ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

133000200 - Fundamentals Of Urban Mining

DEGREE PROGRAMME

13AC - Master Universitario En Economia Circular

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	133000200 - Fundamentals Of Urban Mining
No of credits	4 ECTS
Type	Optional/elective
Academic year ot the programme	Second year
Semester of tuition	Semester 3
Tuition period	September-January
Tuition languages	English
Degree programme	13AC - Master Universitario en Economia 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 *
David Leon Ruiz		david.leon.ruiz@upm.es	M - 09:00 - 12:00 Tu - 09:00 - 12:00 * The tutorial timetables are indicative and may undergo modifications. Tutoring schedules must be confirmed with the teacher by email

Ljiljana Medic Pejic (Subject coordinator)	417	liliana.medic@upm.es	Tu - 11:00 - 14:00 W - 11:00 - 14:00 * The tutorial timetables are indicative and may undergo modifications. Tutoring schedules must be confirmed with the teacher by email
Marcelo Fabian Ortega Romero	414	mf.ortega@upm.es	Sin horario. * The tutorial timetables are indicative and may undergo modifications. Tutoring schedules must be confirmed with the teacher by email
David Bolonio Martin	426	david.bolonio@upm.es	Tu - 15:30 - 18:30 Th - 15:30 - 18:30 * The tutorial timetables are indicative and may undergo modifications. Tutoring schedules must be confirmed with the teacher by email

Isabel Amez Arenillas	427	isabel.amez@upm.es	M - 08:00 - 10:00 Tu - 08:00 - 10:00 W - 08:00 - 10:00 * The tutorial timetables are indicative and may undergo modifications. Tutoring schedules must be confirmed with the teacher by email
Blanca Castells Somoza	422	b.castells@upm.es	M - 15:00 - 17:00 F - 08:00 - 12:00 * The tutorial timetables are indicative and may undergo modifications. Tutoring schedules must be confirmed with the teacher by email

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

3. Skills and learning outcomes *

3.1. 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

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

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

CE09 - El alumno podrá evaluar los procesos de optimización energética en el campo de la economía circular

CG03 - El alumno tendrá capacidad para evaluar los procesos de producción y consumo que permitan una gestión sostenible de los recursos.

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.

3.2. Learning outcomes

RA54 - Identificar fuentes bibliográficas relevantes como base para la profundización en las particularidades de distintas fracciones de residuo. / To identify relevant scientific sources as the basis for deepening in the particularities of waste fractions.

RA46 - - Aportar conocimientos sobre las medidas legales vigentes en la UE para residuos de construcción y demolición

RA11 - Capacidad de gestionar de manera sostenibe los residuos municipales

RA47 - Conocer las buenas prácticas sobre minimización de residuos y su correcta gestión en todo el proyecto de construcción, desde el diseño hasta la fase de ejecución

RA32 - Aplicar buenas prácticas para presentaciones orales./ Apply good practices for oral presentations.

* 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

This subject covers several major themes on fundamentals of urban mining and provides students with a knowledge for safeguarding the environment and the promotion of resource conservation through reuse, recycling, and recovery of secondary resources from waste. It will also help to understand the different secondary resources and economic value of the waste streams generated in urban spaces. This subject gives a basic understanding of the planning and designing of sustainable urban spaces, making the process consistent with the sustainable development goals.

4.2. Syllabus

1. Introduction to Urban Mining
    1.1. Urban Mining and the Three R's: Reduce, Reuse and Recycle
    1.2. Potential of Urban Mining
    1.3. Sources and characterization of materials and energy resources in urban spaces
        1.3.1. Waste Characterization: Approaches and Methods
        1.3.2. Commercial, Institutional and Industrial Waste
    1.4. Valorization of materials and resources and Estimation Methods
    1.5. Waste Transfer Stations and Economical Considerations
    1.6. Healthcare Risk Waste
        1.6.1. Hazardous Waste
        1.6.2. Other Special Waste
2. E-Waste
    2.1. Environmental impact: extraction and pollution
    2.2. Human health risk
    2.3. Legislation
3. Development of Urban Mining
    3.1. Analogy of Natural Ore Processing
    3.2. Technologies for the extraction of materials and resources
    3.3. Physical pretreatments of electronic waste
    3.4. Treatment and refining
4. Urban Mining and Energy
    4.1. Waste-to-energy processes
    4.2. Minerals for solar panels, wind turbines and batteries
    4.3. Energy sustainable cities
5. Spatial data analysis
    5.1. Case study of residues spatial and temporal distribution in Madrid
    5.2. Case study of residues spatial and temporal distribution in Spain and/or Europe

