ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

133000205 - Characterization And Management Of Construction Pr

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	133000205 - Characterization And Management Of Construction Pr
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 *
Javier Angel Ramirez Masferrer	151.02.100.0	j.ramirez@upm.es	Sin horario. By appointment.
Eutiquio Gallego Vazquez	151.02.095.0	eutiquio.gallego@upm.es	Sin horario. By appointment.
Justo Garcia Navarro (Subject coordinator)	151.02.101.0	justo.gnavarro@upm.es	Sin horario. By appointment.

* 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
Anabel Castillo Rodríguez	anabel.castillo@upm.es	UPM - ETSIAAB
Daniel Fernández Llana	d.f.llana@upm.es	UPM - ETSIMFMN
Guillermo íñiguez González	guillermo.iniguez@upm.es	UPM - ETSIMFMN

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

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.

CE01 - El alumno conocerá la legislación ambiental y tendrá la capacidad de planificar un modelo de 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.

CT06 - El alumno tendrá capacidad para liderar equipos de trabajo de diversa índole, con actitud proactiva y motivadora, comunicando con claridad los objetivos y las tareas de cada componente del equipo.

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.

RA55 - Describir tecnologías de reciclaje patentadas: uso, potencial, etc. / To describe patented technologies: use, potential, etc.

RA56 - Analizar los modelos de negocio existentes para el fin de vida de los productos de construcción. / To analyse the existing business models for the end-of-life of construction products.

RA58 - Analizar propiedades químicas y físicas de RCD y materiales secundarios. / To analyse chemical and physical properties of CDW and secondary raw materials.

RA53 - Planificar medidas de deconstrucción; descontaminación de residuos peligrosos, preparación para el reciclaje y reciclaje (fin de vida). / To plan design for deconstruction measures; hazardous waste decontamination, preparation for recycling and recycling (end-of-life stage).

RA57 - Contribuir al diseño y análisis de cadenas de valor para una economía circular. / To contribute to the design and analysis of innovative value chains for a circular economy.

RA52 - Distinguir entre la situación actual de distintos países europeos en cuanto a gestión de los residuos de construcción y demolición (RCD): productos de fin de vida generados, diferentes orígenes, tipo de fracciones, etc. / To know the current picture of construction and demolition waste (CDW) in the European Union: end-of-life products generated, different sources, type of fractions, etc.

* 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 is a subject that analyses construction materials and products from the perspective of the circular economy, with the aim of converting construction and demolition waste into secondary construction materials.

4.2. Syllabus

1. MODULE 1: SUSTAINABILITY, THE CONSTRUCTION SECTOR AND THE EUROPEAN UNION

1.1. LESSON 1.1. Sustainability and the circular economy.

1.1.1. - Introduction to sustainability and circular economy.

1.1.2. - Sustainable construction products.

1.1.3. - EU legislation and regulations. Standards.

1.1.4. - Methods of environmental analysis and life cycle. Regulatory framework for life cycle assessment.

1.1.5. - Environmental Product Declarations (EPDs). Product category Rules (PCRs).

1.1.6. - Use of EPDs in building construction. Case studies.

1.2. LESSON 1.2. Construction and demolition waste (CDW) in the European Union.

1.2.1. - Waste classification. European List of Waste.

1.2.2. - EU Directives and Recommendations on waste. Directive 2008/98/EC.

1.2.3. - Situation in different EU countries. Eurostat database.

2. MODULE 2: FROM CONSTRUCTION AND DEMOLITION WASTE TO SECONDARY BUILDING MATERIALS

2.1. LESSON 2.1. Treatment of construction and demolition waste (CDW).

2.1.1. - Re-use, recycling and recovery of CDW from existing & contemporary construction systems. Challenges and opportunities.

2.1.2. - Waste fractions and sources.

2.1.3. - Existing recycling technology. Waste treatment plants. Patented technologies.

2.2. LESSON 2.2. Design and building deconstruction.

2.2.1. - Building deconstruction for an efficient recovery or products.

2.2.2. - Design strategies.

2.3. LESSON 2.3. Business models for the end-of-life of construction products.

2.3.1. - Innovation in the value chain.

