



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S.I Montes, Forestal y
Medio Natur.

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

133000203 - Water Resource Recovery In Minerals And Constructi

DEGREE PROGRAMME

13AC - Master Universitario En Economía Circular

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	133000203 - Water Resource Recovery In Minerals And Constructi
No of credits	2 ECTS
Type	Optional/elective
Academic year of the programme	Second year
Semester of tuition	Semester 3
Tuition period	September-January
Tuition languages	English
Degree programme	13AC - Master Universitario en Economía Circular
Centre	13 - E.T.S.I. Montes, Forestal Y Medio Natur.
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Blanca Parga Landa (Subject coordinator)	P2-39 ETSIN	blanca.parga@upm.es	M - 19:00 - 20:30 Tu - 09:30 - 12:30 Upon request

* 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
Francisco Hernández Olivares	f.hernandez@upm.es	ETSAM (DCTA Office num 50)

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

- Analisis De Proyectos E Inversiones Ambientales
- Reutilizacion De Aguas
- Caracterizacion Y Gestion De Productos Procedentes

3.2. Other recommended learning outcomes

- Materials Science and Engineering
- Construction and Building Materials

4. Skills and learning outcomes *

4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB09 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE03 - El alumno podrá planificar proyectos de economía circular referidos a la interacción entre actividades e industrias.

CE04 - El alumno conocerá las nuevas tecnologías de la industria 4.0 y desarrollará mejoras en el diseño de los

productos industriales.en el marco de la economía circular

CG04 - El alumno podrá aplicar los principios de economía circular al ciclo de vida de los productos

CT01 - El alumno desarrollará habilidades para trabajar en contextos internacionales, respetando y considerando entornos socioculturales y científico-técnicos distintos, en los trabajos y proyectos realizados.

CT03 - El alumno tendrá capacidad para gestionar la información procedente de diversas fuentes, valorando su relevancia, fiabilidad y pertinencia para un propósito determinado, analizándola y organizándola.

CT04 - El alumno tendrá capacidad para proponer alternativas creativas y originales, valorando su viabilidad en la solución de problemas.

CT07 - El alumno tendrá capacidad para utilizar la lengua inglesa para la comunicación oral y escrita a nivel avanzado en entornos académicos y profesionales.

4.2. Learning outcomes

RA70 - Saber utilizar e interpretar correctamente las técnicas y análisis de laboratorio para evaluar los contenidos de agua en los minerales y en los materiales de construcción vinculados. / To learn how to use and correctly interpret the laboratory techniques and analysis to evaluate the water content in the minerals and in the related construction materials.

RA69 - Habilidad en la aplicación de métodos científicos para el cálculo del consumo de agua en la obtención de materiales y productos de construcción, y en todo su ciclo de vida. / Skill in the application of scientific methods for the calculation of water resource consumption in obtaining materials and construction products, and along their life cycle.

RA68 - Entender técnicas avanzadas para la optimización del uso del agua en productos de construcción, considerando todos los aspectos relevantes a lo largo de su ciclo de vida. / To understand advanced techniques to optimize the use of water in construction products, considering all the relevant aspects along their life cycle.

RA63 - Desarrollar un pensamiento crítico y fundamentado en relación con el aprovechamiento de los recursos naturales

RA72 - RA63 - Desarrollar un pensamiento crítico y fundamentado en relación con el aprovechamiento de los recursos naturales

* 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.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

The programmatic contents consists on 8 specific lectures about the most relevant construction materials, in relation to the consumption of water resources, in their manufacture, from obtaining raw materials, to their put on place, demolition and recycling. Its properties are described regarding to the performance in buildings and civil engineering works.

The syllabus structures the scheduled lectures on materials, in an academic order that presupposes prior knowledge of the students of the physical, chemical and engineering properties of construction materials, for their correct use in building and civil works. One lesson is devoted to comment the relevant normative standard documents and SDG.

All lessons describe the consumption of water resources in the manufacturing, construction, demolition and recycling processes. Transportation is included.

With the completion of this curricular unit the student will have acquired knowledge skills and competences that will allow him:

- To understand the effects of the consumption of water resources to obtain construction materials, on ecosystems and on the health of people, living beings and the environment.
- To know the raw materials and manufacturing processes of the most relevant construction materials, as well as their life cycle, transport and put on place, mainly in relation to the consumption of water resources.
- To be able for understanding the depletion of water resources due to direct and indirect use in the manufacture, transport and implementation of construction materials and products. To quantify the water pollutants and promote actions to reduce the consumption of water resources and depollution of industrial water effluent.

- To understand the genesis and evolution of the quality standards and regulations; and the relationship between the 17 sustainable development goals and circular economy.

