

Course form (FUC)

Course:	MSC IN MECHANICAL ENGINEERING					
Unit	Special Technical Installations				Mandatory	X
					Optional	
Scientific Area	Thermofluids and Energy					
Year: 2º	Semester: 1º	ECTS: 6,0		Total Hours: 162		
Contact Time:	T:	TP: 67,5	PL:	S:	OT:	TT: 67,5
Professor in charge		Academic Degree /Title		Position		
Cláudia Sofia Séneca da L. Casaca		PhD		Assistant Professor		

T- Lectures ; TP – Theory_Practice ; PL – Laboratorial ; S – Seminar ; OT – Tutorial Orientation ; TT – Total Contact Hours

Implementation	Semester: Winter	Year: 2019/2020
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Objectives of the curricular unit and competences (max. 1000 characters)

Unit Objectives:

- Familiarize students with the main HVAC systems and equipment.
- Show students how to apply appropriate procedures for the study of buildings' energy needs.
- Teach students how to size HVAC systems and equipment.
- Prepare students to perform a technical-economic study between several HVAC solutions, balancing investment versus running / maintenance costs.

Competences to be acquired in the Curricular Unit:

- Students will acquire adequate skills to perform studies and design of air conditioning in buildings.

Syllabus (max. 1000 characters)

- 1- HVAC project guides.
- 2- Manuals and literature of the specialty.
- 3- Introduction to air conditioning and ventilation systems in buildings.
- 4- Thermal loads and energy calculations for buildings.
- 5- Heat and cool production plants and distribution of thermal energy.
- 6- Equipment to be incorporated in HVAC systems.
- 7- Air handling units (AHU and OAHU).

- 8 Selection and sizing of HVAC equipment.
9. Preparation of a basic design considering the knowledge acquired in the UC.
- 10- technical-economic study for several HVAC solutions.

Demonstration of the syllabus coherence with curricular unit's objectives (max. 1000 characters)

- 1- To fulfill the basic objectives of the UC the student must:
 - Learn to size the HVAC system and equipment. For this purpose, techniques for calculating thermal loads, thermal capacities and energy consumption will be taught.
 - Learn to perform a technical-economic study between several HVAC solutions, balancing investment versus running / maintenance costs. For this purpose, techniques of economic analysis of investments will be taught.
- 2- Regarding to the competences that the students must acquire:
 - 2.1 Split direct expansion systems.
 - 2.2 Cooling / heating water production plants.
 - 2.3 Cooling/heating water distribution systems (four pipes, variable flow).
 - 2.4 Terminal air handling units.
 - 2.5 Central air handling units.
- 3 - Acquire the basic knowledge to be able to start a professional activity in the sector.

Teaching methodologies (including evaluation) (max. 1000 characters)

The unit is theoretical and practical.

The teaching methodology is then mixed:

- It comprises one theoretical part based on an expository basis, including theoretical-practical classes.
- Another part is practical, in which the students will be monitored, based on computer tools.

Evaluation:

Two individual tests. If the students fail approval in these tests, they can perform a final exam.

Four practical works, developed by the students, throughout the semester. Together, they will constitute the basis for a basic design of an HVAC system.

The final classification will be weighted with 70% for the four works and 30% for the tests/exam. In any of the phases there may be a grade lower than ten values.

Demonstration of the teaching methodologies coherence with the curricular unit's objectives

(max. 3000 characters)

The basic objectives coincide in a direct way with the methodologies of teaching and evaluation, as listed below:

- 1- Theoretical classes describe and qualify the different HVAC systems and equipment.
- 2 - The student, through appropriate research, has to know in depth the national climatic data, especially those of the place of his study and decide on the appropriate choice of climatic data on which his calculations will be based.
- 3 - During the course of teaching, using the adopted software, all the constructive characteristics of the places to be studied, occupancy indexes and their direct or indirect correlation with all sources of heat, whether external or external, must be identified in an objective way. within the building being evaluated.
- 4- The selection of the main equipment, resulting from the calculations made, will be real, identified with the full range of products available in the market.
- 5- The operating characteristics of the various comparative solutions for the actual case under study in the evaluation process will allow a concise evaluation of different operating costs for the solutions being analyzed.
- 6 - As a complement to all the results obtained during the school year, students will have to present schemas of principle of the installation, descriptive memory and justification, spreadsheets, which, as a whole, will form the basis of the preliminary project to be presented for evaluation of practical part of the CU.
- 7- The evaluation of the theoretical part will focus on all the material exposed in the theoretical and practical classes.

Main Bibliography (max. 1000 characters)

ASHRAE Handbook manuals.

Carrier air conditioning manual.

António José da Anunciada Santos. HVAC, A Handbook of Support: Fundamentals. Publisher Engebook.

António José da Anunciada Santos. HVAC, A Handbook of Support: Add-ons. Publisher Engebook.

Exterior design temperatures and degree day numbers, LNEC / IM Lisbon - 2nd edition 1995.

Climatic norms for Portugal 1951-1980 IM.

Climatic Statistics in Continental Portugal VOLUME 1 - Air Temperatures (quantiles) 1951-1980 IM.

Coefficients of thermal transmission of elements of the building envelope 2006 (ITE 50; LNEC).

DL 118/2013 and respective ordinances (SCE).

Procedure for Determining Heating and Cooling Loads for Computerizing Energy Calculations - ASHRAE.

Computer software:

Carrier. Software Systems E20 - II Version available.

- Design Building energy plus.

- Chiller selection program - of different brands in the market (Carrier, Trane, Climaveneta, among others).

- Computer-aided design software in 2D and 3D.