2.3.2. - Viability and circularity of products and systems through design tools.

3. MODULE 3: QUALITY SECONDARY RAW MATERIALS

3.1. LESSON 3.1. CDW characterization.

3.1.1. - Waste fractions and CDW characterization.

3.1.2. - Quality criteria.

3.1.3. - Waste acceptance criteria.

3.2. LESSON 3.2. Secondary materials characterization

3.2.1. - Primary materials quality criteria.

3.2.2. - Secondary raw materials quality criteria.

3.2.3. - Official Laboratories for Testing Construction Materials. Technical visit.

5. Schedule

5.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	**LESSON 0. Presentation of the course.** Duration: 02:00 Lecture **LESSON 1.1. Sustainability and the circular economy.** Duration: 02:00 Lecture **LESSON 1.2. Construction and demolition waste (CDW) in the European Union.** Duration: 02:00 Lecture **WEEKLY CONTROL** Duration: 00:30 Additional activities	**Activity 0.0: Course's Initial questionnaire.** Duration: 00:10 Additional activities **Activity 0.1: Initial questionnaire about Sustainability and the circular economy.** Duration: 00:10 Additional activities **Activity 0.2: Initial questionnaire about the use of wikis; 'Wiki Questionnaire'.** Duration: 00:10 Additional activities **Activity 0.3: Configuration of collaborative groups & waste fraction in which each group focuses.** Duration: 00:30 Cooperative activities **Activity 0.4: Initial draft of the Wiki structure.** Duration: 01:00 Cooperative activities **Activity 1.1.1: Scientific and professional documentation on the field of Sustainability and the circular economy, to feed the relevant section of the Wiki.** Duration: 01:00 Additional activities **Activity 1.1.2: Peer evaluation of the Initial draft of the Wiki structure through the use of the Wiki rubric.** Duration: 01:00 Additional activities **Activity 1.2.1: Final draft of the Wiki structure.** Duration: 01:00 Cooperative activities **Activity 1.2.2: Scientific and professional documentation on the field of CDW, to feed the relevant section of the Wiki.** Duration: 01:00 Cooperative activities		**WEEKLY CONTROL** Individual presentation Progressive assessment Presential Duration: 00:30

2	**LESSON 2.1. Treatment of construction and demolition waste (CDW).** Duration: 02:00 Lecture **LESSON 2.2. Design and building deconstruction.** Duration: 02:00 Lecture **LESSON 2.3. Business models for the end-of-life of construction products.** Duration: 02:00 Lecture **WEEKLY CONTROL** Duration: 00:30 Additional activities	**Activity 2.1.1: Scientific and professional documentation on the waste fraction that the group is working about to feed the relevant section of the Wiki.** Duration: 01:00 Cooperative activities **Activity 2.1.2: Scientific and professional documentation on the patented technology for the waste fraction that the group is working about to feed the relevant section of the Wiki.** Duration: 01:00 Cooperative activities **Activity 2.1.3: Peer evaluation of other groups' wiki developments on the problem, solution, and specific waste fraction, using the Wiki rubric.** Duration: 01:00 Cooperative activities **Activity 2.1.4: Analysis of the information on the Waste Treatment Plant (Flipped learning).** Duration: 02:00 Additional activities **Activity 2.1.5: Prepare questions for the visit to the Plant (Flipped learning).** Duration: 01:00 Additional activities **VISIT TO A WASTE TREATMENT PLANT** Duration: 03:00 Additional activities **Activity 2.1.1. Scientific and professional documentation on the problem (landfilling) and the solution (waste avoidance and recovery), to feed the relevant section of the Wiki.** Duration: 01:00 Cooperative activities **Activity 2.2.1: Scientific and professional documentation on Design and building deconstruction that the group is working about to feed the relevant section of the Wiki.** Duration: 01:00 Cooperative activities **Activity 2.3.1. Documentation of the proposed approach by the group to ensure the circularity of the sustainable construction product, to feed the relevant section of the Wiki.** Duration: 01:00 Cooperative activities **Activity 2.3.2. Initial draft of the Infographic structure.**		**WEEKLY CONTROL** Individual presentation Progressive assessment Presential Duration: 00:30

