ANX-PR/CL/001-01
LEARNING GUIDE

SUBJECT

63000271 - Sustainable Management Of Mining Operations

DEGREE PROGRAMME

06AK - Master Universitario En Mineria Sostenible

ACADEMIC YEAR & SEMESTER

2024/25 - Semester 1

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	63000271 - Sustainable Management Of Mining Operations
No of credits	4 ECTS
Type	Compulsory
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	06AK - Master Universitario en Mineria Sostenible
Centre	06 - Escuela Técnica Superior De Ingenieros De Minas Y Energía
Academic year	2024-25

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Marta Fernandez Hernandez		marta.fernandezh@upm.es	Sin horario.
Iñigo Mariano De Vicente Mingarro	214 (M3)	inigomariano.devicente@upm.es	Tu - 08:00 - 10:00 W - 09:00 - 11:00
Pedro Mora Peris (Subject coordinator)	221 (M3)	pedro.mora@upm.es	Tu - 10:00 - 12:00 F - 16:00 - 18:00
Marcelo Fabian Ortega Romero	235	mf.ortega@upm.es	Sin horario.

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.3. External faculty

Name and surname	Email	Institution
Enrique García Franco	enrique.gfranco@upm.es	ETSI MINAS Y ENERGÍA

3. Skills and learning outcomes *

3.1. Skills to be learned

CE6 - Aplicar las principales herramientas y técnicas de análisis, control y gestión medioambiental más adecuadas. Los KPI / To apply the main analysis, control and environmental management tools and techniques. Environmental KPI.

CG1 - Aplicar conocimientos de ciencias y tecnologías avanzadas a la práctica profesional o investigadora de la Ingeniería Minera / To apply knowledge in advanced science and technology to the professional or research practice of Mining Engineering

CG2 - Poseer capacidad para diseñar, desarrollar, implementar, gestionar y mejorar productos, sistemas y procesos en los distintos ámbitos de la actividad minera, usando técnicas analíticas, computacionales o experimentales avanzadas / To be able to design, develop, implement, manage and improve products, systems, and processes in different environments of the mining activity, using advanced analytic, computational or experimental techniques

CG3 - Comprender el impacto de la Ingeniería Minera y la extracción de recursos minerales y energéticos en el medio ambiente, el desarrollo sostenible de la sociedad y la importancia de trabajar en un entorno profesional y responsable / To understand the impact that Mining of mineral and energetic resources has on the environment, the sustainable development of society and the importance of working in a professional and responsible environment.

CG4 - Capacidad de trabajar en un contexto internacional y en entornos complejos, multidisciplinares y bilingües (inglés-español) / Capacity to learn in an international context and complex environments, multidisciplinary and bilingual (English-Spanish).

CG5 - Organización, planificación y gestión en el ámbito de la empresa, y otras instituciones y organizaciones de proyectos avanzados y equipos humanos / Organizing, planning and management in a business environment and other institutions and organizations of advanced projects and human teams.

3.2. Learning outcomes

RA50 - Liderar y desarrollar la planificación la fase de construcción de proyectos mineros, con una visión integrada considerando, de forma sustentada, capacidades/rendimientos y condiciones propias de la operación

RA32 - Understand the environmental problems as a whole, identifying all the processes involved and the possible interrelationships. Searching, identifying, evaluating and integrating the bibliography and the information exist about a problem, until achieving a scenario that allows identifying and integrating the processes that act on the area.Present hypotheses and proposals to validate or discard them.

RA9 - Understanding of the Land Management concepts related with mining activities

RA52 - Conocer metodologías y herramientas de carácter avanzado de mejoras de procesos y aplicarlas en la planificación

RA10 - ? Ability to zoning the land with management criteria and to develop a mining land management mapping

RA13 - Typology of operations. Technologies and operational tools applied and their influence on the end state of the mine operation

RA19 - To have a basic knowledge of other environmental aspects: detonation gases and carbon footprint / ? Alcanzar un conocimiento básico de otros aspectos medioambientales: gases de detonación y huella de carbono

RA6 - The development of studies and decision capability on the impact of mineral and energy resources extraction in the environment, even in the first phase of the minerals beneficiation, foreseeing the future affection on the natural environment.

