

**1. General information****Course:** THERMAL MACHINES**Type:** ELECTIVE**Degree:** 421 - UNDERGRADUATE DEGREE PROG. IN MECHANICAL ENGINEERING**Center:** 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL**Year:** 4**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 56367**ECTS credits:** 6**Academic year:** 2022-23**Group(s):** 20**Duration:** C2**Second language:** English**English Friendly:** Y**Bilingual:** N**Lecturer:** MAGIN LAPUERTA AMIGO - Group(s): 20

Building/Office	Department	Phone number	Email	Office hours
Politécnico/2-D17	MECÁNICA ADA. E ING. PROYECTOS	926295431	magin.lapuerta@uclm.es	Anytime, after appointment

2. Pre-Requisites

Previous knowledge on Thermodynamics, Heat transfer, Fluid mechanics, chemistry and basic mathematical tools for engineers

3. Justification in the curriculum, relation to other subjects and to the profession

Basic knowledge on the most widely used power plants (reciprocating internal combustion engines and turbomachinery) will likely be applied in the professional exercise of both Mechanical and Energy intensifications

4. Degree competences achieved in this course**Course competences**

Code	Description
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
CB03	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
CB05	Have developed the necessary learning abilities to carry on studying autonomously
CEO38	Capacity to manage, analyse and design hydraulic machines, thermal machines and combustion installations and devices.
CG03	Knowledge of basic and technological subjects to facilitate learning of new methods and theories, and provide versatility to adapt to new situations.
CG04	Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of industrial engineering.
CG05	Knowledge required to carry out measurements, calculations, valuations, appraisals, valuations, surveys, studies, reports, work plans and other similar work.
CG06	Ability to handle specifications, regulations and mandatory standards.
CG07	Ability to analyse and assess the social and environmental impact of technical solutions.
CT02	Knowledge and application of information and communication technology.
CT03	Ability to communicate correctly in both spoken and written form.

5. Objectives or Learning Outcomes**Course learning outcomes****Description**

Theoretical and applied knowledge of internal combustion engines and turbomachinery.

6. Units / Contents**Unit 1: General characteristics and thermodynamic cycles in reciprocating internal combustion engines****Unit 2: Parameters in reciprocating internal combustion engines****Unit 3: Gas exchange processes in 4-stroke and 2-stroke engines****Unit 4: Mechanical losses****Unit 5: Heat losses****Unit 6: Mixing, ignition and combustion in spark ignition engines****Unit 7: Mixing, autoignition and combustion in compression ignition engines****Unit 8: Pollutant emissions**

Unit 9: Introduction to turbomachinery

Unit 10: Reaction engines

Unit 11: Euler equation for stages in turbines and compressors

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CB01 CB02 CB03 CB04 CB05 CEO38 CG03 CG05 CG06 CG07 CT02 CT03	1	25	N	-	
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	CB01 CB02 CB03 CB05 CEO38 CG03 CG05 CG06	0.6	15	Y	Y	
Formative Assessment [ON-SITE]	Assessment tests	CB01 CB02 CB03 CB04 CB05 CEO38 CG03 CG04 CG05 CG06 CG07	0.2	5	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	CB01 CB02 CB03 CB04 CB05 CEO38 CG03 CG04 CG05 CG06 CG07	3.6	90	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CB01 CB02 CB03 CB04 CB05 CEO38 CG03 CG04 CG06 CG07	0.6	15	N	-	
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Final test	0.00%	70.00%	Non continuous assessment: Two blocks at the end, both scoring 35% of the final score. A minimum score of 4 out of 10 is required.
Laboratory sessions	15.00%	15.00%	Continuous evaluation: Compulsory attendancy and presentation of a report. Non-continuous evaluation: Questions will be included in a specific test in the ordinary and extraordinary calls about concepts learned in laboratory sessions
Assessment of problem solving and/or case studies	15.00%	15.00%	Practical cases about reciprocating engines and turbomachinery, to be solved in the ordinary and extraordinary calls, scoring 7.5% each Continuous evaluation: the first case will be included in the progress test Non-continuous evaluation: Both cases will be solved in the ordinary and extraordinary calls.
Mid-term tests	70.00%	0.00%	Continuous assessment: Two progress tests at the end, both scoring 35% of the final score, and one in the middle covering the first part. Compensation between them is only possible from a score of 4 out of 10.
Total:	100.00%	100.00%	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The course will be passed if after weighting both parts, the final score is higher than 5

Non-continuous evaluation:

The course will be passed if after weighting both parts, the final score is higher than 5

Specifications for the resit/retake exam:

Same as in the ordinary call

Specifications for the second resit / retake exam:

Same as in the ordinary call

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	25
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	15
Formative Assessment [PRESENCIAL][Assessment tests]	5

Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	15
Global activity	
Activities	hours
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	15
Class Attendance (theory) [PRESENCIAL][Lectures]	25
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	15
Formative Assessment [PRESENCIAL][Assessment tests]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Total horas: 150	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
F. PAYRI, J.M. DESANTES	MOTORES DE COMBUSTION INTERNA ALTERNATIVOS	REVERTE-UPV		978-84-291-4802--2	2011	
J.K. MATTINGLY	ELEMENTS OF GAS TURBINE PROPULSION	MCGRAW-HILL		0-07-912196-9	1996	
M. MUÑOZ	PROBLEMAS RESUELTOS DE MOTORES TÉRMICOS Y TURBOMÁQUINAS TÉRMICAS	UNED		978-84-362-5564-5	2009	
S.J. FYGUEROA, J.O. ARAQUE	PROBLEMAS DE MOTORES DE COMBUSTION INTERNA	SPUA		980-11-0658-1	2003	
C. MATAIX	TURBOMÁQUINAS TÉRMICAS: TURBINAS A VAPOR, TURBINAS DE GAS,	DOSSAT 2000		84-237-0727-X	1999	
J.B. HEYWOOD	INTERNAL COMBUSTION ENGINE FUNDAMENTALS	MCGRAW-HILL		0-07-100499-8	1988	