		Duration: 02:00 Cooperative activities **Activity 2.3.3. Peer evaluation of other groups' initial Infographic structure, through the use of the Wiki rubric.** Duration: 01:00 Additional activities **Activity 3.1.0. Initial questionnaire about CDW characterization.** Duration: 00:10 Additional activities		
3	**LESSON 3.1. CDW characterization.** Duration: 02:00 Lecture **LESSON 3.2. Secondary materials characterization.** Duration: 02:00 Lecture **WEEKLY CONTROL** Duration: 00:30 Additional activities	**Activity 3.1.1: Scientific and professional documentation on the waste characterization on which the group is working about, to feed the relevant section of the Wiki.** Duration: 01:00 Cooperative activities **Activity 3.1.2: Peer evaluation of other groups' wiki developments on waste characterization, through the use of the Wiki rubric.** Duration: 01:00 Additional activities **Activity 3.1.3: Final draft of the Infographic.** Duration: 02:00 Cooperative activities **Activity 3.2.1: Analysis of the information on the Official Laboratory for Testing Construction Materials.** Duration: 01:00 Cooperative activities **Activity 3.2.2: Prepare questions for the visit to the Official Laboratory for Testing Construction Materials.** Duration: 01:00 Additional activities **VISIT TO THE OFFICIAL LABORATORY** Duration: 03:00 Additional activities **Activity 3.2.3. Scientific and professional documentation on the secondary materials characterization. Including a case study report documenting relevant data on the visit to the Official Laboratory for Testing Construction Materials.** Duration: 01:00 Cooperative activities **Activity 3.2.4: Peer evaluation of the rest of Groups' Final project (Wiki & Infographic), through the use of the Wiki rubric.**		**WEEKLY CONTROL** Individual presentation Progressive assessment Presential Duration: 00:30

		Duration: 01:00 Additional activities		
4	**PREPARATORY ORAL DEFENCE (Students receive feedback by students and teachers).** Duration: 02:00 Cooperative activities **WEEKLY CONTROL** Duration: 00:30 Additional activities			**WEEKLY CONTROL** Individual presentation Progressive assessment Presential Duration: 00:30
5				
6				
7	**GLOBAL EVALUATION/ DEFENSE OF THE COURSE PROJECT** Duration: 02:00 Additional activities			**GLOBAL EVALUATION/ DEFENSE OF THE COURSE PROJECT** Individual presentation Progressive assessment Presential Duration: 02:00 **GLOBAL EVALUATION/ DEFENSE OF THE COURSE PROJECT** Individual presentation Global examination Presential Duration: 02:00
8				
9				
10				
11				
12				
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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	WEEKLY CONTROL	Individual presentation	Face-to-face	00:30	10%	5 / 10	CB06 CB09 CB10 CT01 CT03 CT04 CT07 CT06
2	WEEKLY CONTROL	Individual presentation	Face-to-face	00:30	10%	5 / 10	CB06 CB09 CB10 CT01 CT03 CT04 CT07 CT06
3	WEEKLY CONTROL	Individual presentation	Face-to-face	00:30	10%	5 / 10	CB06 CB09 CB10 CT01 CT03 CT04 CT07 CT06
4	WEEKLY CONTROL	Individual presentation	Face-to-face	00:30	10%	5 / 10	CB06 CB09 CB10 CT01 CT03 CT04 CT07 CT06
7	GLOBAL EVALUATION/ DEFENSE OF THE COURSE PROJECT	Individual presentation	Face-to-face	02:00	60%	5 / 10	CE01 CB06 CB09 CB10 CT01 CT03 CT04

							CT07 CT06 CG04

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	GLOBAL EVALUATION/ DEFENSE OF THE COURSE PROJECT	Individual presentation	Face-to-face	02:00	100%	5 / 10	CE01 CB06 CB09 CB10 CT01 CT03 CT04 CT07 CT06 CG04

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
GLOBAL EVALUATION/ DEFENSE OF THE COURSE PROJECT	Individual presentation	Face-to-face	02:00	100%	5 / 10	CE01 CB06 CB09 CB10 CT01 CT03 CT04 CT07 CT06 CG04

6.2. Assessment criteria

All the teaching programmed as face-to-face may be taught indistinctly as physical or remote face-to-face (online). The same occurs with the evaluation activities, which may be carried out face-to-face or online in accordance with the criteria established by the teachers, or due to external circumstances. For this academic year, everything is planned in person.

