



## 1. General information

Course: HYDRAULIC STRUCTURES AND HYDROPOWER PLANTS  
Type: CORE COURSE  
Degree: 2343 - MASTERS DEGREE PROGRAMME IN ENGINEERING OF ROADS, CANALS AND PORTS  
Center: 603 - E.T.S. CIVIL ENGINEERS OF CR  
Year: 1

Main language: English

Use of additional languages:

Web site:

Code: 310807  
ECTS credits: 4.5  
Academic year: 2023-24  
Group(s): 20  
Duration: C2  
Second language: English  
English Friendly: N  
Bilingual: N

Lecturer: SARAI DIAZ GARCIA - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
A37	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	926052824	Sarai.Diaz@uclm.es	These hours are not final: Monday from 15:00 to 18:00, Wednesday from 15:00 to 18:00
Lecturer: JAVIER GONZALEZ PEREZ - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
A38	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	926295422	javier.gonzalez@uclm.es	These hours are not final: Monday from 15:00 to 18:00, Thursday from 15:00 to 18:00

## 2. Pre-Requisites

Numerical Analysis

Hydraulic Engineering

Geotechnics

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

This course allows the student to acquire knowledge and skills associated with the operation of Hydraulic Structures and Systems, linking the theoretical aspects of fluid mechanics and hydraulic engineering, with the techniques of engineering problem solving using

## 4. Degree competences achieved in this course

## Course competences

Code	Description
AFC1	Ability to address and solve advanced mathematical engineering problems, from problem solving to formulation development and implementation in a computer program. In particular, the ability to formulate, program and apply advanced analytical and numerical models for calculation, design, planning and management, as well as the ability to interpret the results obtained, in the context of civil engineering.
CB10	Have the learning skills which allow to continue studying in a self-directed or autonomous way
G01	Scientific-technical and methodological capacity for the continuous recycling of knowledge and the exercise of the professional functions of consultancy, analysis, design, calculation, project, planning, leadership, management, construction, maintenance, conservation and exploitation in the fields of civil engineering.
G13	Ability to plan, carry out studies and design surface or groundwater intake structures (dams, pipelines, pumping).
G27	Ability to communicate in a second language.
TE04	Ability to design, dimension, build and maintain waterworks.

## 5. Objectives or Learning Outcomes

## Course learning outcomes

## Description

Students are familiar with the usual orders of magnitude in hydraulic works in Civil Engineering.  
Students numerically analyze the behavior of a hydraulic work design.  
Students are aware of the environmental implications of interventions in hydraulic works.  
Students understand the principles of operation, design and maintenance of the different types of hydraulic works common in Civil Engineering.

## 6. Units / Contents

## Unit 1: Open Channel and Drainage

Unit 1.1 Unsteady Open Channel and Channel Flow Management

Unit 1.2 Open Channel Design

## Unit 2: Pressure flow and pumping systems

Unit 2.1 Unsteady pressure flow. Protection elements.

## Unit 3: Flood defense structures and river management

Unit 3.1 Sediment traps. Erosion protection.

Unit 3.2 Flood control structures.

## Unit 4: Dam Engineering

Unit 4.1 Tensional state computation in concrete dams.

Unit 4.2 Stability analysis in earth filled dams.

## Unit 5: Dam outlet works

Unit 5.1 Spillway design and outlets elements

## Unit 6: Turbines and hydroelectric power

Unit 6.1 Turbines desing

## 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]	Combination of methods	AFC1 CB10 G01 G13 G27 TE04	0.48	12	N	-	
Workshops or seminars [ON-SITE]	Combination of methods	AFC1 CB10 G01 G13 G27 TE04	0.48	12	Y	N	This part cannot be retaken
Project or Topic Presentations [ON-SITE]	Project/Problem Based Learning (PBL)	AFC1 CB10 G01 G13 G27 TE04	0.39	9.75	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	AFC1 CB10 G01 G13 G27 TE04	1.12	28	N	-	
Writing of reports or projects [OFF-SITE]	Project/Problem Based Learning (PBL)	AFC1 CB10 G01 G13 G27 TE04	2.03	50.75	Y	Y	
Final test [ON-SITE]	Assessment tests	AFC1 CB10 G01 G13 G27 TE04		0	Y	Y	Partial and final exams (outside of class hours)
Total:			4.5	112.5			
Total credits of in-class work: 1.35							Total class time hours: 33.75
Total credits of out of class work: 3.15							Total hours of out of class work: 78.75

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	40.00%	40.00%	Exam
Assessment of active participation	10.00%	0.00%	This part cannot be retaken
Assessment of problem solving and/or case studies	40.00%	40.00%	Submission of case studies
Oral presentations assessment	0.00%	10.00%	Oral presentation of a scientific paper related to the subject
Oral presentations assessment	10.00%	10.00%	Presentation and defense of case studies
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:

Details about the content, length and requirements of written works will be indicated at the beginning of the semester.

The submission of case studies is mandatory and must have a global grade  $\geq 4$  points out of 10.

The presentation of case studies is mandatory and must have a minimum grade of 4 out of 10.

The test must have a grade  $\geq 4$  points out of 10.

The minimum overall grade to pass the module is 5 out of 10.

The grades associated with the case studies and the assessment of active participation are kept from one year to the next as long as the topic is the same and the student has presented him/her-self to one of the previous year calls.

## Non-continuous evaluation:

Unless stated otherwise, continuous evaluation criteria will be applied to all students.

Anyone choosing non-continuous assessment must notify it to the lecturer within the class period of the subject. The option is only available if the student's participation in evaluation activities (from the continuous assessment) has not reached 50% of the total evaluation for the subject.

