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|------------------|---|---------------|----------------|-------------------------------------|-------|
| Course Unit | Thermal Solar Systems | | Field of study | Energy | |
| Master in | Renewable Energy and Energetic Efficiency | | 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 |
| | | | Code | 6793-475-1205-00-23 | |
| Workload (hours) | 162 | Contact hours | T - | TP 30 | PL 30 |
| | | | TC - | S - | E - |
| | | | OT - | O - | |

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) João da Rocha e Silva, Luis Miguel Silva Correia

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
 1. Calculate and Integrate different solar-thermal technologies in buildings HVAC systems.
 2. Intervene over architecture projects in order to improve energy performance.

Prerequisites

Before the course unit the learner is expected to be able to:
 Notions of thermodynamics, heat transfer and fluid mechanics.

Course contents

Active and passive solar thermal systems.

Course contents (extended version)

1. Introduction
 - Energy conversion
 - Forms of energy
 - Solar energy conversion
 - Solar radiation
 - Bioclimatic architecture
 - Introduction to solar systems -Composition -Capture -Storage -Energy distribution
2. Passive solar systems
 - General principles. Summer and winter operations
 - Bioclimatic strategies
 - Thermal isolation in buildings
 - Passive heating systems
 - Direct gain
 - Indirect gain -Thermal insulation wall-Massive wall -Trombe wall -Water column, Thermal storage roof
 - Separate gain - greenhouses
 - Passive cooling systems -Ventilation -Evaporative and radiative cooling -Soil cooling
 - Dimensioning passive solar buildings
3. Active solar systems
 - Types of flat collectors -water -air
 - Vacuum tubes
 - Concentrating collectors -low concentration -average -high
 - Systems of forced circulation
 - Thermosiphon circulation systems
 - Energy storage
 - Domestic water heating
 - System description -Heat charge -"f-chart" method -Parameters that conditioned the system
 - Heating water in industrial processes -pool heating -Indoor heating -Other applications

Recommended reading

1. "Thermal Analysis and Design of Passive Solar Buildings", Athienitis, A. K. , Santamouris, M. , Earthscan Publications Ltd, 2002
2. "En Detail: Architecture Solar", C. Schittich (Editor), Princeton Arch Staff, 2005
3. "Solar Architecture: The Direct Gain Approach (Energy Learning Systems Book)", T. E. Johnson, MacGraw-Hill, 1981
4. "Solar Technologies for Buildings", U. Eicker, Wiley, ISBN 047148637X, 2003

Teaching and learning methods

-Theoretical classes - Exposure of concepts - presentation and discussion over examples -Practical classes - Application exercises

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
 - Practical Work - 70%
 - Work Discussion - 30%
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
 - Final Written Exam - 100%

Language of instruction

Portuguese

| Electronic validation | | | |
|---|-----------------------------------|--|--------------------------|
| João da Rocha e Silva, Luis Miguel Silva Correia | João Eduardo Pinto Castro Ribeiro | Ângela Paula Barbosa da Silva Ferreira | José Carlos Rufino Amaro |
| 18-03-2024 | 18-03-2024 | 18-03-2024 | 24-03-2024 |

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