The students will follow the subject carrying out the activities and evaluation controls progressively. In them, their attitude towards the subject will be valued in the first place: that is, effort, involvement and willingness to achieve the stated learning objectives. In addition, the initiative, the rigor in the work, the viability of their proposals, and the application of the knowledge acquired will be valued, confirming the acquisition of basic, general, transversal and specific competences.

In the event that students do not follow the subject continuously and attend the global evaluation directly, it will be understood that the students have renounced following the subject program and have chosen to achieve the objectives by themselves and following the guidelines of the subject (this document), so only the acquisition of the formulated competences will be valued.

In addition to the weights described in the assessment tests, the other aspects to consider for the student's final grade will be considered as follows:

BRIEF DESCRIPTION OF ASSESSABLE ACTIVITIES	MOMENT	PLACE	WEIGHT IN THE MARK
Participation / attitude	Continued	Face-to-face / online	10 %
By assessing assignment and activities	Continued	Face-to-face / online	30 %
By assessing a test / final exam	Punctual	Face-to-face / online	60 %

The final marks of the student will consider the following criteria:

- Participation / attitude percentage. The student must complete the defined program following the itinerary and options that he/she decides according to his/her personal and professional interests: 10 %.
- Percentage of the mark that will be obtained by evaluating works and activities: 30%.
- Percentage of the mark that will be obtained by evaluating a test / final exam: 60%.

- Attendance to classes and tutorials: It is recommended that the student participate in not less than the 80% of the scheduled sessions in any case. The tutorials may be face-to-face or online, and are encouraged for the continuous evaluation of the student, through a closer and tailor-made academic monitoring.

Evaluation system	MINIMUM Weighting	MAXIMUM Weighting
Participation / attitude	5	15
Assignments and activities	15	45
Final Exam	50	70

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
BIBLIOGRAPHY about Sustainability, Life cycle and Circular Economy	Bibliography	
Analysis of waste hierarchy in the European waste directive 2008/98/EC.	Bibliography	Gharfalkar, M., Court, R., Campbell, C., Ali, Z., & Hillier, G. (2015). Waste management, 39, 305-313.

Circular Economy Action Plan for a cleaner and more competitive Europe.	Bibliography	European Commission. https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf
Circular economy scientific knowledge in the European Union and China: A bibliometric, network and survey analysis (2006?2016).	Bibliography	Türkeli, S., Kemp, R., Huang, B., Bleischwitz, R., & McDowall, W. (2018). Journal of cleaner production, 197, 1244-1261.
Exploring factors influencing post-consumer gypsum recycling and landfilling in the European Union.	Bibliography	Jiménez-Rivero, A., & García-Navarro, J. (2017a). Resources, Conservation and Recycling, 116, 116?123. https://doi.org/10.1016/j.resconrec.2016.09.014
Life cycle energy and material flow implications of gypsum plasterboard recycling in the European Union.	Bibliography	Jiménez Rivero, A., Sathre, R., & García Navarro, J. (2016). Resources, Conservation and Recycling, 108, 171?181. https://doi.org/10.1016/j.resconrec.2016.01.014
Overview of Deconstruction in Selected Countries	Bibliography	CIB International Council for Research and Innovation in Building and Construction. (2000). CIB Publication 252. Edited by Charles J. Kibert and Abdol R. Chini. Task Group 39: Deconstruction.
BIBLIOGRAPHY about New building models, Design and Building Deconstruction	Bibliography	
Design for deconstruction and materials reuse.	Bibliography	Guy, B., Shell, S., & Esherick, H. (2006). Proceedings of the CIB Task Group, 39(4), 189-209.
Salvaging building materials in a circular economy: A BIM-based whole-life performance estimator.	Bibliography	Akanbi, L. A., Oyedele, L. O., Akinade, O. O., Ajayi, A. O., Delgado, M. D., Bilal, M., & Bello, S. A. (2018). Resources, Conservation and Recycling, 129, 175-186.
Recycling apparatus for gypsum plasterboard.	Others	Rasmussen, K. (2004). European Patent Application.

