



IDENTIFYING DATA

Sustainable exploitation of mining resources I

Subject	Sustainable exploitation of mining resources I			
Code	V09G311V01302			
Study programme	Grado en Ingeniería de los Recursos Mineros y Energéticos			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Alonso Prieto, Elena de las Mercedes			
Lecturers	Alonso Prieto, Elena de las Mercedes Delgado Marzo, Fernando			
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General description	Sustainable exploitation of mining resources. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

Code	
A1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
A2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
A3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
A4	That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B1	Scientific and technical training and qualification as a Mining Engineer and knowledge of the functions of consultancy, analysis, design, calculus, project, construction, maintenance, preservation and exploitation.
B2	To be familiar with the multiple technical and legal factors involved in the process of development, within the field of mining engineering, with the knowledge acquired in accordance with section 5 of order CIN/306/2009, pertaining to geological and mining prospecting and investigation, the explorations of all sorts of geological resources, including groundwater, underground construction, underground storage, treatment and benefit plants, energy plants, mineral processing and steel and iron plants, building materials plants, carbon chemistry, petrochemistry and gas plants, waste treatment and tributary plants, explosives factories, and ability to use well-tested methods and accredited technologies, with the aim of achieving the highest efficiency and ensuring the protection of the Environment and the safety and health of workers and users.
B3	Ability to design, write and plan partial or specific projects within the units specified in the previous section, such as mechanical and electric plants and their maintenance, networks of energy transportation, facilities for transportation and storage of solid, liquid and gaseous materials, waste sites, tailing dams, foundation and support, demolition, restoration, controlled explosions and explosives logistics.
B4	Ability to design, plan, run, inspect, sign and manage projects, plants or facilities, within their field.
B5	Ability to do studies of land-use planning and of the environmental aspects involved in projects, plants and facilities, within their field.
B6	Ability to maintain, preserve and exploit projects, plants and facilities, within their field.

- B7 Ability to do, within the field of mining engineering, with the knowledge acquired in accordance with section 5 of order CIN/306/2009, measurements, stakeouts, planes and maps, calculations, assessments, risk analyses, expert reports and studies, work plans, environmental and social impact studies, restoration plans, quality control systems, prevention systems, analysis and assessment of the properties of metal, ceramic, refractory, synthetic and other materials, soil and rock mass classification and other works of a similar kind.
- B8 To be familiar with and ability to apply the relevant legal framework to practice professionally as a Mining Engineer.
- C23 To know, understand and use the principles of extraction of raw materials of mineral origin.
- D1 Ability to draw links between the different elements of all the knowledge they acquired, understanding them as components of a body of knowledge with a clear structure and strong internal cohesion.
- D2 Ability to develop a project to completion in any field of this branch of engineering, combining appropriately the knowledge acquired, consulting the relevant sources of information, carrying out any required inquiries, and joining interdisciplinary work teams.
- D3 To suggest and develop practical solutions, using the relevant theoretical knowledge, to phenomena and problems-situations of ordinary reality that are specific to engineering, developing appropriate strategies.
- D5 To be familiar with the relevant sources of information, including constant updating, in order to practice one's profession competently, accessing all the present and future tools of information search, constantly adapting to technological and social changes.
- D6 To be familiar with and to be able to use the legislation applicable in this sector, to be acquainted with the social and business environments and to be able to deal with the relevant administration, integrating this knowledge into the drawing up of engineering projects and into the implementation of every aspect of their professional work.
- D8 Understanding engineering within a framework of sustainable development with environmental awareness.
- D13 Commitment to environmental sustainability. Fair, responsible, efficient use of resources.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Dominate the basic terminology employed in the industry and the mining technology	A1 A4	B8	D5 D6	
Know the basic characteristics of the mining industry and the current situation of the sector of mining in the world, in Spain and in the Autonomous Community of Galicia.	A3 A4	B2	D5 D6 D8 D13	
Possess a knowledge detailed of the systems of exploitation and of the conditions of application of each one of them. Differentiate method and system of exploitation. Know the equipment of conventional exploitation and open pit mining		B7	D1 D3	
Develop the capacity to represent, interpret and resolve properly some concrete problems, that can present in his future professional activity.	A5	B1 B4 B5 B8	D1 D2	
Know the mining cycle of production, as well as the available technology to carry out the unitary operations that conform it.	A2	B3 B6	C23	D8 D13
Use the learnt like element of support and complement of the understanding of other disciplines that compose the studies of the career.	A5	B1 B3	C23	D6 D8
Interpret and make a planning of an open pit mine	A2	B3 B4 B6 B8	C23	D6
Elaborate and interpret maps of an open pit mine	A3	B1 B2 B3 B4 B5	C23	D6