5. Schedule

5.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	**S41 (05-09) Fundamentals of urban mining.** Duration: 03:00 Lecture **S41 (05-09) Fundamentals of urban mining.** Duration: 03:00 Lecture **S41 (05-09) Fundamentals of urban mining.** Duration: 03:00 Lecture **S41 (05-09) Fundamentals of urban mining.** Duration: 01:00 Cooperative activities **S41 (05-09) Fundamentals of urban mining.** Duration: 02:00 Lecture			**Completion of a sample multiple-choice test** Written test Progressive assessment Presential Duration: 00:15 **Moodle Questionnaire** Online test Progressive assessment Not Presential Duration: 00:30 **Classroom evaluation** Written test Progressive assessment Presential Duration: 00:15
2	**S42 (12-16) Fundamentals of urban mining.** Duration: 03:00 Lecture **S42 (12-16) Fundamentals of urban mining.** Duration: 03:00 Lecture **S42 (12-16) Fundamentals of urban mining.** Duration: 03:00 Lecture **S42 (12-16) Fundamentals of urban mining.** Duration: 03:00 Lecture			**Classroom evaluation** Written test Progressive assessment Presential Duration: 00:15 **Classroom evaluation** Group work Progressive assessment Presential Duration: 00:15 **Moodle Questionnaire** Online test Progressive assessment Not Presential Duration: 00:30 **Evaluation** Group work Progressive assessment Presential Duration: 00:30

3	**S43 (19-23) Fundamentals of urban mining.** Duration: 03:00 Lecture **S43 (19-23) Fundamentals of urban mining.** Duration: 03:00 Lecture **S43 (19-23) Fundamentals of urban mining.** Duration: 03:00 Lecture **S43 (19-23) Fundamentals of urban mining.** Duration: 03:00 Lecture **S43 (19-23) Fundamentals of urban mining.** Duration: 03:00 Lecture			**Presentation of supervised works** Individual work Progressive assessment Presential Duration: 00:30 **Presentation of supervised works** Individual work Progressive assessment Presential Duration: 00:30 **Presentation of supervised works** Group work Progressive assessment Presential Duration: 00:30
4				**Final Evaluation** Written test Progressive assessment Presential Duration: 02:00 **Final Examination** Written test Global examination Presential Duration: 02:00
5				
6				
7				
8				
9				
10				
11				
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
1	Completion of a sample multiple-choice test	Written test	Face-to-face	00:15	5%	3.5 / 10	CB07 CB08 CB10 CT03 CT07 CB06
1	Moodle Questionnaire	Online test	No Presential	00:30	5%	3.5 / 10	CB06 CB10 CB08 CT03 CT07
1	Classroom evaluation	Written test	Face-to-face	00:15	5%	3.5 / 10	CE09 CG03 CG04 CB06 CB07 CB08 CB10 CT01 CT07
2	Classroom evaluation	Written test	Face-to-face	00:15	5%	3.5 / 10	CB06 CB07 CB08 CB10 CT01 CT03 CT07
2	Classroom evaluation	Group work	Face-to-face	00:15	5%	3.5 / 10	CG03 CB06 CB07 CB10 CT03 CT07

2	Moodle Questionnaire	Online test	No Presential	00:30	5%	/ 10	CB07 CB10 CT03 CT07 CG03 CB06
2	Evaluation	Group work	Face-to-face	00:30	5%	/ 10	CE04 CE09 CG03 CB06 CB07 CB10 CE03 CT03 CT04 CT07
3	Presentation of supervised works	Individual work	Face-to-face	00:30	5%	/ 10	CE03 CE04 CE09 CG03 CG04 CB06 CB07 CB10 CT01 CT03 CT04 CT07
3	Presentation of supervised works	Individual work	Face-to-face	00:30	5%	/ 10	CE09 CG03 CG04 CB06 CB07 CB10 CT03 CT07 CE03 CE04
3	Presentation of supervised works	Group work	Face-to-face	00:30	5%	/ 10	CG03 CB06 CB07 CB10 CT03 CT07
4	Final Evaluation	Written test	Face-to-face	02:00	50%	3.5 / 10	CE03 CE04 CE09 CG03 CB06 CB07 CB08 CB10 CT01

