UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: FLUVIAL HYDRAULICS
Code: 38339
Type: CORE COURSE
ECTS credits: 6
Degree: 345 - UNDERGRADUATE DEGREE PROGRAMME IN CIVIL ENGINEERING
Academic year: 2023-24
Center: 603 - E.T.S. CIVIL ENGINEERS OF CR
Group(s): 20
Year: 3
Duration: C2
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **ALVARO GALAN ALGUACIL** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
A43	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	926051927	alvaro.galan@uclm.es	Tentative: Wednesday: 08:30 to 10:00 and 16:30 to 17:30 hours Thursday: 08:30 to 10:00 hours Friday: 12:00 to 14:00 hours

2. Pre-Requisites

It is highly recommended for the student to have completed the subject "Hydraulic Engineering"

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

In this subject we go into further detail about the knowledge on morphology and fluvial dynamics introduced in the subjects of "Hydraulic Engineering" and "Hydrological and Fluvial Engineering". During the course a special attention will be paid to sediment transport issues and to the study of technical solutions for the restoration and environmental adaptation of river and the knowledge and understanding of the functioning of ecosystems and environmental factors.

4. Degree competences achieved in this course

Course competences

Code	Description
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.
CE01	Students can apply their knowledge in the practical solution of civil engineering problems, with capacity for the analysis and definition of the problem, the proposal of alternatives and their critical evaluation, choosing the optimal solution with technical arguments and with capacity of defense against third parties.
CE08	Students have basic knowledge of geology and geomorphology and their application in problems related to engineering. Climatology
CE25	Students have the capacity for the spatial planning of fluvial areas and the flood plains, knowing the processes and tools for modelling the natural dynamics of these areas and the risks to which they are subjected by anthropogenic pressures.
CE33	Students have the ability to apply ecological and landscape criteria to the practice of the profession of Civil Engineer in general, with special attention to the functions of design, project, construction, operation and monitoring.
CE34	Students reach the understanding of the ecological, environmental and landscape constraints of a technical and legal nature that arise in the construction of a public work, and the ability to use proven methods and technologies, with the aim of achieving the greatest efficiency in construction while respecting the environment.
CG02	Students can use proper oral and written communication
H02	Students have knowledge and understanding of the functioning of ecosystems and environmental factors.

5. Objectives or Learning Outcomes

Course learning outcomes

Description
Knowledge of physical modellling, their possibilities and their limitations
Capacity of calculate rating curves of erodible sections with and without sediment transport
Ability to calculate protections of frequent fluvial structures
Capacity of design non-erodible channel section with granular materials
Capacity to calculate sediment transport in rivers
Knowledge of the main properties of sediments related to the sediment transport phenomena
Knowledge of the dynamic equilibrium in rivers and ability to evaluate the effects of some anthropic actions on rivers
Knowledge of the sediment transport mechanisms in rivers
Knowledge of the basic principles of the pollutants transport in rivers

6. Units / Contents

Unit 1: Properties of the sediments

Unit 1.1 Introduction

Unit 1.2 Characterization of an individual particle
Unit 1.3 Characterization of a sediment sample
Unit 1.4 Sediment Sampling Methodology

Unit 2: Sediment entrainment and bed forms
Unit 2.1 Analysis over a horizontal bed
Unit 2.2 Analysis over a non-horizontal bed
Unit 2.3 Design of non erodible channels
Unit 2.4 Bed forms classification and size

Unit 3: Flow resistance
Unit 3.1 Review of the hydrodynamic equations
Unit 3.2 Flow resistance with fixed be
Unit 3.3 Flow resistance with movable bed

Unit 4: Sediment transport
Unit 4.1 Soil erosion: USLE method
Unit 4.2 Sediment transport in an uniform flow

Unit 5: Bridges hydraulic
Unit 5.1 Introduction
Unit 5.2 How a bridge affects river flow
Unit 5.3 Factors that affect the hydraulic performance of a bridge
Unit 5.4 How to calculate discharge and aflux
Unit 5.5 How to evaluate and combat scour

Unit 6: Models in Fluvial Hydraulics
Unit 6.1 Introduction
Unit 6.2 Numerical models: method of characteristics
Unit 6.3 Physical models

Unit 7: Regulation, protection and stabilization of rivers
Unit 7.1 Introduction
Unit 7.2 River protection and stabilization
Unit 7.3 Flood risk management measures

Unit 8: Introduction to the contaminant transport in rivers
Unit 8.1 New concepts and preliminary definitions
Unit 8.2 The diffusive phenomenon
Unit 8.3 The balance equation

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	CB03 CE08 CE25 CE33 CE34 H02	1.6	40	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CE01 CE25 CE33 CE34	0.4	10	Y	N	Some exercises will be proposed during the lessons. Not recoverable activity
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CB03 CE01	0.1	2.5	Y	Y	Assessment of the student participation during the assistance to the Laboratory. Not recoverable activity
Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	CB03 CE01 CG02	0.8	20	Y	Y	Report for laboratory test is compulsory and must be on date. This activity can be retaken with a maximum grade of 5 over 10 unless plagiarism has been detected.
Project or Topic Presentations [ON-SITE]	Reading and Analysis of Reviews and Articles	CB03 CE01 CE25 CG02	0.1	2.5	Y	Y	There will be 2 oral presentations during the course: i) scientific paper and ii) local scour estimation methods. These activities can be retaken with a maximum grade of 5.0 out of 10 by doing an exam of the related contents.
Writing of reports or projects [OFF-SITE]	Combination of methods	CE01 CE25 CE33 CE34	0.8	20	Y	Y	Report for numerical practice is compulsory and must be on date. This activity can be retaken with a maximum grade of 5 over 10 unless plagiarism has been detected.
Mid-term test [ON-SITE]	Assessment tests	CB03 CE01 CE08 CE25 CE33 CE34 H02	0.2	5	Y	Y	It will consist of 2 partial exams (continuous assessment) or a single exam of all the content (non-continuous evaluation). In continuous assesment, these activities can be retaken in a single final exam.
Study and Exam Preparation [OFF-SITE]	Assessment tests	CB03 CE01 CE08 CE25 CE33 CE34 H02	2	50	N	-	
		Total:	**6**	**150**			

