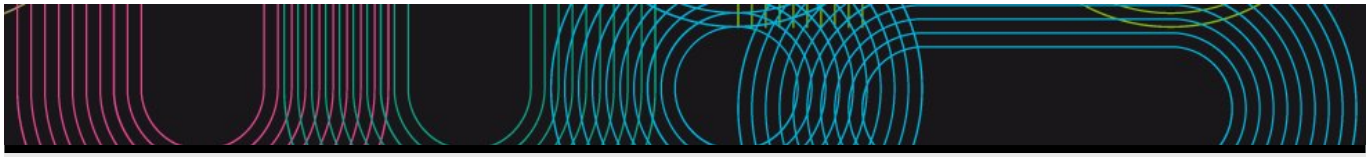

IDENTIFYING DATA				
Heating and cooling in the process industry				
Subject	Heating and cooling in the process industry			
Code	V12G350V01913			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cerdeira Pérez, Fernando			
Lecturers	Cerdeira Pérez, Fernando			
E-mail	nano@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The main objective is that the students acquire the basic knowledge related to the heat exchanges that take place in the different equipment and installations, such as the heat exchangers, boilers, heat pumps, etc. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Skills	
Code	
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
B5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
B7	CG7 Ability to analyze and assess the social and environmental impact of the technical solutions.
B11	CG11 Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer.
D2	CT2 Problems resolution.
D7	CT7 Ability to organize and plan.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.
D20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes		
Expected results from this subject	Training and Learning Results	
New	B4 B5 B6 B7 B11	D2 D7 D9 D10 D17 D20
New	B4 B5 B6 B7 B11	D2 D7 D9 D10 D17 D20

New	B4 B5 B6 B7 B11	D2 D7 D10 D17 D20
New	B4 B5 B6 B7 B11	D2 D7 D9 D10 D17 D20

Contents	
Topic	
Transmission of Heat	Heat exchangers . - Analysis of heat exchangers. - Method NTU - Types of exchangers. Boiling and condensation
Thermal engineering.	Processes of combustion. Burners. Boilers Ovens and dryers. Isolations.
Refrigeration technology	Refrigeration machine and Heat pump. Coefficients of efficiency. Vapor compression refrigeration cycles. Devices for the production of cold. Refrigerants Cryogenics.
Energetic efficiency	Application of the renewable energies (solar thermal, geothermal, biomass,...) as an energy source in the process industry.
-- Practical of laboratory and with support of the TIC	- Determination of the enthalpy of combustion. - Calculation of a deposit of LPG. - Study of the propagation of flame. - Higrometric study of the air. - Study of the heat exchangers. - Energetic balance of a boiler. - Visit to a boilers room.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	24	30	54
Laboratory practical	12	10	22
Problem solving	12	24	36
Mentored work	0	12	12
Practices through ICT	4	4	8
Field practice	5	2	7
Objective questions exam	1	10	11
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Explanation in blackboard supported with presentation in transparencies, videos and any material that the teacher consider useful to do comprehensible the syllabus of the subject.
Laboratory practical	Practices of laboratory applied.
Problem solving	Resolution of exercises and necessary practical cases to comprise the concepts seen in the classes of theory.
Mentored work	Execution of works individual and/or in group. Inside this activity includes the presentation of works in front of the group and his back evaluation.
Practices through ICT	Resolution of exercises by means of the support of computer programs.
Field practice	(*)Se realizan visitas a instalaciones térmicas reales (salas de máquinas de industrias de proceso) para conocer aspectos de eficiencia energética, medioambiental y seguridad de la práctica de la ingeniería. En algunos casos, tendrán que realizar una búsqueda bibliográfica previa de la normativa de obligado cumplimiento. Esta acción se completa con un breve cuestionario sobre nociones de salud y seguridad industrial.

Personalized assistance

Methodologies	Description
Lecturing	The professor will attend the doubts of the students so much in the classroom as in the schedule of tutorial.
Laboratory practical	The professor will attend the doubts of the students so much in the laboratory as in the schedule of tutorial.
Problem solving	The professor will attend the doubts of the students so much in the classroom as in the schedule of tutorial.
Practices through ICT	The professor will attend the doubts of the students so much in the computer classroom as in the schedule of tutorial.
Mentored work	The professor will attend the doubts of the students so much in the classroom as in the schedule of tutorial.

Assessment				
	Description	Qualification	Training and Learning Results	
Lecturing	Classical master explanation on whiteboard supported by presentation on transparencies, videos and any material that the teacher considers useful to make the syllabus of the subject.	30	B4 B5 B6 B7	D2 D9 D10
Problem solving	Realization of applied laboratory practices	30	B4 B5 B6 B7	D2 D9 D10
Mentored work	Preparation of a memory and presentation of the work proposed, individually or in group, on the thematic proposal to the start of course.	20	B4 B5 B6 B7 B11	D7 D9 D10 D17 D20
Objective questions exam	Objective proof(s) consisting of short questions or multiple choice to know the progressive evolution of the students during the development of the matter.	20	B4 B5 B6 B7 B11	D7 D9

Other comments on the Evaluation

The continuous evaluation (EC, 40%) will be evaluated through the work and of objective proofs; those that have renounced officially to the EC will have to make a specific questionnaire (SQ) at the earliest opportunity of the course call.

In the second opportunity (July call), the students that have made the EC will be able to choose between keeping the EC mark or make the SQ of the second opportunity.

The End of Degree call will be fully evaluated by means of an exam (100%), that is, the EC of the previous course will not be taken into account.

A numerical rating system of 0 to 10 points will be used according to current legislation (RD 1125/2003, September 5, BOE September 18).

It is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

The use of any electronic device for the assessment tests is not allowed unless explicitly authorized. The fact of introducing unauthorized electronic device in the examination room will be considered reason for not passing the subject in the current academic year and will hold overall rating (0.0).

Sources of information

Basic Bibliography

Incropera, F.P. et al, **Principles of heat and mass transfer**, 7th ed., international student version, 2013

Múñoz Domínguez, M.; Rovira de Antonio, A.J., **Ingeniería Térmica**, 2006

Complementary Bibliography

Moran, Michael J.; Shapiro, Howard N., **Fundamentos de termodinámica técnica**, 2ª ed., 2004

Rey Martínez F.J.; Velasco Gómez E., **Bombas de calor y energías renovables en edificios**, 2005
Torrella Alcaraz, Enrique, **Frío industrial : métodos de producción**, 2010
Kohan, Anthony L., **Manual de calderas**, 2000
Kreith, Frank, **The CRC handbook of thermal engineering**, 2000

Recommendations

Subjects that it is recommended to have taken before

(*)Física: Física I/V12G350V01102
(*)Física: Física II/V12G350V01202
Chemistry: Chemistry/V12G350V01205
Thermodynamics and heat transfer/V12G350V01301

Other comments

To enrol in this matter is necessary to have surpassed or enrol of all the subjects of the inferior courses.