							CT03 CT04 CT07

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
4	Final Examination	Written test	Face-to-face	02:00	100%	3.5 / 10	CE03 CE04 CE09 CG03 CG04 CB06 CB07 CB08 CB10 CT01 CT03 CT04 CT07

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Evaluacion extraordinaria	Written test	Face-to-face	02:00	100%	3.5 / 10	CE03 CE04 CE09 CG03 CG04 CB06 CB07 CB08 CB10 CT01 CT03 CT04 CT07

6.2. Assessment criteria

1. A special revision test:

- Throughout the course, short control tests will be proposed in class.

- It will be necessary to have carried out at least 3 control tests.

2) Presentation of supervised works:

- At least two works related to the subject matter will be proposed to be developed individually or in small groups.

3) Collaborative exercises in the classroom

- During the course, three application exercises will be carried out in the classroom in order to solve by working in small groups.

- It will be necessary to have carried out at least 2exercises in the classroom.

The evaluation of 50% of the records for activities other than the exam will only be carried out when:

- The final exam grade is equal to or greater than 3.5 points over 10.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Takashi Nakamura & Kohmei Halada: Urban mining systems. Springer Japan	Bibliography	

Thomas H. Christensen: Solid Waste Technology & Management VOLUME 1. John Wiley & Sons	Bibliography	
Mining, U. (2015). Urban mining: Concepts, terminology, challenges. Waste Management, 45, 1-3	Bibliography	
C. Tunsu et al. / Hydrometallurgy 156 (2015) 239?258: Reclaiming rare earth elements from end-of-life products: A review of the perspectives for urban mining using hydrometallurgical unit operations	Bibliography	
Baldé, C. P., Forti, V., Gray, V., Kuehr, R., Stegmann, P.: Cantidades, Flujos, y Recursos	Bibliography	Observatorio mundial de los residuos electrónicos 2017
Baumann, H., & Tillman, A. M. (2004). The Hitch Hiker's Guide to LCA. An orientation in life cycle assessment methodology and application. External organization.	Bibliography	
Brunner, P.H. (2011). Urban Mining: A contribution to Reindustrializing the City. Journal of Industrial Ecology. Vol 15, 3. DOI: 10.1111/j.1530-9290.2011.00345.x	Bibliography	
Krook, J., & Baas, L. (2013). Getting serious about mining the technosphere: a review of recent landfill mining and urban mining research. Journal of Cleaner Production, 55, 1-9.	Bibliography	
Klinglmair, M., & Fellner, J. (2010). Urban mining in times of raw material shortage. Journal of Industrial Ecology, 14(4), 666-679.	Bibliography	

Widmer, R., Oswald-Krapf, H., Sinha-Khetriwal, D., Schnellmann, M., & Böni, H. (2005). Global perspectives on e-waste. Environmental impact assessment review, 25(5), 436-458.	Bibliography	
Waste Framework Directive 2018: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0851&from=EN	Web resource	
The European Commission - critical raw materials here: http://ec.europa.eu/enterprise/policies/rawmaterials/critical/index_en.htm	Web resource	
Green Paper - Plasitc wastes https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0123: :	Web resource	
Moodle platform of the subject. In it you can find all the contents of the subject, as well as the questionnaires and links to other resources	Web resource	

8. Other information

8.1. Other information about the subject

The subject is designed for continuous avaluation, developing in the classroom numerous activities of application of the contents of the program. Throughout the course will be carried out collaborative works, exercises, questionnaires in Moodle, application and evaluation tests. Evaluation only by the final test is not recommended due to the technical nature and practical focus of the subject.

La asignatura está diseñada para la evaluación continua, desarrollándose en el aula numerosas actividades de aplicación de los contenidos del programa. A lo largo del curso se realizarán trabajos colaborativos, ejercicios, cuestionarios en Moodle, pruebas de aplicación y evaluación. No se recomienda la Evaluación sólo por prueba final debido al carácter técnico y al enfoque práctico de la asignatura.