Contents

Topic	
Introduction and presentation of the subject	Justification of the subject in the studies of mining engineering. Aims of the subject. Information on educational planning, formative activities, systems of evaluation, educational materials.
The paper of the mining like provider of prime matters	Brief historical review of the mining. Classification of the mineral substances. The mining industry: basic concepts, characteristic and singularity. Current panorama of the mineral resources in the world and in Spain. The paper of the mining like provider for the industry. The paper of the mining in the decarbonization and digitalisation of the economy. Critical minerals for the EU. Basic terminology in the mining industry in Spanish and English.
Chain of value in mining	Resources and reserves. Concept of grade. Chain of value in mining. The mining cycle and his phases. Mining project.

The exploitation of mining resources and the sustainability	Mining and sustainability. UNE Normative of sustainability. The paper of the mining in a model of production of circular economy
Open pit mining	Geometrical and economic variables of the exploitations to open pit mines. Geometrical and economic stripping ratio. Introduction to the mining planning. Estimate of mining final geometry for simple cases by analytical methods
Cycle of production in open pit mining	Unit operations in open pit mining. Equipment and technology. Digitalisation in the mining operations.
Quarries for materials of construction and dimensional stone	General characteristics of the quarries of materials of construction and dimensional stone. Basic cycle of production.
Open pit	Description of the method of exploitation by open pit. Field of application, advantages and limitations. Types of open pits.
Strip mining	Description of the method of strip mining. Field of application, systems of exploitation
Chemical mining	Leaching: basic cycle of production. Systems of leaching. Comparison of the systems of leaching. Other methods of chemical mining
Legislation in mining	Legislative frame of mining activities in Spain. Sectorial and transversal normative. Classification of the mining resources from the administrative point of view. Legislation in the autonomic field. "Lei de Ordenación de la Minería 3/2008".
The technical direction	Functions and responsibilities of the technical direction of a mine. Preparation and interpretation of plans of an open pit mine. Preparation and interpretation of maps of works in open pit mining

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	10	10	20
Studies excursion	4	0	4
Case studies	2	2	4
Lecturing	24	0	24
Practices through ICT	10	14	24
Essay questions exam	1	28	29
Problem and/or exercise solving	1.5	23.5	25
Report of practices, practicum and external practices	0	20	20

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Problem solving	Activity in the that formulate problem and/or exercises related with the subject. The student owes to develop the correct solutions by means of it ejercitación of routines, the application of formulas or algorithms, the application of procedures of transformation of the available information and the interpretation of the resulted
Studies excursion	Visits to installations with the objective that the student identify the technology and processes developed in the subject and know the reality and problems that present in practice daily real
Case studies	Search, reading and work of documentation, proposals of resolution of problems and/or exercises that will realize of autonomous form by part of the students.
Lecturing	Exhibition by part of the professor of the contained envelope to subject object of study, theoretical bases and/or guidelines of one work, exercise or project to develop pole student
Practices through ICT	Activities of applying knowledge in a given context and acquiring basic and procedural skills in relation to the subject, through ICT.

Personalized assistance

Methodologies	Description
Lecturing	The doubts posed by the students will be attended by appointment in person or by means of telematic means (email, MOOVI, Campus Remoto)
Problem solving	The doubts posed by the students will be attended by appointment in person or by means of telematic means (email, MOOVI, Campus Remoto)
Studies excursion	The doubts posed by the students will be attended by appointment in person or by means of telematic means (email, MOOVI, Campus Remoto)
Case studies	The doubts posed by the students will be attended by appointment in person or by means of telematic means (email, MOOVI, Campus Remoto)

Practices through ICT The doubts posed by the students will be attended by appointment in person or by means of telematic means (email, MOOVI, Campus Remoto)