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

La gestión ambiental en la gestión global de la empresa: relaciones entre el medio ambiente y la empresa, organizaciones, servicios, procesos y productos y su mejor gestión ambiental.
Significado de sostenibilidad y desarrollo sostenible en minería. La licencia social.

La sostenibilidad como evolución del sistema productivo de la economía. Caso de estudio.

Estructura organizativa para la gestión sostenible. Recursos Humanos y sostenibilidad.

Factores estratégicos para el negocio en la industria minera sostenible.

Sistemas de gestión ambiental: tipos y ámbitos de aplicación. Metodología de implantación de un sistema. Principales elementos. Aspectos e impactos. Certificación y verificación.

Indicadores de minería sostenible. Informes ambientales,GRI y WBCSD. Aplicación a la empresa. Mecanismos de evaluación. Sistemas de certificación.

La huella de carbono como factor clave en la competitividad de la empresa. Metodologías de evaluación y gestión de las emisiones de carbono. Tendencias actuales y modelos en la empresa.

La evaluación de riesgos ambientales como herramienta de gestión. La Responsabilidad Ambiental, Civil y Penal en operaciones mineras.

Environmental management in the global management of the company: relations between the environment and the company, organizations, services, processes and products and their best environmental management.

Meaning of sustainability and sustainable development in mining. The social license to operate (SLO).

Sustainability as an evolution of the productive system of the economy. Case study.

Organizational structure for sustainable management. Human resources and sustainability.

Strategic factors for business in the mining industry. sustainable.

Environmental management systems: types and areas of application. Methodology of implementation of a system. Main elements Aspects to impacts. Certification and verification.

Sustainable mining indicators. Environmental reports, GRI and WBCSD. Application to the company. Evaluation Mechanisms Certification systems.

Carbon footprint as a key factor in the competitiveness of the company. Methodologies for evaluation and management of carbon emissions. Current trends and models in the company.

Evaluation of environmental risks as a management tool. Environmental, Civil- Other instruments / tools ('tool-kit') for the prevention, reduction or minimization of impacts and assessment of aspects.

4.2. Syllabus

1. Sostenibilidad y empresa minera. Sustainability and mining companys.

   1.1. Los objetivos internacionales de desarrollo sostenible. International sustainable development goals.

   1.2. Índices y reportes de sostenibilidad en el ámbito internacional. Sustainability indexes and reports at international level.

   1.3. La normalización para la organización de la sostenibilidad. Sustainability standardization.

   1.4. Normalización sobre sostenibilidad en la industria extractiva. Sustainability standardization in the extractive industry.

2. La tecnología como base de la sostenibilidad. Technology as principal issue for sustainability.

   2.1. Mejores Técnicas Disponibles. Best Available Technologies.

   2.2. Equipos y maquinaria para la sostenibilidad minera. Equipment and machinery for mining sustainability.

3. Herramientas para la gestión ambiental en la empresa minera sostenible. Tools for enviromental managment in sustainable mining operations.

   3.1. Los análisis de ciclo de vida (ACV). Programas de eco-etiquetado. Aplicación a la empresa.Life cycle analysis (LCA). Eco-labelling programs. Industries applications.

   3.2. Evaluación de impacto ambiental. Environmental impact assessment .

   3.3. Análisis de riesgos ambientales. Environmental risk analysis.

3.4. Sistemas de gestión ambiental. Metodología de implantación. Principales elementos. Certificación y verificación. Environmental management systems. Implementation methodology. Main elements. Certification and verification.

3.5. Responsabilidad social empresarial. La licencia social para operar.Corporate social responsibility. The social license to operate.

3.6. La evaluación del patrimonio minero. Mining Heritage Assessment.

4. El enfoque ecosistémico para incrementar los activos ambientales en operaciones mineras.Ecosystem approach to increase environmental assets in mining operations.

5. Uso sostenible del subsuelo: Las tecnologías CCS/CCU. Sustainable use of mininig underground: CCS/CCU technologies.

5.1. Tecnologías de captura de CO2. CO2 capture technologies.

5.2. Transporte de CO2, cluster de CO2 o región cero emisiones. Nexo fuente/almacén. CO2 transport. Zero emissions region (cluster). Source-Storage links.

5.3. Almacenamiento geológico de CO2. CO2 Geological Storage.

5.4. Usos de CO2: fijación biológica de CO2 y valorización de biomasa. CO2 Uses: microalgae production and biomass valorisation.

