

Course Unit	Cogeneration 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	6793-475-1202-00-23				
Workload (hours)	162	Contact hours	T 30	TP -	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) Alexandra Sofia Rosa Jeronimo, Luís Manuel Frolen Ribeiro

Learning outcomes and competences

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

1. acquire knowledge and understanding about several thermodynamics principles and exergy analysis,
2. solve problems related to the thermodynamics of combined heat and power (CHP) plants,
3. make economic analyses and assessments of schemes,
4. communicate to raise awareness of technically safer environmental options and a safer financial return.

Prerequisites

Before the course unit the learner is expected to be able to: to have basic skills on maths, physics and chemistry.

Course contents

Introduction and historical background of energy sources. Review of thermodynamics fundamentals. Exergy analysis. Thermodynamics of CHP plants. Thermoeconomic applications of exergy. Examples of some practical CHP schemes. Examples of several district heating systems.

Course contents (extended version)

1. Introduction and historical background of energy sources and CHP.
2. Review of thermodynamics fundamentals.
3. Exergy analysis.
4. Combined cycle and CHP power plants. Examples of some practical CHP schemes.
5. Absorption chillers in CHP.
6. Operation and maintenance of cogeneration systems.
7. Examples of several district heating systems.
8. Regulatory actions - laws and regulations. Financing of cogeneration projects.

Recommended reading

1. Yang Shi, Mingxi Liu, and Fang Fang - Combined cooling, heating, and power systems modelling optimisation, and operation - 2017 - 1st edition - ASME Press & Jonh Wiley & Sons - ISBN: 978-1-119-28335-5
2. ASHRAE - Combined Heat and Power Design Guide - 2015 - 1st Edition - American Society of Heating, Refrigerating and Air-Conditioning Engineers - ISBN 978-1-936504-87-9
3. Neil Petchers - Combined Heating, Cooling & Power Handbook Technologies & Applications - 2023 - 2nd Edition - River Publishers - Denmark - ISBN 9788770229135
4. Martin Pehnt, Barbara Praetorius, Katja Schumacher et. all - Micro Cogeneration - Towards Decentralized Energy Systems - 2010 - Springer Berlin, Heidelberg - ISBN 978-3-642-06498-2

Teaching and learning methods

The unit will be taught using a combination of lectures such as: theoretical exposition, discussion, practical classes, self guided learnig, and laboratory assignments. Practices will rely on Project Based Learning methodology with a common project for the whole class.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
 - Projects - 70%
 - Presentations - 30%
2. Alternative 2 - (Student Worker) (Final, Supplementary, Special)
 - Projects - 100%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Alexandra Sofia Rosa Jeronimo, Luís Manuel Frolen Ribeiro	João Eduardo Pinto Castro Ribeiro	Ângela Paula Barbosa da Silva Ferreira	José Carlos Rufino Amaro
14-03-2024	14-03-2024	14-03-2024	16-03-2024