To be able to access relevant international literature, both normative (standards, guidelines, recommendations) and scientific, and to express orally and in a written report their specific analyzes regarding industries dedicated to the mining of minerals and materials for the manufacture of construction products, regarding to the reduction of the consumption of water resources, without diminishing the performance quality of construction materials. Similar skills regarding the manufacturing industries of construction materials.

With the completion of this curricular unit the student will have acquired knowledge skills and competences that will allow him to:

- To understand advanced techniques for optimizing the use of water in construction products, considering all the relevant aspects along their life cycle.
- To know and acknowledge the laboratory techniques and test procedures regarding evaluate the final quality of the water used in the construction materials during their life cycle.
- To be able for the application of scientific methods for the evaluation of water resource consumption in obtaining materials and construction products, and along their life cycle

5.2. Syllabus

1. Introduction. Hydric Resources in minerals for construction and building materials. Quality and Environmental rules and standards. A Review considering the ODS genesis
2. Water resources in metallic materials. Iron, Steel, Copper and Aluminium Alloys
3. Water resources in Cements.
4. Water resources in Limes, Gypsum and Plasters.
5. Water resources in the extraction of natural stone. Quarries of Limestones, Marbles, Granites and Slates.
6. Water resources in Concrete manufacturing and placing on site.
7. Water resources in the manufacture of ceramic and glass.
8. Hydric Resources in the processes of construction and demolition of buildings.

6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	<p>Monday. November 3rd. 18:00. Lecture 1. Introduction. Hydric Resources in minerals for building materials. Part 1 Quality and Environmental rules and standards. A Review considering the ODS genesis Duration: 01:45 Lecture</p> <p>Monday. November 3rd.19:30. The works will be assigned to students Duration: 00:15 Cooperative activities</p> <p>Tuesday 4th. 18:00. Lecture 1 (cont) Introduction. Hydric Resources in minerals for building materials. Part 2 Duration: 01:30 Lecture</p> <p>Tuesday 4th. 19:30. Tutorial students personal works Duration: 00:30 Cooperative activities</p> <p>Wednesday 5 th. 18:00. Lecture 2. Hydric Resources in metallic materials. Iron, Steel, Copper and Aluminum Alloys Part 1 Duration: 01:30 Lecture</p> <p>Wednesday 5th. 19:30. Tutorial students personal works Duration: 00:30 Cooperative activities</p> <p>Thursday 6th. 18:00. Lecture 2. Hydric Resources in metallic materials. Iron, Steel, Copper and Aluminum Alloys Part 2 Duration: 01:30 Lecture</p> <p>Thursday 6th. 19:30. Tutorial students personal works Duration: 00:30 Cooperative activities</p>	<p>Tutorials Duration: 00:15 Cooperative activities</p> <p>Other activities. Seminars, conference Duration: 01:00 Additional activities</p>		<p>Active attendance Other assessment Progressive assessment Presential Duration: 00:00</p>

2	<p>Friday. November 7th. 18:00. Lecture 3. Hydric Resources in Cement industry. Duration: 01:30 Lecture</p> <p>Friday 7th. 19:30. Tutorial students personal works Duration: 00:30 Cooperative activities</p> <p>Monday 10th November. 18:00. Lecture 4. Hydric Resources in Lime Gypsum and Plaster. Duration: 01:30 Lecture</p> <p>Monday 10th. 19:30. Tutorial students personal works Duration: 00:30 Cooperative activities</p> <p>Tuesday 11th November. 18:00. Lecture 5. Hydric Resources in the extraction of natural stone. Quarries of Limestone, Marble, Granite and Slate. Duration: 01:30 Lecture</p> <p>Tuesday 11th. 19:30. Tutorial students personal works Duration: 00:30 Cooperative activities</p> <p>Wednesday 12th November. 18:00. Lecture 6. Hydric Resources in Concrete Plants. Duration: 01:30 Lecture</p> <p>Wednesday 12th. 19:30. Tutorial students personal works. Students oral presentations. Students oral presentations Duration: 00:30 Cooperative activities</p> <p>Thursday 13th November. 18:00. Lecture 7. Hydric Resources in the manufacture of clay bricks and ceramic materials. Duration: 01:30 Lecture</p> <p>Thursday 13th. 19:30. Tutorial students personal works. Students oral presentations Duration: 00:30 Cooperative activities</p>	<p>Other activities. Seminars, conference Duration: 01:00 Additional activities</p> <p>Tutorials Duration: 00:30 Cooperative activities</p>		<p>Active attendance Other assessment Progressive assessment Presential Duration: 00:00</p> <p>Write and deliver an unpublished original work on water resources in manufacturing construction materials. Oral presentation of Title, Abstract, References and main Conclusions. Individual work Global examination Presential Duration: 00:00</p>
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3	<p>Friday 14th November. 18:00. Lecture 8. Hydric Resources in the processes of construction and demolition of buildings. Quality and Environmental rules and standards. A review. Duration: 01:30 Lecture</p> <p>Friday 14th. 19:30. Tutorial students personal works. Students oral presentations Duration: 00:30 Cooperative activities</p>			<p>Active attendance Other assessment Progressive assessment Presential Duration: 00:00</p>
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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.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Active attendance	Other assessment	Face-to-face	00:00	15%	6 / 10	
2	Active attendance	Other assessment	Face-to-face	00:00	15%	6 / 10	CB06 CB09 CB10 CG04 CT01 CT03 CT04 CT07 CE03 CE04
3	Active attendance	Other assessment	Face-to-face	00:00	15%	6 / 10	CB06 CB09 CB10 CG04 CT01 CT03 CT04 CT07 CE03 CE04

