# Universida<sub>de</sub>Vigo

## Subject Guide 2020 / 2021

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IDENTIFYIN	G DATA				
Thermal Te	chnology II				
Subject	Thermal				
	Technology II				
Code	V04M141V01115				
Study	(*)Máster				
programme	Universitario en				
	Enxeñaría				
	Industrial				
Descriptors	ECTS Credits		Choose	Year	Quadmester
	3		Mandatory	lst	<u>1st</u>
Teaching	Spanish				
language	English				
Department					
Coordinator	Sieres Atienza, Jaime				
Lecturers	Sieres Atienza, Jaime				
E-mail	Jsieres@uvigo.es				
Web	At the second of the 's second school such as			a and al illa famili	
General	At the end of this course students are	expected to have	ve the knowledge	s and skills for	the selection, design and
description		amp;amp;R, S	stems (neating,	venulating, all o	
	Temperation).				
<u></u>	•				
Competenc	les				
			we and wattenals		
A4 Studen	ts can communicate their conclusions, a	and the knowled	ge and rationale	underpinning tr	lese, to specialist and
non-spe	ecialist audiences clearly and unampigu	iousiy.	antinua atuduina	in a way that	will be largely calf
AS Studen		enable them to		g in a way that i	will be largely sell-
	a of autonomous.	racassas facilit	ios and plants		
	powing how to communicate the conclu	usions and the	knowledge and ra	tionale underni	nning these to specialist
and not	-specialist audiences clearly and unam	higuously	chowledge and ra		ming these, to specialist
$\frac{100}{100}$ CFT10	Possess learning skills that will allow fu	inther study of a	self-directed or a	utonomous mo	de
C16 CTI5 K	nowledge and skills for the design and a	analysis of them	hal machines and	engines hydra	ulic machines and
facilitie	s for heat and industrial refrigeration		iai machines ana	clightes, flyara	and machines and
D1 ABFT-a	An ability to apply knowledge of math	ematics, science	and engineering	ז.	
D3 ABFT-C	An ability to design a system compon	ent or process t	o meet desired n	eeds within rea	listic constraints such as
econor	nic, environmental, social, political, ethi	cal, health and s	afety, manufactu	rability, and su	stainability.
D5 ABET-e	. An ability to identify, formulate, and so	olve engineering	problems.	<b>,</b> ,	
D11 ABFT-k	An ability to use the techniques, skills,	and modern en	aineerina tools n	ecessary for en	gineering practice.
			<u></u>		<u></u>
	Itcomoc				
Exported real	cults from this subject				Training and
Expected les					Learning Anu
	denote a data difference ta transference di				

	Learning Results
Know and understand the different types of systems and equipments used in air conditioning systems, for	r C1
both heating and refrigeration applications	C16
ow and understand the different types of systems and equipments used in air conditioning systems, for th heating and refrigeration applications now and understand the components used in heating and refrigeration equipments of air conditioning stems	D1
	D3
	D5
	D11
Know and understand the components used in heating and refrigeration equipments of air conditioning	C1
systems	
	D1
	D3
	D5
	D11

Ability to calculate heat engines and its main components	C1	
	C16	
	D1	
	D3	
	D5	
	D11	
Ability to perform designs, calculations and tests of heat engines, heating and refrigeration systems	A4	
Ability to calculate heat engines and its main components	A5	
	C1	
	C9	
	C10	
	D5	

Contents	
Торіс	
1. PSYCHROMETRICS	1. Moist air
	2. Psychrometric properties
	3. Psychrometric Charts
2. PSYCHROMETRIC PROCESSES	1. Introduction
	2. Adiabatic mixing of two streams
	3. Condition line and sensible heat ratio
	4. Sensible heating or cooling
	5. Cooling and dehumidification
	6. Heating and humidification
	7. Adiabatic humidification
	8. Heating and dehumidification
3. AIR CONDITIONING SYSTEMS	1. Introduction
	1.1 Concept of thermal load
	1.2. Concepts of space, zone and building
	1.3 Components of thermal loads
	2. Types of systems
	3. Air systems
	3.1. Basics
	3.2. Description of the system and components
	3.3. Calculations
	4. Water systems
	4.1. Basics
	4.2. Description of the system and components
	4.3. Calculations
	5. Air-water systems
	5.1. Basics
	5.2. Description of the system and components
	5.3. Calculations
	6. Direct expansion systems
	6.1. Basics
	6.2. Description of the system and components
4. VAPOR COMPRESSION REFRIGERATION	1. Introduction. Refrigerators and heat pumps
SYSTEMS	2. The reversed Carnot cycle
	3. Thermodynamic diagrams
	4. Ideal cycle or dry cycle
	5. Basic components of a refrigeration system
	5.1 Compressor
	5.2 Evaporator
	5.3 Condenser
	5.4. Expansion device
	6. Calculation parameters
	7. Actual refrigeration cycle
	8. Influence of the thermal conditions
	9. Liquid-vapor heat exchanger

