[GCLL02] THERMAL ENGINEERING

GENERAL INFORMATION

Studies	DEGREE IN ENGINEERING IN ECO-TECHNOLOGY IN INDUSTRIAL PROCESS	**Subject**	THERMAL AND FLUID ENGINEERING
Semester	2 **Course** 2	**Mention / Field of specialisation**	
Character	COMPULSORY		
Plan	2013	**Language**	ENGLISH
Credits	6 **Hours/week** 3.22	**Total hours**	58 class hours + 92 non-class hours = **150 total hours**

PROFESSORS

ZARATE LARRINAGA, ENRIQUE

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
MATHEMATICAL FOUNDATIONS I	*(No previous knowledge required)*
MATHEMATICAL FOUNDATIONS II	
PHYSICS MECHANICS	
ELECTRICAL PHYSICS	

SKILLS

SKILLS	*ECTS*
G1C219 - To have knowledge of applied thermodynamics and heat transfer. To understand the fundamental principles and apply them to problems of engineering.	5,52
G1C227 - To be able to work in multidisciplinary, multilingual environments, and to effectively communicate knowledge, procedures, results and ideas about Eco-technologies for industrial Processes both verbally and in writing.	0,48
Total:	**6**

LEARNING RESULTS

RGC291 Analyses and discusses the mass and energy balance, the efficiency and the reversibility of thermodynamic processes in closed and open systems.

LEARNING ACTIVITIES	*CH*	*NCH*	*TH*
Classroom presentations of relevant concepts and procedures in participatory environments.	25 h.		25 h.
Individual study and work, tests and evaluations.	4 h.	15 h.	19 h.
Individual and group exercises.	8 h.	15 h.	23 h.
Problem solving practice and projects in real contexts.	4 h.	4 h.	8 h.

EVALUATION SYSTEM	*W*
Individual written and oral tests to assess technical skills in the subject.	85%
Exercise reports, practical case studies, computer simulations and laboratory practices	15%

Comments: Students will develop a short project about power and cooling thermodynamic cycles

MAKE-UP MECHANISMS

Individual written and oral tests to assess technical skills in the subject.

Comments: > Final mark of the written tests in case retake is necessary: Retake exam (75%) + First exam (25%). > The rest of activities will have a continuous assessment.

CH - Class hours: 41 h.
NCH - Non-class hours: 34 h.
TH - Total hours: 75 h.

RGC292 Analyses the different mechanisms of heat transfer.

LEARNING ACTIVITIES	*CH*	*NCH*	*TH*
Classroom presentations of relevant concepts and procedures in participatory environments.	10 h.		10 h.
Individual and group exercises.	7 h.	8 h.	15 h.
Individual study and work, tests and evaluations.		5 h.	5 h.

EVALUATION SYSTEM	*W*
Individual written and oral tests to assess technical skills in the subject.	85%
undefined	15%

Comments:

MAKE-UP MECHANISMS

Individual written and oral tests to assess technical skills in the subject.

Comments: > Final mark of the written tests in case retake is necessary: Retake exam (75%) + First exam (25%). > The rest of activities will have a continuous assessment.

CH - Class hours: 17 h.
NCH - Non-class hours: 13 h.
TH - Total hours: 30 h.

RGC293 **[!]** ***Aplica los conceptos y las herramientas de Ecotecnologías y Procesos Industriales en un entorno práctico***

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of group projects and/or POPBL.		33 h.	33 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Documentation handed in, results obtained, presentation and technical defence made and skills and attitudes shown by the student in the End of Semester Project and End of Degree Project.	100%	Continuous assessment
Comments:		**Comments:**

CH - Class hours: 0 h.
NCH - Non-class hours: 33 h.
TH - Total hours: 33 h.

RGC2171 **[!]** ***Define los objetivos, realiza la planificación para su consecución y su seguimiento sistemático coordinando su trabajo con los demás miembros del equipo.***

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of group projects and/or POPBL.		3 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Documentation handed in, results obtained, presentation and technical defence made and skills and attitudes shown by the student in the End of Semester Project and End of Degree Project.	100%	Continuous assessment
Comments:		**Comments:**

CH - Class hours: 0 h.
NCH - Non-class hours: 3 h.
TH - Total hours: 3 h.

RGC2172 **[!]** ***Argumenta la selección de las teorÍas, métodos y/o tecnologías más relevantes que permitan definir y/o solucionar un problema utilizando bibliografía internacional.***

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of group projects and/or POPBL.		3 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Documentation handed in, results obtained, presentation and technical defence made and skills and attitudes shown by the student in the End of Semester Project and End of Degree Project.	100%	Continuous assessment
Comments:		**Comments:**

CH - Class hours: 0 h.
NCH - Non-class hours: 3 h.
TH - Total hours: 3 h.

RGC2173 **[!]** ***Redacta informes técnicos de forma clara, concisa y estructurada siguiendo las especificaciones establecidas haciendo énfasis en la coherencias entre los distintos apartados .***

LEARNING ACTIVITIES	CH	NCH	TH

Development, writing and presentation of group projects and/or POPBL.	3 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Documentation handed in, results obtained, presentation and technical defence made and skills and attitudes shown by the student in the End of Semester Project and End of Degree Project. **Comments:**	100%	Continuous assessment **Comments:**

CH - Class hours: 0 h.
NCH - Non-class hours: 3 h.
TH - Total hours: 3 h.

RGC2174 **[!]** ***Presenta y defiende el trabajo en público de forma clara, concisa y estructurada mediante el uso apropiado de soporte visual según las especificaciones establecidas.***

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of group projects and/or POPBL.		3 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Documentation handed in, results obtained, presentation and technical defence made and skills and attitudes shown by the student in the End of Semester Project and End of Degree Project. **Comments:**	100%	Continuous assessment **Comments:**

CH - Class hours: 0 h.
NCH - Non-class hours: 3 h.
TH - Total hours: 3 h.

CONTENTS

1. Basic concepts
2. First law of thermodynamics (closed systems)
3. Properties of pure substances
4. Open systems
5. Second law of thermodynamics. Entropy. Exergy
6. Fundamentals of heat transfer
7. Conduction
8. Convection
9. Heat exchangers

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Moodle Platform	Y. A. Çengel, M. A. Boles “Thermodynamics. An Engineering Approach”, Mc Graw Hill, 8th edition (2015).
Class presentations	Y. A. Çengel, A. J. Ghajar “Heat and Mass Transfer”, Mc Graw Hill, 5th edition (2015) (Euskaraz ere).
Topic related web quires	(Ebook) M. Massoud, “Engineering Thermofluids”, Springer (2005).
Specific Master Software	(Ebook) H. Struchtrup, “Thermodynamics and Energy Conversion”, Springer (2014).
Slides of the subject	(Ebook) J. H. Lienhard IV, J. H. Lienhard V “A Heat Transfer Textbook”, 4th edition (2012).
	M. J. Moran, H. N. Shapiro, D. D. Boettner, M. B. Bailey, “Fundamentals of Engineering Thermodynamics”. 8th edition (2014) (Euskeraz ere).
	G. Rogers, Y. Mayhew, “Engineering Thermodynamics: Work and Heat Transfer”, Pearson, 4th edition (1992).
	T. L. Bergman, A. S. Lavine, F. P. Incropera, D. P. Dewitt, “Fundamentals of Heat and Mass Transfer”, 7th edition (2011).

Eastop & McConkey, “Applied Thermodynamics for Engineering Technologists”, Pearson-Prentice Hall (1993).