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Write and deliver an unpublished original work on water resources in manufacturing construction materials. Oral presentation of Title, Abstract, References and main Conclusions.	Individual work	Face-to-face	00:00	85%	7 / 10	CB06 CB09 CB10 CG04 CT01 CT03 CT04 CT07 CE03 CE04

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

The marks will be expressed numerically in accordance to Article 5 of the Spanish Royal Decree 1125/2003, of the 5th of September, for which the European system of credits and the grading system of the official university degrees and validity are established.

The final score of the student will be obtained by applying the following criteria:

- Participation / attitude: 15%.
- Evaluation of works and activities: 85%.

1. Attendance and active participation in the course (Weighted 15%).
2. Preparation of an unpublished work on the cyclical use of water resources in the extraction of raw materials, manufacture of construction materials, demolition, classification, waste management and reuse in new or restoration work. With references to the environmental impact and applicable regulations.

The work should be done individually. The originality and quality of the written document delivered will be assessed (maximum length 40 pages double-spaced) and the public oral presentation of a summary with the main

conclusions. The work will be signed by the author, with explicit indication of the bibliographic sources and time dedication that has involved its preparation and presentation. (Weighted 85%)

The works will be proposed and assigned the first day of the course to students. Its delivery and public presentation will be made during the three last days of the course.

PERSONAL WORKS PROPOSAL (Optional)

1. Water resources in the Concrete manufacturing industry. Case Study: For instance: Cement Portland Valderrivas, Lafarge or Cemex.
2. Water resources in the Copper mining and products manufacturing industry. For instance: Riotinto Copper mine
3. Circular Economy in the Copper industry. For instance: Atlantic Copper
4. Hydric resources in the Natural Stone extraction and cutting- Case Study: Slate mining and building products. For instance, Bernardos(Segovia) Quarry and products
5. Water resources in the Gypsum and Plaster industry.. For instance. Escayolas Marín or EPYSA Case Studies
6. Water in ceramic industry. For instance: Ceratres or Cerámicas La Oliva industry
7. Marble industry for building construction and water resources. Consentino Case Study.
8. Steel manufacturing products. For instance, Arcelor Mittal industries in Spain.

9. Other optional proposed by the students

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
P.W. Gerbens-Leenesa, A.Y. Hoekstrab, R. Bosmanb. The blue and grey water footprint of construction materials: Steel, cement and glass. Water Resources and Industry 19 (2018) 1-12	Bibliography	
S. Bardhan Assessment of water resource consumption in building construction in India. WIT Transactions on Ecology and the Environment,	Bibliography	

doi:10.2495/ECO110081		
Akinshipe O, Kornelius G (2017) Chemical and Thermodynamic Processes in Clay Brick Firing Technologies and Associated Atmospheric Emissions Metrics-A Review. J Pollut Eff Cont 5: 190. doi: 10.4176/2375-4397.1000190	Bibliography	
A.Gazi, G. Skevis, M.A. Founti. Energy efficiency and environmental assessment of a typical marble quarry and processing plant. Journal of Cleaner Production 32 (2012) 10-21	Bibliography	
Joan-Manuel F. Mendoza, CinziaCapitano, Giorgia Peri, Alejandro Josa,Joan Rieradevall, Xavier Gabarrell. Environmental management of granite slab production from an industrial ecology standpoint. Journal of Cleaner Production 84 (2014) 619628	Bibliography	
Gulnur Maden Olmez, Filiz B. Dilek, Tanju Karanfil, Ulku Yetis. The environmental impacts of iron and steel industry: a life cycle assessment study. Journal of Cleaner Production 130 (2016) 195-201.	Bibliography	
Katarina Wärmark. Assessment of water footprint for civil construction projects. PhD Dissertation. Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences (SLU), Lennart Hjelm's väg 9, Box 7050, SE-750 07	Bibliography	

Uppsala. 2015		
I. Zabalza, A. Valero, A. Aranda. Life cycle assessment of building materials. Building and Environment 46 (2011) 1133-1140.	Bibliography	
www.un.org	Web resource	

9. Other information

9.1. Other information about the subject

This subject review all Sustainable Development Goals. But specifically are studied SDG; 6.3, 6.4 and 9.4.