Assessment			
	Description	Qualification	Training and Learning Results
Problem solving	Evaluation of exercises. Along the course, once exposed and developed in the classroom the necessary tools to tackle the resolution of exercises, will propose a group of exercises for autonomous and face-to-face resolution by part of the student. The maximum punctuation is of 3 points. It requires a minimum punctuation of 1,2 points in this epigraph. The expected results that evaluate are: Dominate the basic terminology that employs in the industry and the mining technology, Possess a knowledge detailed of the systems of exploitation and of the conditions of application, Differentiate method and system of exploitation, Know the mining cycle of production, as well as the available technology to carry out the unitary operations that conform it.	30	C23 D5 D6 D8
Lecturing	Evaluation of a proof written. The maximum punctuation of the proof is 4 points. It requires a minimum punctuation of 1,6 points in this epigraph. The expected results that evaluate are: Dominate the basic terminology that employs in the industry and the mining technology, Know the basic aspects of the mining industry, and the current situation of the sector of mining the world, in Spain and in Galicia, Possess a knowledge detailed of the systems of exploitation and of the conditions of application of each one of them, Differentiate method and system of exploitation, Know the systems of conventional exploitation and the teams employed in open pit mining, Use the learnt like element of support and complement of the understanding of other disciplines that compose the studies of the career.	40	B1 C23 D1 B2 B3 B4 B5 B6 B7 B8
Practices through ICT	Evaluation of a practice that has like aim the preparation of a plan of simple works. The maximum punctuation is 3 points. The minimum punctuation required is 1,2 point. The expected results are: Dominate the basic terminology that employs in the industry and the mining technology, Develop the capacity to represent, interpret and resolve properly some concrete problems, that can present in his future professional activity, Interpret and make a plan of works of an open pit mine, Elaborate and interpret maps of works of open pit mines	30	

Other comments on the Evaluation

Continuous evaluation first opportunity

Continuous Assessment Test 1 (PEC1). Throughout the semester, the student body will carry out practices with ICT support and will have to present a practice report, which has a weight of 30% of the final grade. The minimum score required in this test is 1.2 points out of a maximum of 3.

Continuous Assessment Tests 2 and 3 (PEC1 and PEC2). Throughout the semester, the student body will take two evaluation tests consisting of solving problems autonomously and in person. The total score for PEC1 and PEC2 is 30% of the final grade. It is necessary to achieve a minimum of 1.2 points out of 3 in the PEC1+PEC2 set.

PEC3 Continuous Assessment Test. The remaining 40% of the subject will be evaluated on the official date set by the center in an exam with objective questions. It will be necessary to achieve a minimum score of 1.6 out of 4 points in this test.

If by adding the qualifications of all the continuous assessment tests, 5 points are reached but the minimum score is not reached in any of the tests, the subject will be considered as not passed and the mark that will appear in the first opportunity record will be 4.5 points.

Continuous evaluation in second opportunity:

The mark obtained from the Practice Report will be maintained in the case of having reached the minimum mark. If this is not the case, a new Practice Report may be delivered.

Students who have passed any of the PECs at the first opportunity will not have to repeat these tests. Students will only have to repeat the tests not passed on the first chance in the exam of the official date of the second chance test.

Global evaluation:

The student that renounces the continuous evaluation will be evaluated on all the theoretical and practical content that will correspond to 100% of the note and must reach a minimum of 50% to pass the subject, both in the first and in the second opportunity.

Sources of information

Basic Bibliography

Ley de Minas y Reglamento General de Normas Básicas y Seguridad Minera,

Varios, **Manual de arranque, carga y transporte en minería a cielo abierto**, Instituto Geológico Minero de España (IGME), 1991

Varios, **Manual de restauración de terrenos y evaluación de impactos ambientales en minería**, Instituto Geológico Minero de España (IGME), 1996

Varios, **Factores geomecánicos que influyen en la selección de equipos de arranque, minas y obras a cielo abierto**, Instituto Geológico Minero de España (IGME), 1987

Varios, **Minería química**, Instituto Geológico Minero de España (IGME), 1991

Complementary Bibliography

Hartman, H.L., Mutmanský, J.M., **Introductory mining engineering**, 2ª, John Wiley & Sons, 2002

B. Kennedy, **Surface mining**,

Herrera Herbert, J., **Introducción a los fundamentos de la tecnología minera**, Fundación Gómez-Pardo, 2006

Herrera Herbert, J., **Métodos de minería a cielo abierto**, Fundación Gómez-Pardo, 2006

Herrera Herbert, J. y Castilla Gómez, J., **La actividad minera actual y sus vectores de desarrollo**, Dpto. de Explotación de recursos minerales y obras, 2012

Herrera Herbert, J., **Explotaciones de roca ornamental**, ETI de Ingenieros de Minas de Madrid, 2007

Recommendations

Subjects that continue the syllabus

Sustainable exploitation of mining resources II/V09G311V01308

Subjects that are recommended to be taken simultaneously

Rock mechanics/V09G311V01304

Blasting/V09G311V01303

Subjects that it is recommended to have taken before

Graphic expression: Graphic expression/V09G311V01101

Geology: Geology/V09G311V01206

Fluid mechanics/V09G311V01204