

Course Unit	Air Conditioning and Refrigeration		Field of study	Energy	
Master in	Industrial Engineering - Mechanical Engineering		School	School of Technology and Management	
Academic Year	2022/2023	Year of study	1	Level	2-1
Type	Semestral	Semester	2	ECTS credits	6.0
		Code		9572-356-1201-00-22	
Workload (hours)	162	Contact hours	T 20	TP -	PL 40
		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) Luís Manuel Frolen Ribeiro

Learning outcomes and competences

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

1. Identify different types of heating and air conditioning equipment and solutions.
2. Distinguish and agree/disagree with design criteria of HVAC: Heating, Ventilating and Air Conditioning systems and equipment.
3. Be acquainted with energy efficiency and conservation on Heating, Ventilating and Air Conditioning systems and equipment.
4. Apply knowledge of thermodynamics, fluid mechanics and heat transfer concepts to Heating, Refrigerating and Air Conditioning systems and equipment.

Prerequisites

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

Course contents

Heating, ventilating and air conditioning systems and operation. Thermal comfort. Air quality control. Psicrometry. Solar geometry and site suitability. Calculus of heat and cooling needs and application of national standards for heating and cooling in buildings.

Course contents (extended version)

1. Introduction to Heating, Ventilating and Air Conditioning
 - HVAC Systems
 - Basic concepts
2. Human comfort
 - Physiological considerations
 - Comfort index
 - Comfort conditions
3. Air properties
 - Air and standard atmosphere
 - Fundamental parameters
 - Adiabatic saturation
 - Wet bulb and psicrometric chart
 - Air conditioning
4. Air Quality
 - Basic considerations
 - Contaminants
 - Carbon dioxide and other common gases
 - Volatile organic compounds
 - Particular substances
 - Indoor air control methods
5. Weather and solar radiation
 - Thermal radiation
 - Earth movement around the Sun
 - Weather
 - Solar angles
 - Solar radiation
6. Thermal equilibrium in buildings
 - Heat transfer through building structures
 - Heating needs
 - Cooling needs
7. Application examples of Portuguese HVAC standards

Recommended reading

1. McQuinston, Faye C. ; Heating, ventilating and air conditioning - ASHRAE Handbook of Fundamentals, 2005
2. Maldonado, E. - "Manual de Aplicação do RSECE" - Ordem dos Engenheiros

Teaching and learning methods

The practical classes will be dedicated to the resolution, individually or in groups, of problems that will be presented and discussed in the classroom. The issues raised will have to be solved during off-class hours. Students that will not attend class will not have access to the problems. Therefore presence is mandatory within the bounds of educational regulations.

Assessment methods

1. Assignments - Alternative 1 - (Regular) (Final)
 - Practical Work - 75% (Work on the classroom - practical assignments.)
 - Practical Work - 25% (Theoretical assignments.)
2. Integrated HVAC project - (Student Worker) (Final, Supplementary, Special)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

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22-02-2023	10-03-2023	10-03-2023	10-03-2023