UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: GEOLOGICAL ENGINEERING AND MECHANICS OF ROCKS
Code: 310813
Type: ELECTIVE
ECTS credits: 4.5
Degree: 2343 - MASTERS DEGREE PROGRAMME IN ENGINEERING OF ROADS, CANALS AND PORTS
Academic year: 2023-24
Center: 603 - E.T.S. CIVIL ENGINEERS OF CR
Group(s): 20
Year: 2
Duration: First semester
Main language: English
Second language:
Use of additional languages:
English Friendly: N
Web site:
Bilingual: N

Lecturer: **LAURA ASENSIO SANCHEZ** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Edif. Politécnica 2D-56	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	926052472	laura.asensio@uclm.es	MON, TUE, FRI: 11.30 - 12.00. WED, THURS: 11.30 - 13.45. Contact by email to arrange alternative office hours if necessary.

Lecturer: **VICENTE NAVARRO GAMIR** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Edif. Politécnica 2D-59	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	926295453	vicente.navarro@uclm.es	Monday to Friday 13:30 to 15:00. Contact by email to arrange alternative office hours if necessary.

Lecturer: **ANGEL YUSTRES REAL** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Edif. Politécnica 2D-58	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	926051983	angel.yustres@uclm.es	Monday to Friday 14:00 to 15:30. Contact by email to arrange alternative office hours if necessary.

2. Pre-Requisites

It is recommended to have a basic knowledge of the following aspects:

- Mechanics of rigid solids

- Mechanics of deformable solids

- Science and Technology of Materials of interest in Civil Engineering

- Strength of Materials

It is recommended to master the contents of the following subjects:

- Geotechnical Engineering (1st year of the master's degree).

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

Within Ground Engineering, Geological Engineering and Rock Mechanics is the last branch that the student who has followed the complete itinerary of the Bachelor's Degree in Civil and Territorial Engineering and the Civil Eng. Master's Degree still needs to know. Within the syllabus, it is directly related to the subject Geotechnical Engineering.

4. Degree competences achieved in this course

Course competences

Code	Description
CB06	Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
CB07	Apply the achieved knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the area of study
CB08	Be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of knowledge and judgments
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.
G02	Understanding of the multiple technical, legal and property constraints that arise in the design of a public work, and the capacity to establish different valid alternatives, to choose the optimum one and to express it adequately, anticipating the problems of its construction, and using the most suitable methods and technologies, both traditional and innovative, with the aim of achieving the greatest efficiency and promoting the progress and development of a sustainable and respectful society with the environment.
G05	Knowledge of the Civil Engineering profession and the activities that can be carried out in the field of civil engineering.
	Ability to plan, design, inspect and manage land (roads, railways, bridges, tunnels and urban roads) or sea (port works and facilities)

G06	transport infrastructures.
G11	Capacity for the design, execution and inspection of structures (bridges, buildings, etc.), foundation works and underground civil works (tunnels, car parks), and the assessment of their integrity.
G12	Capacity to plan, design, manage, maintain and operate infrastructure.
G20	Ability to choose between construction alternatives and public works management, anticipating the effects derived from the option assumed.
G28	Ability to work in an international context.
ICET5	Capacity to characterise the rock mass, obtain rock quality indices and define models of the mechanical behaviour of the rock mass.
ICET6	Characterization of flow in rock masses.
ICET7	Determination of the bearing capacity of foundations on rock. Calculation of the rock mass stability.
TE01	Application of the knowledge of soil and rock mechanics to the development of the study, design, construction and operation of foundations, cuttings, embankments, tunnels and other constructions made on or through the ground, whatever the nature and state of the ground, and whatever the purpose of the work in question may be.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Students can determine the structure of the flow network in rock massifs.

Students can calculate the support of tunnels and underground works in a way integrated with the construction process.

Students can calculate the bearing capacity of rock foundations and determine the stability of rock slopes.

Students can characterize a rock massif, assigning it a rock quality index, and determining a constituent model to describe its mechanical behavior.