BIBLIOGRAPHY about Waste and Secondary raw materials	Bibliography	
Characterization of quality recycled gypsum and plasterboard with maximized recycled content.	Bibliography	Jiménez-Rivero, A., & García-Navarro, J. (2017). Materiales de Construcción, 67(328), 1?10. https://doi.org/10.3989/mc.2017.06016
Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.	Bibliography	European Parliament and the Council of the European Union. (2008). Retrieved March 20, 2017, from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:en:PDF
End of waste criteria. Final Report.	Bibliography	? Delgado, L., Sofia-Catarino, A., Eder, P., Litten, D., Luo, Z., & Villanueva, A. (2009). https://doi.org/10.2791/28650
EU Construction & Demolition Waste Management Protocol.	Bibliography	European Commission. (2016). Retrieved from http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8983
European Commission - Environment - Waste - Studies on Waste.	Bibliography	European Commission. (2017). Retrieved from http://ec.europa.eu/environment/waste/studies/
Quality Protocol. Gypsum. End of waste criteria for the production and use of recycled gypsum from waste plasterboard.	Bibliography	WRAP, & Environment Agency. (2013).
Screening template for Construction and Demolition Waste management in Belgium.	Bibliography	Deloitte. (2015). Retrieved from http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Belgium_Factsheet_Final.pdf
WEB RESOURCES	Web resource	
ISO	Web resource	https://www.iso.org/home.html
Moodle	Web resource	Web site of the course.
Recursos Científicos FECYT	Web resource	https://www.recursoscientificos.fecyt.es/
RECOLECTA FECYT	Web resource	https://recolecta.fecyt.es/

ScienceDirect	Web resource	http://www.sciencedirect.com/science/journals
SCOPUS	Web resource	https://www.scopus.com/home.uri
UNE	Web resource	https://www.une.org/

8. Other information

8.1. Other information about the subject

SHORT DESCRIPTION OF THE ORGANIZATIONAL MODALITIES AND TEACHING METHODS USED

LECTURES

This subject is face-to-face, but it can be taught in a blended format and even totally online, depending on the needs or exceptional circumstances that may arise. 10 sessions are planned in a master class format with discussions and collaborative activities.
Allocation foreseen: 20 hours.

PRACTICAL LECTURES

The practical lectures consist of carrying out the activities proposed in each of the lessons of the program, including specific planned face-to-face or online sessions for the monitoring and assistance of the student.
Allocation foreseen: 20 hours.

TEAMWORKS

The subject is based on a Course Work on CIRCULAR ECONOMY OF CONSTRUCTION PRODUCTS, which focuses on a specific construction product and mainly consist of enhancing the quality of the contents in Wikipedia; creating an infographic/poster to convey the written contents visually, to accompany or be a reference in the Wikipedia page whenever possible; and delivering a short video to spread the main message of your work. This dissemination video will aim to provide visibility to your effort, sending it for approval to the UPM YouTube Channel and other Social Media.
Allocation foreseen: 40 hours.

TUTORIALS

The tutorials may be face-to-face or online sessions, depending on the interests of the students.
Allocation foreseen: 4 hours.

SELF-STUDY AND AUTONOMOUS WORK

Self-study and autonomous work of the student are one of the basis of the course, since the rest of the activities and other didactic resources depend to a large extent on its results. The following of the offered program must be completed with the search, selection and reading of materials that complement the objectives defined by the students under the tutoring of the professors.
Allocation foreseen: 12 hours.

CONTROLS AND EXAMS

The Course Work will end with a presentation and oral defense by the students who, in addition to self-assessing their work, will be evaluated by a Jury and by their peers.
Allocation foreseen: 4 hours.