

**1. General information****Course:** EXPLORATION TECHNOLOGY**Type:** ELECTIVE**Degree:** 384 - MINING AND ENERGY ENGINEERING DEGREE**Center:** 106 - SCHOOL OF MINING AND INDUSTRIAL ENGINEERING**Year:** 4**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 19559**ECTS credits:** 6**Academic year:** 2020-21**Group(s):** 51**Duration:** C2**Second language:****English Friendly:** Y**Bilingual:** N**Lecturer:** LUIS MANSILLA PLAZA - Group(s): 51

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**2. Pre-Requisites**

It is a subject without established requirements, but it would be advisable for the student to have passed the subjects related to geology, mining research, mineral deposits, etc.

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

The mining technique of the boreholes is the essence of the evidence of the existence of a specific mining deposit, as well as of the knowledge of any underground material of interest for the material execution of a civil work, which makes it an essential subject to complete the training of a graduate in Mining Technology Engineering. It is also a subject that is intimately related to others in the degree, especially those of a geological mining nature, providing clear support to the knowledge of these.

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

Code	Description
A10	Technical and scientific capacity for the profession of Technical Mining Engineer and knowledge of the duties of consultancy, analysis, design, calculation, project, construction, maintenance, preservation and exploitation.
A11	To understand the multiple legal and technical restrictions which are to be considered in the Mining Engineering field and which are intended, according to what it was established in part 5 of the ministerial order CIN/306/2009 of 09-02-2009, the prospection and mining-geological research, all kind of geological exploitations including ground water, underground works, underground storage, treatment and processing plants, energy plants, metallurgical as well as iron and steel plants, building material plants, carbon and chemical, petrochemical, gas, waste treatment plants and effluents, explosive factories, and capacity to use verified methods and recognized technologies with the aim of getting the highest efficacy having environmental concern and protecting the health and security of workers and users of those facilities.
A13	Capacity to design, plan, operate, inspect, sign and manage projects, plants or installations in their field.
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
CT00	To promote respect and promotion of Human Rights as well as global access principles and design for everybody according to the 10th final order of the Law 51/2003 of December 2nd, about equal opportunities, non-discrimination and universal accessibility for people with disabilities.
CT02	To be acquainted with Information and Communication Technology ICT
CT03	Capacity for written and oral communication skills.
CT04	Capacity to accept ethical and deontological professional responsibility.
E12	Capacity to know, understand and use the principles of design, planning and execution for the prospection and extraction of minerals, rocks, fossil fuels, nuclear fuel, underground waters and geotechnical. Design, execution and planning for fluid injection in underground structures

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

Capacity to plan, manage and run drilling the mining field, underground water, geotechnics, hydrocarbons and fluid injection.

To be able to use bibliography and documentation to write reports and practical assignments

To express yourself with a minimum vocabulary in the professional drilling field

To know and understand the basic principles which shape drilling investigation in the mining field, underground water, hydrocarbons and geotechnics

## 6. Units / Contents

**Unit 1: Introduction. General information.**

**Unit 2: Percussion drilling.**

**Unit 3: Rotor percussive drilling**

**Unit 4: Rotational drilling**

**Unit 5: Drilling with core recovery**

**Unit 6: Rotary drilling system.**

**Unit 7: Safety and environment in surveys.**

**Unit 8: Directional Drilling**

**Unit 9: Applications for groundwater abstraction.**

**Unit 10: Applications for geological-mining research.**

**Unit 11: Applications for hydrocarbon research**

**Unit 12: Applications for civil engineering**

## 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	A10 A11 A13 CB01 CB02 CB03 CB04 CB05 CT00 CT02 CT03 CT04 E12	0.95	23.75	Y	N	Participatory masterclass using a blackboard, overhead projector, video player (DVD) and video cannon. Use of the virtual Campus Moodle platform as a support for communication, obtaining information for the preparation of notes and issuing documents.
Class Attendance (practical) [ON-SITE]	Combination of methods	A10 A11 A13 CB01 CB02 CB03 CB04 CB05 CT00 CT02 CT03 CT04 E12	0.4	10	Y	N	Presentation of the fundamentals of the practice. Resolution of the proposed problems, either individually or in groups in a participatory manner.
Other on-site activities [ON-SITE]	Case Studies	A10 A11 A13 CB01 CB02 CB03 CB04 CB05 CT00 CT02 CT03 CT04 E12	0.54	13.5	Y	N	Resolution of drilling project models applied to the different fields of engineering and earth sciences.
Study and Exam Preparation [OFF-SITE]	Self-study	A10 A11 A13 CB01 CB02 CB03 CB04 CB05 CT00 CT02 CT03 CT04 E12	3.6	90	N		Independent personal study of the student and supervised work. Use of the virtual campus Moodle platform as a support for communication, obtaining information for the preparation of notes and issuing documents.
Group tutoring sessions [ON-SITE]	Guided or supervised work	A10 A11 A13 CB01 CB02 CB03 CB04 CB05 CT00 CT02 CT03 CT04 E12	0.26	6.5	N		Individual or group tutorials with direct and virtual teacher-student interaction. Use of the virtual campus Moodle platform as a support for communication, obtaining information for the preparation of notes and issuing documents.
Final test [ON-SITE]	Assessment tests	A10 A11 A13 CB01 CB02 CB03 CB04 CB05 CT00 CT02 CT03 CT04 E12	0.25	6.25	Y	Y	Theoretical and practical tests to assess theoretical and practical knowledge
<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
Final test	70.00%	85.00%	Final exam eminently practical and applied to the world of the polls
Other methods of assessment	15.00%	0.00%	Proposals of solutions to typical cases in the world of the polls studied in the subject by students
Practicum and practical activities reports assessment	15.00%	15.00%	Resolution and delivery of practical exercises carried out in class. Resolution and delivery of practical exercises carried out in class. Resolution and delivery of practical exercises carried out in class.