Details about the content, length and requirements of written works will be indicated at the beginning of the semester.

The submission of case studies is mandatory and must have a global grade  $\geq 4$  points out of 10.

The presentation of case studies is mandatory and must have a minimum grade of 4 out of 10.

The test must have a grade  $\geq 4$  points out of 10.

The minimum overall grade to pass the module is 5 out of 10.

The grades associated with the case studies and the presentation of a scientific paper are kept from one year to the next as long as the topic is the same and the student has presented himself/herself to one of the previous year calls.

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

For the retake exam, the assessment type used for the final exam will remain valid.

Grades above the established minimum will be maintained from the final exam. The remaining activities (except the assessment of active participation) can be retaken.

The submission of case studies is mandatory and must have a global grade  $\geq 4$  points out of 10.

The presentation of case studies is mandatory and must have a minimum grade of 4 out of 10.

The test must have a grade  $\geq 4$  points out of 10.

The minimum overall grade to pass the module is 5 out of 10.

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

Same criteria than for the resit/retake exam.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
<b>Unit 1 (de 6): Open Channel and Drainage</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1.8
Workshops or seminars [PRESENCIAL][Combination of methods]	1.8
Project or Topic Presentations [PRESENCIAL][Project/Problem Based Learning (PBL)]	1.46
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	7.61
<b>Unit 2 (de 6): Pressure flow and pumping systems</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1.8
Workshops or seminars [PRESENCIAL][Combination of methods]	1.8
Project or Topic Presentations [PRESENCIAL][Project/Problem Based Learning (PBL)]	1.46
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	7.61
<b>Unit 3 (de 6): Flood defense structures and river management</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1.8
Workshops or seminars [PRESENCIAL][Combination of methods]	1.8
Project or Topic Presentations [PRESENCIAL][Project/Problem Based Learning (PBL)]	1.46
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	7.61
<b>Unit 4 (de 6): Dam Engineering</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	3
Workshops or seminars [PRESENCIAL][Combination of methods]	3
Project or Topic Presentations [PRESENCIAL][Project/Problem Based Learning (PBL)]	2.44
Study and Exam Preparation [AUTÓNOMA][Self-study]	8
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	12.69
<b>Unit 5 (de 6): Dam outlet works</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1.8
Workshops or seminars [PRESENCIAL][Combination of methods]	1.8
Project or Topic Presentations [PRESENCIAL][Project/Problem Based Learning (PBL)]	1.46
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	7.61
<b>Unit 6 (de 6): Turbines and hydroelectric power</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Combination of methods]	1.8
Workshops or seminars [PRESENCIAL][Combination of methods]	1.8
Project or Topic Presentations [PRESENCIAL][Project/Problem Based Learning (PBL)]	1.47
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	7.62
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Workshops or seminars [PRESENCIAL][Combination of methods]	12
Study and Exam Preparation [AUTÓNOMA][Self-study]	28
Class Attendance (theory) [PRESENCIAL][Combination of methods]	12
Project or Topic Presentations [PRESENCIAL][Project/Problem Based Learning (PBL)]	9.75
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	50.75
<b>Total horas: 112.5</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Cítr	ISBN	Year	Description
CEDEX	Guía técnica sobre redes de saneamiento y drenaje urbano	CEDEX			2009	
COMITÉ NACIONAL ESPAÑOL DE GRANDES PRESAS	Guía técnica de seguridad de presas nº6: Construcción de presas y control de calidad	CNEGP-CICCP			1999	
Liria, J.	Canales hidráulicos: Proyecto, construcción, gestión y modernización	CICCP			2001	
Mays, L.	Water resources engineering	John Wiley and Sons			2000	
USBR	Hydraulic design of stilling basins and energy dissipators	USBR			1984	
USBR	Design of small dams	USBR			1987	
Colorado Energy Office	Small hydropower handbook	Colorado Energy Office			2011	
USBR	Design of gravity dams: Design manual for concrete gravity dams	USBR			1976	
Roads and Traffic Authority	Culvert risk assessment guideline	NSW			2010	
Wurbs, R. and James, W.	Water resources engineering	Prentice Hall			2002	
Vallarino, E.	Tratado Básico de Presas: Tomo II	CICCP			2006	
COMITÉ NACIONAL ESPAÑOL DE GRANDES PRESAS	Guía técnica de seguridad de presas nº2: Criterios para proyectos de presas y sus obras anejas (Tomo I)	CNEGP-CICCP			2003	
Ministerio de Fomento	Norma 5.2-IC Drenaje superficial de la Instrucción de Carreteras	BOE			2016	
Gulliver, J.S. and Arndt, R.E.A.	Hydropower engineering handbook	McGraw-Hill			1991	
CEDEX	Guía técnica sobre tuberías para el transporte de agua a presión	CEDEX			2002	
Vallarino, E.	Tratado Básico de Presas: Tomo I	CICCP			2006	
Chow, Ven Te	Hidráulica de canales abiertos / Ven Te Chow	Diana		968-13-1327-5	1993	
Brater, Ernest F.Ernest Frederick1912-	Handbook of hydraulics: for the solution of hydraulic engine	Mc-Graw-Hill		0-07-007247-7	1996	
Díez-Cascón Sagrado, Joaquín	Ingeniería de presas: presas de fábrica	Servicio de Publicaciones de la Universidad de Can		84-8102-292-6	2001	
ASCE	Journal of hydraulic engineering	American Society of Civil Engineers		0733-9429	1983	