5. Schedule

5.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	**TEMA 1.1** Duration: 02:00 Lecture **TEMA 1.2.** Duration: 02:00 Lecture			
2	**TEMA 1.3.** Duration: 02:00 Lecture **TEMA 1.4.** Duration: 02:00 Additional activities			
3	**TEMA 2.1.** Duration: 02:00 Lecture **TEMA 2.2.** Duration: 02:00 Additional activities			
4	**TEMA 3.1.** Duration: 02:00 Lecture **TEMA 3.2.** Duration: 02:00 Lecture			
5	**TEMA 3.3.** Duration: 02:00 Lecture **TEMA 3.4.** Duration: 02:00 Lecture			
6	**TEMA 3.4.** Duration: 02:00 Cooperative activities **TEMA 3.4.** Duration: 02:00 Lecture			

7	**TEMA 3.5.** Duration: 02:00 Lecture **Tema 3.4. Casos** Duration: 02:00 Problem-solving class			**TEMA 3.4. CASOS** Group presentation Progressive assessment Presential Duration: 02:00
8	**TEMA 3.6.** Duration: 02:00 Additional activities **TEMA 4.** Duration: 02:00 Cooperative activities			
9	**TEMA 5.1.** Duration: 02:00 Lecture **TEMA 5.2.** Duration: 02:00 Cooperative activities			
10	**TEMA 5.4.** Duration: 02:00 Lecture **Tema 5.4** Duration: 02:00 Problem-solving class			**TEMA 5.3.** Individual presentation Progressive assessment Presential Duration: 02:00
11				**FINAL EXAM** Written test Progressive assessment and Global Examination Presential Duration: 02:00
12				
13				
14				
15				
16				
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	TEMA 3.4. CASOS	Group presentation	Face-to-face	02:00	20%	5 / 10	CG1 CG2 CG5
10	TEMA 5.3.	Individual presentation	Face-to-face	02:00	20%	5 / 10	CE6 CG4
11	FINAL EXAM	Written test	Face-to-face	02:00	100%	5 / 10	CG1 CG2 CG3 CG5 CE6 CG4

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
11	FINAL EXAM	Written test	Face-to-face	02:00	100%	5 / 10	CG1 CG2 CG3 CG5 CE6 CG4

6.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

6.2. Assessment criteria

La calificación final del alumno en Evaluación Continua se realizará de acuerdo a los siguientes criterios:
? Porcentaje de la nota que se obtendrá mediante la valoración de trabajos y actividades: 40 %.

? Porcentaje de la nota que se obtendrá mediante la valoración de una prueba/ examen final: 60 %.

The final mark of the student in Continuous Evaluation will be made according to the following criteria:

? Percentage of the mark that will be obtained by evaluating works and activities: 40%.

? Percentage of the mark that will be obtained by evaluating a test / final exam: 60%.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Botin, J.A. Ed. 2009. Sustainable Management of Mining Operations. Society for Mining, Metallurgy and Exploration. Littleton, Colorado	Bibliography	

Darling, P. Ed. 2011. SME Mining Engineering Handbook, 3nd Ed. Society for Mining, Metallurgy and Exploration. Littleton, Colorado.	Bibliography	
Eggert, R.G. 2000. "Sustainable development and the mineral industry," chapter 1 in Sustainable Development and the Future of Mineral Investment, JM Otto and J Cordes, editors. United Nations Environment Programme and Metal Mining Agency of Japan.	Bibliography	
Van Zyl, Dirk J.A. 2005. Contributions of Mining Projects to Sustainable Development, Proceedings of 20th World Mining Congress, November 7 - 11, Teheran, Iran, 10 pp.	Bibliography	
S.M. Benson (2005). Overview of Geologic Storage of CO2 in Carbon Dioxide Capture for Storage in Deep Geologic Formations, Vol. 2 (Eds. Thomas, D.C., Benson, S.M.) Elsevier.	Bibliography	
Bocin-Dumitriu A, Perez Fortes M del M, Tzimas E, et al (2013) Carbon capture and utilisation workshop: background and proceedings.	Bibliography	
B. Llamas, P. Cienfuegos. Multicriteria decision methodology to select suitable areas for storing CO2. Energy and environment, 23 (2-3). 2012.	Bibliography	