Planning				
	Class hours	Hours outside the classroom	Total hours	
Lecturing	18	27	45	
Laboratory practical	6	6	12	
Autonomous problem solving	0	14	14	
Essay questions exam	3	0	3	

0

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Lecturing	Lecturer's introduction of the contents of the matter object of study
Laboratory practical	Real processes experimentations in the laboratory which complement the contents covered in the course. Use of software for modelling thermal systems.
Autonomous problem solving	Resolution of problems and/or exercises related with the course that the student will carry out following the classroom and/or laboratory guidelines. Examples of direct application of the contents studied as well as practical examples will be solved. The methodology will be focused on explaining how to solve the problems rather than on determining the final numerical solution.

Personalized assistance			
Methodologies	Description		
Laboratory practical	Students' questions or doubts about any of the course contents will be solved during the instructor's office hours.		
Lecturing	Students' questions or doubts about any of the course contents will be solved during the instructor's office hours.		

	Description	Qualification	Trainir	Training and Learning Results		
Essay questions exam	Final exam to evaluate the whole contents of the course	0-10	A4	C1	D1	
				C9	D3	
				C16	D5	
					D11	
Objective questions	The corresponding note to the Continuous Assessment will be	0-2	A4	C1	D1	
exam	based on written tests or essays		A5	C9	D3	
				C10	D5	
				C16	D11	

## Other comments on the Evaluation

Assessment: The final qualification (CF) is determined by adding the points obtained on the final exam (EF) and those obtained during the continuous assessment (EC). The continuous evaluation grade will be scored over 2 points and the final exam over 10 points. The final qualification is obtained from the following formula:

## CF=EC+(10-EC)\*EF/10

The points achieved by continuous assessment will be valid in the first and the second calls. None of the qualifications obtained in the final exam of the the first call will be saved for the second call.

Ethical commitment: The student is expected to present an adequate ethical behavior. In the event that an unethical behavior is detected (copying, plagiarism, use of unauthorized electronic devices, for example), it will be considered that the student does not meet the necessary requirements for passing the subject. Depending on the type of unethical behavior detected, it could be concluded that the student has not reached the competencies of the course.

IMPORTANT NOTE: this is the english translation of the subject guide. In the event of any conflict between the English and Spanish versions, the Spanish version shall prevail.

Sources of information

Basic Bibliography

ASHRAE, ASHRAE handbook. Fundamentals, ASHRAE, 2013

ASHRAE, ASHRAE handbook. Refrigeration, ASHRAE, 2014

Yunus A. Çengel, Afshin J. Ghajar, **Heat and mass transfer : fundamentals & amp; amp; amp; applications**, McGraw-Hill Education, 2015

Complementary Bibliography

ASHRAE, **ASHRAE handbook: heating, ventilating, and air-Conditioning systems and equipment**, ASHRAE, 2012 ASHRAE,, **ASHRAE handbook : heating, ventilating and air-conditioning applications**, ASHRAE, 2015 Wang S.K., **Handbook of air conditioning and refrigeration**, Mc Graw-Hill, 2001

Torrella Alcaraz E., Navarro Esbrí J., Cabello López R., Gómez Marqués F., Manual de climatización, AMV Ediciones, 2005

## Recommendations

#### **Other comments**

In order to take this course it is highly recommended that students have completed courses about thermodynamics, heat transfer and thermal engineering and technology.

In particular, a good background in psychrometrics and psychrometrics processes is strongly recommended.

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#### Contingency plan

## Description

## === EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

\* Teaching methodologies maintained: lecturing and autonomous problem solving will be mantained. For the classes the online platforms CampusRemoto and FaiTIC will be used.

\* Teaching methodologies modified: laboratory practices will be replaced by software modelling of thermal systems

- \* Non-attendance mechanisms for student attention (tutoring): email and the CampusRemoto platform will be used
- \* Modifications (if applicable) of the contents: none
- \* Additional bibliography to facilitate self-learning: none
- \* Other modifications: none

## === ADAPTATION OF THE TESTS ===

\* The assessment described in the "Assessment" section of the subject guide will continue to apply. However, the weight of the continuous evaluation part will be increased to a maximum of 4 points. The final weight of the continuous evaluation part will depend on the moment in which the extraordinary planning is activated. \*The platforms CampusRemoto and FaiTIC will be used for the different tests.

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