Total credits of in-class work: 2.4 Total credits of out of class work: 3.6	Total class time hours: 60 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%	Final exam of all the contents developed in the subject (NC1). Some questions about practical activities will be included. Compulsory activity for NCE
Oral presentations assessment	0.00%	30.00%	Reading and presentation of scientific article in English language (NC2) related with some interesting topic. Compulsory activity for NCE
Assessment of active participation	15.00%	0.00%	Active participation in theory classes and the predisposition of the student for solving proposed exercises during the lessons (C1). Not-compulsory activity
Practicum and practical activities reports assessment	20.00%	0.00%	The quality of the reports of practicums will be assessed - Laboratory Practice (PL) on sediment transport phenomena (10% of the overall mark). - Numerical practice (PN) on 1D flow modelling and bridge local scour (10% of the overall mark). Compulsory activity for CA
Mid-term tests	25.00%	0.00%	Partial exam with the content developed in Topics 1-4 (P1). Compulsory activity for CA
Oral presentations assessment	15.00%	0.00%	During the course the student will do 2 oral presentations: - Reading and presentation of scientific article in English language (O1) of current issues in the field of Fluvial Hydraulics (7.5% of the overall mark). Compulsory activity for CA - Presentation and explanation of analytical / empirical methods for calculatiing scour depths (O2) at different hydraulic structures (7.5% of the overall mark). Compulsory activity for CA
Mid-term tests	25.00%	0.00%	Partial exam with the content developed in Topics 5-8 (P2). Compulsory activity for CA
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 assistance to the Hydraulic Laboratory on the proposed date is a compulsory and not recoverable activity.

Both laboratory and numerical reports outside the deadline will result in a maximum mark of 5.0 out of 10. If the report is not delivered on the proposed date and choose to deliver it on the date of the final exam (15 days before), the maximum grade will be 5.0 out of 10.

In order to pass the subject, the following requirements must be satisfied:
a) O1, O2, PL, PN >=3.5
b) P1, P2 >=4.0
c) 0.15*C1 + 0.1*PL + 0.1*PN + 0.075*O1 + 0.075*O2 + 0.25*P1 + 0.25*P2 >=5.0

Qualifications of assessment of participation (C1), oral presentations (O1, O2) and practical reports (PL, PN) will be maintained from one course to another as long as there are no substantial changes in the covered topics and the student has attended to any of the calls during the course.

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.

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

In order to pass the subject, the following requirements must be satisfied:
a) NC1, NC2 >= 4.0
b) 0.7*NC1 + 0.3*NC2 >= 5.0

Specifications for the resit/retake exam:

Same criteria used for the final exam

Specifications for the second resit / retake exam:

Same criteria used for the non-continuous evaluation

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	2.5
Project or Topic Presentations [PRESENCIAL][Reading and Analysis of Reviews and Articles]	2.5
Mid-term test [PRESENCIAL][Assessment tests]	5

Study and Exam Preparation [AUTÓNOMA][Assessment tests]	50
Unit 1 (de 8): Properties of the sediments	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	2.5
Unit 2 (de 8): Sediment entrainment and bed forms	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	2.5
Unit 3 (de 8): Flow resistance	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	2.5
Unit 4 (de 8): Sediment transport	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	2.5
Unit 5 (de 8): Bridges hydraulic	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	2.5
Unit 6 (de 8): Models in Fluvial Hydraulics	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	2.5
Unit 7 (de 8): Regulation, protection and stabilization of rivers	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	2.5
Unit 8 (de 8): Introduction to the contaminant transport in rivers	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	2.5
Global activity	
Activities	**hours**
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	2.5
Writing of reports or projects [AUTÓNOMA][Combination of methods]	20
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	20
Project or Topic Presentations [PRESENCIAL][Reading and Analysis of Reviews and Articles]	2.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	10
Mid-term test [PRESENCIAL][Assessment tests]	5
Class Attendance (theory) [PRESENCIAL][Lectures]	40
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	50
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Cardoso, António Heleno	Hidráulica fluvial	Fundaçao Calouste Gulbenkian		972-31-0815-1	1998	
Chang, Howard H.	Fluvial processes in river engineering	Krieger		1-57524-212-5	2002	
Chanson, Hubert	The hydraulics of open channel	Butterworth		0-340-74067-1	2002	

	flow : an introduction : basi	Heinemann		
Graf, Walter Hans	Fluvial hydraulics : flow and transport processes in channe	Wiley & Sons	0-471-97714-4	1998
Julien, Pierre Y.	Erosion and sedimentation	Cambridge University Press	0-521-63639-6	1998
Julien, Pierre Y.	River mechanics	Cambridge University Press	0-521-56284-8	2002
Kundu, Pijush K. (1941-1994)	Fluid mechanics	Academic Press	978-0-12-373735-9	2008
Leopold, Luna B.	Fluvial processes in geomorphology	Dover	0-486-68588-8	1995
Martín Vide, Juan P.	Ingeniería de ríos	UPC	84-8301-563-3	2002
Martínez Marín, Eduardo	Hidráulica fluvial : principios y práctica	Bellisco	84-95279-44-4	2001
Pope, Stephen B.	Turbulent flows	Cambridge University Press	0-521-59886-9	2005
White, Frank M.	Fluid mechanics	McGraw-Hill	0-07-124343-7	2005