

**1. General information****Course:** HYDRAULIC MACHINES**Type:** ELECTIVE**Degree:** 353 - UNDERGRADUATE DEGREE PROG. IN MECHANICAL ENGINEERING (CR)**Center:** 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL**Year:** 4**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 56365**ECTS credits:** 6**Academic year:** 2021-22**Group(s):** 20 21**Duration:** C2**Second language:** English**English Friendly:** Y**Bilingual:** N**Lecturer:** MANUEL DOMINGO BARRIGA CARRASCO - Group(s): 20

Building/Office	Department	Phone number	Email	Office hours
Politécnico/2-A26	MECÁNICA ADA. E ING. PROYECTOS	Vía Teams	manuel.d.barriga@uclm.es	

**Lecturer:** GONZALO RODRIGUEZ PRIETO - Group(s): 20

Building/Office	Department	Phone number	Email	Office hours
INEI	MECÁNICA ADA. E ING. PROYECTOS	926055036	gonzalo.rprieto@uclm.es	

**2. Pre-Requisites**

The subjects of the previous courses related to fluids are fundamental, but all the subjects of the previous courses should be approved before facing this one.

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

Hydraulic circuits including a pump or a turbine are very frequent in industrial environment. This subject proposes to familiarize the students with this type of elements and their integration in a hydraulic circuit, and teach them to design one of the most used pumps, the centrifugal pump. The knowledge that is used is closely related to those acquired in "Fluid Mechanics" and "Engineering of Fluids"

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

Code	Description
A02	To know how to apply knowledge to work or vocation in a professional manner and possess the competences that are usually demonstrated by the formulation and defence of arguments and the resolution of problems in the field of study.
A03	To have the capability to gather and interpret relevant data (normally within the area of study) to make judgements that include a reflection on themes of a social, scientific or ethical nature.
A04	To be able to transmit information, ideas, problems and solutions to a specialized audience.
A05	To have developed the learning skills necessary to undertake subsequent studies with a greater degree of autonomy.
A13	Ability to take the initiative to solve problems, take decisions, creativity, critical reasoning and ability to communicate and transmit knowledge, skills and abilities in Mechanical Engineering.
A16	Ability to analyse and evaluate the social and environmental impact of technical solutions.
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.
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
E07	Ability to manage, analyse and design hydraulic and thermal machinery.

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

Not established.

**Additional outcomes**

Knowledge of the various types of hydraulic machines Design of a centrifugal pump Design of a hydraulic circuit, counting on the Cavitation effects and optimal diameter choice

**6. Units / Contents****Unit 1: Introduction to hydraulic machines****Unit 2: Hydraulic turbomachines theory (centrifugal pumps)****Unit 3: Cavitation phenomena in turbomachines**

## ADDITIONAL COMMENTS, REMARKS

These themes correspond to the themes of the guide as follows:

Topic 1 and 2: Energy balance, physical similarity, 1D theory, 2D theory, characteristic curve for centrifugal pumps.

Topic 3: Cavitation, water hammer, economic diameter, design of the pump and hydraulic circuit for a certain industrial application.

## 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	A02 A03 A04 A05	1.12	28	N	-	
Problem solving and/or case studies [ON-SITE]	Cooperative / Collaborative Learning	A02 A03 A04 A05	0.8	20	N	-	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	A02 A03 A04 A05	0.4	10	Y	Y	
Final test [ON-SITE]	Assessment tests	A02 A03 A04 A05 A13 CB01 CB03 CB04 CB05	0.08	2	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	A02 A03 A04 A05 A13 CB01 CB03 CB04 CB05	3.28	82	N	-	
Practicum and practical activities report writing or preparation [OFF-SITE]	Cooperative / Collaborative Learning	A02 A03 A04 A05 A13 A16 CB01 CB03 CB04 CB05 E07	0.32	8	Y	Y	
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 2.4</b>			<b>Total class time hours: 60</b>				
<b>Total credits of out of class work: 3.6</b>			<b>Total hours of out of class work: 90</b>				

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
Practicum and practical activities reports assessment	30.00%	30.00%	
Progress Tests	20.00%	20.00%	
Final test	50.00%	50.00%	
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

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 exam will consist of problems and / or theoretical questions related to the whole subject, the work and the memories of practices will be delivered before the exam, in a deadline to be specified.

#### Non-continuous evaluation:

Evaluation criteria not defined

### Specifications for the resit/retake exam:

There is only one exam.

### Specifications for the second resit / retake exam:

Due to the type of resit, please contact the teacher beforehand to specify dates and other topics.

## 9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
<b>Hours</b>	<b>hours</b>
Final test [PRESENCIAL][Assessment tests]	2
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	8
<b>Unit 1 (de 3): Introduction to hydraulic machines</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	10
Problem solving and/or case studies [PRESENCIAL][Cooperative / Collaborative Learning]	7
Study and Exam Preparation [AUTÓNOMA][Self-study]	28
<b>Unit 2 (de 3): Hydraulic turbomachines theory (centrifugal pumps)</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	9
Problem solving and/or case studies [PRESENCIAL][Cooperative / Collaborative Learning]	7
Study and Exam Preparation [AUTÓNOMA][Self-study]	27
<b>Unit 3 (de 3): Cavitation phenomena in turbomachines</b>	

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	9
Problem solving and/or case studies [PRESENCIAL][Cooperative / Collaborative Learning]	6
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	10
Study and Exam Preparation [AUTÓNOMA][Self-study]	27
<b>Global activity</b>	
Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	28
Problem solving and/or case studies [PRESENCIAL][Cooperative / Collaborative Learning]	20
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	10
Final test [PRESENCIAL][Assessment tests]	2
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	8
Study and Exam Preparation [AUTÓNOMA][Self-study]	82
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Cristopher E. Brennen	Hydrodynamics of Pumps.	Oxford University Press		0198564422		
Claudio Mataix	Mecánica de Fluidos y Máquinas Hidráulicas.	Ediciones del Castillo		8421901753		
Blas Zamora Parra y Antonio Viedma Robles	Máquinas Hidráulicas. Teoría y Problemas. <a href="http://repositorio.upct.es/bitstream/handle/10317/5476/isbn9788416325191.pdf">http://repositorio.upct.es/bitstream/handle/10317/5476/isbn9788416325191.pdf</a>	CraizUPCT ediciones		9788416325191		
Agüero Soriano, Jose	Mecánica de Fluidos incompresibles y turbomáquinas hidráulicas. <a href="http://www.uco.es/termodinamica/">http://www.uco.es/termodinamica/</a>	Ciencia 3, Córdoba		84953910105		