			Resolution and delivery of practical exercises carried out in class
<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 ordinary evaluation of the subject will include: the value obtained in the final test (this test will consist of a series of exercises whose subject matter will cover most of the aspects of the subject, establishing the evaluation scales for each question), the work and practices developed throughout the course and participation with class participation. For those students who have not submitted their work and class practices, a series of questions related to these subjects will be included in the final test, with a total score of 25% of the final grade of the test.

##### Non-continuous evaluation:

Evaluation criteria not defined

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

The extraordinary evaluation of the subject will include: the value obtained in the final test (this test will consist of a series of exercises whose subject matter will try to cover most of the aspects of the subject, establishing the evaluation scales in each question), the work and practices developed throughout the course and participation with class participation. For those students who have not submitted their work and class practices, a series of questions related to these subjects will be included in the final test, with a total score of 25% of the final grade of the test.

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

The evaluation of the special call for completion of the course will include: the value obtained in the final test (this test will consist of a series of exercises whose subject matter will try to cover most of the aspects of the subject, establishing the evaluation scales in each question), the work and practices developed throughout the course and participation with use in class. For those students who have not submitted their work and class practices, a series of questions related to these subjects will be included in the final test, with a total score of 25% of the final grade of the test.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
<b>Hours</b>	<b>hours</b>
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Group tutoring sessions [PRESENCIAL][Guided or supervised work]	6.5
Final test [PRESENCIAL][Assessment tests]	6.25
<b>Unit 1 (de 12): Introduction. General information.</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	1
<b>Unit 2 (de 12): Percussion drilling.</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
<b>Unit 3 (de 12): Rotor percussive drilling</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	4
<b>Unit 4 (de 12): Rotational drilling</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	1
<b>Unit 5 (de 12): Drilling with core recovery</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	4
<b>Unit 6 (de 12): Rotary drilling system.</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	4
<b>Unit 7 (de 12): Safety and environment in surveys.</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
<b>Unit 8 (de 12): Directional Drilling</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	5.75
<b>Unit 9 (de 12): Applications for groundwater abstraction.</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (practical) [PRESENCIAL][Combination of methods]	3
Other on-site activities [PRESENCIAL][Case Studies]	4
<b>Unit 10 (de 12): Applications for geological-mining research.</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (practical) [PRESENCIAL][Combination of methods]	3
Other on-site activities [PRESENCIAL][Case Studies]	4.5
<b>Unit 11 (de 12): Applications for hydrocarbon research</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (practical) [PRESENCIAL][Combination of methods]	3
Other on-site activities [PRESENCIAL][Case Studies]	4
<b>Unit 12 (de 12): Applications for civil engineering</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (practical) [PRESENCIAL][Combination of methods]	1

Other on-site activities [PRESENCIAL][Case Studies]	1
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	23.75
Class Attendance (practical) [PRESENCIAL][Combination of methods]	10
Other on-site activities [PRESENCIAL][Case Studies]	13.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Group tutoring sessions [PRESENCIAL][Guided or supervised work]	6.5
Final test [PRESENCIAL][Assessment tests]	6.25
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Astier, B. et al.	Realisation des forages dirigés et controle des trajectoires	Technip			1985	
Cambefort, H.	Perforaciones y Sondeos				1980	
García, Elvira	Manual de Perforación Dirigida Horizontal	U:D: Proyectos de la ETSIM de Madrid			2002	
Hartley, J.J.	Drilling tools and programme	A.A.Bakaman			1987	
I:F:P	Formulaire de Foreur/ Drilling data Handbook	Technip			2000	
Lopez Jimeno, C. et al.	Manual de Sondeos	U:D: Proyectos de la ETSIM de Madrid			2000	
Mansilla Plaz Luis et. al	Proyecto tipo para la ejecución de un sondeo para captación de aguas subterráneas (2ª edición)	Arcelande			2015	
Nguyent, J.P.	Le Foreur	Technip			1993	
Pimienta, J.	La captación de las aguas subterráneas	Editores técnicos asociados			1973	
Plote, H.	Sondage de reconnaissance hidrogeologique. Methode du marteau fond-de-trou	BRGM			1985	
Puy Huarte, J.	Procedimientos de sondeos	Servicio de Publicaciones de JEN			1984	