Applications of Solar Energy	Renewable Energy Engineering	6	Semester	156
Dissertation					

2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					

Conditions for obtaining the Degree:

*** TRANSLATE ME: Para aprovação na componente curricular é necessário a aprovação (através de avaliação ou creditação) das seguintes unidades curriculares: {\}newline

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1º Semestre: {\}newline

5 UC obrigatórias num total de 30 Ects{\}newline

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2º Semestre: {\}newline

4 UC obrigatórias num total de 24 Ects{\}newline

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Para obtenção do grau, é necessário também a aprovação na Dissertação, com um total de 36 ECTS, no 3.º Semestre. ***

Program Contents

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The Solar Resource (FIS10368M)

1.Introduction: Earth-Sun geometry, height and azimuth angle of the sun; angles of sunrise and sunset. Solar constant and extraterrestrial radiation on a horizontal plane. Global solar radiation, diffuse, direct and direct normal. Irradiance, Insolation and Radiation. Instruments.
2. Methods of calculation based on average values: Values hourly/daily/monthly/yearly. Generation of radiation data. Solar radiation in the fixed and follow up inclined plane. Thermal solar systems and calculation of the energy supplied. The concept of usability. Methods of line charging, f-chart, of Gordon. Methods for PV systems.
3.Calculation methods based on instantaneous values: Generation of hourly data of global and diffuse solar irradiance. Existing models, model comparison.
4. Direct Normal Radiation: Calculating the direct irradiance and irradiance. Influence the content of the atmosphere on irradiance, spectral content. Variation in the response of cells to high concentration.

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Electricity as an Energy Carrier (FIS10369M)

1. Power Networks
- Introduction to Electrical Energy Systems. The electricity sector. Power generation systems. Power transformers. Components. Equivalent circuits.
- Transmission lines. Components and operational characteristics.
- Load Charts. Power flow calculation.
- Quality of energy. Service quality classes. Power quality - normalization. Main power quality disturbances. Measuring the quality of energy.
2. Intelligent Systems for Control and Supervision
- Industrial Sensors. Acquisition and Signal Processing: NI ? LabView and Siemens-Simatic technology.
- System Control - Feedforward and feedback. Design of automatic systems with GRAFCET.
- Design and implementation of SCADA systems with Siemens WinCC (Supervisory Control and Data Acquisition).

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Conversion and Storage Technologies (FIS10370M)

Introduction

Thermal-chemical conversion: combustion

Thermal conversion - power: solar thermal and biomass

Electrical-mechanical conversion

Conversion chemistry - physical, electrical power y

Other energy storage technologies

Electricity generation centralized and decentralized

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Thermal Solar Energy Technologies (FIS10371M)

1.. Introduction
2. Thermal applications at temperatures up to 80 ° C
3. Applications at medium temperatures (80 ° C

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Management and Energy Planning. Projects. (FIS10372M)

European regulations.

National energy landscape.

Regulatory framework for the national energy sector.

"Energy Resource Assessment "

Introduction to energy audit

Methodologies for environmental impact studies produced by energy projects.

Introduction to project management of energy

Professional ethics and environmental crimes

Economic and financial analysis of projects

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Power Electronics (FIS10373M)

1. Introduction to power electronic converters
The importance of inverters in the context of electrical systems; Structure of converters.

2. Naturally commutated converters
The rectifier using diodes and thyristors with ideal adjacent circuits; connection of the converter to the generator using adjacent non-ideal circuits; Converters AC-AC; Modeling and control.

3. Forced commutated converters
Study of forced commutated circuits; DC-DC with ideal adjacent circuits and non-ideal circuits; Modeling and control.

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Solar Concentration Technologies (FIS10374M)

1.Introduction

2.Fundamentals of Optics Concentration

3. Types of Concentrators

4. Solar Trackers: technological aspects and implementation

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Solar Photovoltaic Energy Technologies (FIS10375M)

1.Introduction
• The Physics of photovoltaic conversion.
• Conversion Technologies (1st, 2nd and 3rd generations).
2. Photovoltaic Systems.
• stationary systems and tracking systems.
• Photovoltaics with Concentration (CPV).
• photovoltaic systems with cogeneration of heat. Systems PV / T.
3. Applications and Projects.
• Types of applications: autonomous, connected to the network, integration into buildings (BIPV) and other (water purification, telecommunications systems, electric vehicles).
• Design of Photovoltaic systems.
• Standards for Testing and Monitoring Photovoltaic systems.
• Photovoltaic systems modeling.
4. New Trends.
• Photovoltaic Systems and Intelligent Networks (Smart Grid)
New technologies for direct conversion of solar energy into electricity.

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Special Topics - Other Applications of Solar Energy (FIS10376M)

1. Desalination
• Basics
• Via Thermal evaporation / condensation; systems simple effect, multiple effect systems, multi-flash; evaporation in membranes.
• Via mechanical, reverse osmosis, using membranes.
2. Solar technologies for Potabilization / decontamination of water.
• Basics
• Solar Ultraviolet Decontamination.
• Photocatalysis and Pasteurization.
• Experiences concrete, photocatalysis and solar pasteurization.
3. Drying with solar energy.
• Basics.
• Dryers simple; greenhouse type dryers
• Production of hot air dryers
• Experiences concrete, Solar Drying.
4. Greenhouses.
• Basics.
• Experiences concrete Solar Greenhouse.
5. Air conditioning / refrigeration
• Systems sorption for combination with solar thermal
• Compression systems for combination with solar electricity
• Other systems.
6. Food Cooking with Solar Energy
• Solar-type box.
• Solar concentrators.
• Experiences concrete, Solar Drying.