6. Units / Contents

Unit 1: Rock mass characterization.

Unit 2: Rock mass classification.

Unit 3: Mechanical modelling of rock mass behaviour. Experimental techniques for the determination of parameters.

Unit 4: Water flow in rock masses.

Unit 5: Stability of rock masses.

Unit 6: Rock-support interaction. Tunnels and caverns support dimensioning.

Unit 7: Bearing capacity of rock foundations .

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	CB06 CB07 CB08 CB10 G01 G02 G05 G06 G11 G12 G20 G28 TE01	0.63	15.75	N	-	
Class Attendance (practical) [ON-SITE]	Problem solving and exercises	CB06 CB07 CB08 CB10 G01 G02 G05 G06 G11 G12 G20 G28 TE01	0.4	10	N	-	
Computer room practice [ON-SITE]	Work with simulators	CB06 CB07 CB08 CB10 G01 G02 G05 G06 G11 G12 G20 G28 TE01	0.12	3	N	-	
Field work [ON-SITE]	Case Studies	CB06 CB07 CB08 CB10 G01 G02 G05 G06 G11 G12 G20 G28 TE01	0.08	2	N	-	
Final test [ON-SITE]	Assessment tests	CB06 CB07 CB08 CB10 G01 G02 G05 G06 G11 G12 G20 G28 TE01	0.06	1.5	Y	Y	A minimum grade of 4.0 over 10.0 is required to pass the course.
Writing of reports or projects [OFF-SITE]	Problem solving and exercises	CB06 CB07 CB08 CB10 G01 G02 G05 G06 G11 G12 G20 G28 TE01	1.52	38	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	CB06 CB07 CB08 CB10 G01 G02 G05 G06 G11 G12 G20 G28 TE01	1.63	40.75	N	-	
Mid-term test [ON-SITE]	Assessment tests	CB06 CB07 CB08 CB10 G01 G02 G05 G06 G11 G12 G20 G28 TE01	0.06	1.5	Y	Y	A minimum grade of 4.0 over 10.0 is required to pass the course.
		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
Mid-term tests	70.00%	0.00%	Partial exams which, if not passed, will be re-evaluated in an ordinary final exam. The minimum pass mark will not be less

Assessment of problem solving and/or case studies	20.00%	0.00%	than 4.0 out of 10. Problems to be solved and handed in to the teacher.
Final test	0.00%	100.00%	Final test that combines all the evaluation activities.
Practicum and practical activities reports assessment	10.00%	0.00%	Preparation of a report on the field trip to be carried out during the teaching period of the course.
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 the weighted average mark of the progress tests (or final exam in case of failing the progress tests) and problems is higher than 5 out of 10.

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.

No marks will be retained for the following year.

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.

The course will be passed if the mark of the final exam is not lower than 5 over 10.

The final test may be different from the one corresponding to the continuous assessment in order to evaluate the competences linked to the progress tests.

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

Specifications for the resit/retake exam:

A single final exam that combines all the assessment activities. The course will be passed with a mark of no less than 5.0 over 10 in the final exam.

The final exam will have several parts to evaluate the different evaluable learning activities with the same weights as in the ordinary exam.

Specifications for the second resit / retake exam:

A single final exam that combines all the assessment activities. The course will be passed with a mark of no less than 5.0 over 10 in the final exam.

The final exam will have several parts to evaluate the different evaluable learning activities with the same weights as in the ordinary exam.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Final test [PRESENCIAL][Assessment tests]	1.5
Mid-term test [PRESENCIAL][Assessment tests]	1.5
Unit 1 (de 7): Rock mass characterization.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	3
Computer room practice [PRESENCIAL][Work with simulators]	3
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 2 (de 7): Rock mass classification.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Field work [PRESENCIAL][Case Studies]	2
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	8
Unit 3 (de 7): Mechanical modelling of rock mass behaviour. Experimental techniques for the determination of parameters.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.75
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.75
Unit 4 (de 7): Water flow in rock masses.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Unit 5 (de 7): Stability of rock masses.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2

Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	10
Study and Exam Preparation [AUTÓNOMA][Self-study]	6

Unit 6 (de 7): Rock-support interaction. Tunnels and caverns support dimensioning.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	2
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	16
Study and Exam Preparation [AUTÓNOMA][Self-study]	5

Unit 7 (de 7): Bearing capacity of rock foundations .	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	6

Global activity	
Activities	**hours**
Class Attendance (practical) [PRESENCIAL][Problem solving and exercises]	10
Computer room practice [PRESENCIAL][Work with simulators]	3
Final test [PRESENCIAL][Assessment tests]	1.5
Class Attendance (theory) [PRESENCIAL][Lectures]	15.75
Study and Exam Preparation [AUTÓNOMA][Self-study]	40.75
Mid-term test [PRESENCIAL][Assessment tests]	1.5
Field work [PRESENCIAL][Case Studies]	2
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	38
Total horas:	112.5

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
John P. Harrison and John A Hudson	Engineering Rock Mechanics : Part 2: Illustrative Worked Examples	Elsevier Science & Technology		9780080430102	2001	
	https://ebookcentral.proquest.com/lib/bibliotecauclm-ebooks/detail.action?docID=318112					
Jaeger, C.	Rock Mechanics and Engineering	Cambridge University Press	Cambridge	9780521218986	1979	
	https://web.s.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fODM1NTc5X19BTg2?sid=bb9c2ddd-4fa6-477b-a0b5-2bfdc2d61599%40redis&vid=0&format=EB&rid=1					
John A. Hudson, John P. Harrison	Engineering Rock Mechanics : An Introduction to the Principles	Elsevier Science & Technology		9780080438641	1997	
	https://ebookcentral.proquest.com/lib/bibliotecauclm-ebooks/detail.action?docID=318112					
Bieniawski, Z. T.	Engineering rock mass classifications :a complete manual for	John Wiley & Sons		0-471-60172-1	1989	
Goodman, Richard E.	Engineering geology: rock in engineering construction	John Wiley & Sons		0-471-59959-X	1993	
Hoek, Evert	Rock slope engineering	Institution of Mining and Metallurgy		0-419-16010-8	1997	
Hoek, Evert	Support of undergroung excavations in hard rock	A.A. Balkema		89-5410-187-3	1998	
Hoek, Evert	Underground excavations in rock	E & FN Spon		0-419-16030-2	1997	
Wyllie, Duncan C.	Foundations on rock	E & FN Spon		0-419-23210-9	1999	
Zhao, Jian	Course on Rock Mechanics Principles				2020	
	https://isrm.net/isrm/page/show/1235					
Hudson, John	Key Principles in Rock Mechanics				2014	
	https://isrm.net/isrm/page/show/1144					
R. Tomas, J.C. Santamarta, M. Cano, L.E. Hernandez, J. García-Barba	ENSAYOS GEOTÉCNICOS DE SUELOS Y ROCAS	Universidades de Alicante y de La Laguna		978-846165397-3	2013	
	https://www.semr.es/archivos/ensayos_.pdf					
Ramírez Oyanguren, Pedro Alejano Monge, Leandro R.	Mecánica de rocas : fundamentos e ingeniería de taludes				2004	
	https://oa.upm.es/14183/					
Arzúa, Javier; Alejano, Leandro; Pérez-Rey, Ignacio;	PROBLEMAS DE MECÁNICA DE ROCAS: Fundamentos e ingeniería de taludes	Bubok Publishing S.L		978-84-686-6705-8	2015	
	https://www.semr.es/archivos/Arzua_problemas.pdf					
Barton, Nick	Course on Empirical Methods in Rock Mechanics and Rock Engineering				2021	
	https://isrm.net/isrm/page/show/1553					
Eberhardt, Erick	Rock Engineering Practice and Design				2008	
	https://isrm.net/isrm/page/show/993					