Course guide
310752 - 310752 - Construction Life Cycle Analysis

Last modified: 03/01/2025

Unit in charge: Barcelona School of Building Construction
Teaching unit: 753 - TA - Department of Architectural Technology.

Degree: BACHELOR'S DEGREE IN ARCHITECTURAL TECHNOLOGY AND BUILDING CONSTRUCTION (Syllabus 2019). (Optional subject).

Academic year: 2024 **ECTS Credits:** 3.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: JOSE MANUEL VICENTE GOMEZ SOBERON

Others: JOSE MANUEL VICENTE GOMEZ SOBERON

PRIOR SKILLS

Specific capabilities:
a) Cognitive:
- Basic knowledge of the behavior of the materials used in engineering and architecture works, such as: environmental degradation processes, stresses and minimum requirements.
- General mechanical behavior and physical properties of materials.
- Basic knowledge of the construction process of architectural and engineering elements.
b) Procedural-Instrumental:
- Evaluation of variations and their implication within the general behavior of the materials used in construction.
c) Skills-Attitudes:
- Predisposition for the application of the use of sustainable materials, techniques or solutions in construction.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
FE-05. FE-5 Ability to adapt the construction materials to the typology and use of the building, manage and run the receipt and quality control of the materials, its implementation in the construction, the control of execution of the construction units and the realization of trials and final tests.
FE-12. FE-12 Knowledge of the evaluation of the environmental impact of the construcion and demolition, the sustainability in the construction, and the procedures and techniques to evaluate the energetic efficiency of the buildings.
FE-13. FE-13 Ability to apply the technical regulation to the construction process, and generate documents of technical specification in the constructive procedures and methods of buildings.

Transversal:
07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
04 COE. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
02 SCS. SUSTAINABILITY AND SOCIAL COMMITMENT. Being aware of and understanding the complexity of social and economic phenomena that characterize the welfare society. Having the ability to relate welfare to globalization and sustainability. Being able to make a balanced use of techniques, technology, the economy and sustainability.

TEACHING METHODOLOGY

Demonstrative master classes.
Active learning.
Self-learning.
Teamwork.
Activities:
1. Peer evaluation.
2. Positive active participation.
3. Work inside and outside the classroom, small deliverables.
4. Exhibition of real cases.
5. Multiple choice test.
6. Co-directed research work and its presentation.
Means:
Use of computer room.
LCA program (open use).
Classroom.

LEARNING OBJECTIVES OF THE SUBJECT

The new trend in the study of the optimal life cycle of materials, new specifications and environmental requirements, and current economic constraints in the construction sector; make the application of sustainable criteria, of designing to prevent beyond the useful life and of applying new second-generation materials within the construction field, is currently required as a recommendable nature. Therefore, the general objective of the course is to provide knowledge of these alternative design procedures, their evaluation in the design phase through simulation, and their evaluation of economic feasibility.

The content of this subject is intended to provide a coherent answer to questions of great importance for the students who study it. These issues are related to: on the one hand with aspects such as obtaining knowledge that allows adapting the new current environmental requirements to construction technology and, on the other hand, acquiring capacities and competencies to adapt, propose, investigate and implement new applications that have the component of being environmentally less aggressive, that encourages a closed cycle in the construction industry, and that favor proposals that implement the concept of zero emissions.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	40.00
Self study	45,0	60.00

Total learning time: 75 h

CONTENTS

Module 1 GENERAL CONCEPTS

Description:
In this content we work:
1.1 The environment and sustainable development.
1.2 The incidence of materials in a sustainable construction.
1.3 Energy in the process of sustainable construction.
1.4 The impact of transport on sustainable criteria.
1.5 Waste from the construction process (generation and typologies).
1.6 Waste treatment policies.
1.7 Pollutant emissions.
1.8 Recycling and the life cycle of materials.
1.9 Waste management.

Related activities:
Activities within the classroom:
M1 ACT1 Class. Active learning and peer evaluation.
M1 ACT2 Class. Individual work.
Activities outside the classroom:
M1 ACT1 Home. Reading / synthesis / expression.
M1 ACT2 Home. Positive interdependence.
Test: M1. Multiple choice test evaluation.
Class forum.
Real Case Work.

Full-or-part-time: 23h 30m
Theory classes: 5h
Practical classes: 4h
Guided activities: 9h
Self study : 5h 30m

Module 2 LIFE CYCLE ANALYSIS (LCA)

Description:
In this content we work:
2.1 Applicable regulations and terminologies (ISO 14040/44, ISO 14040, ISO 14044, UNE EN 15978 BUILDING, UNE EN 15804 PRODUCT).
2.2 Functional unit and service unit.
2.3 Definition of objectives and scope of an LCA.
2.4 Inventory analysis of an LCA (ICV).
2.4 Environmental Impact Analysis (EIA).
2.5 Life Cycle Cost Analysis (ACCV).
2.6 Risk analysis (AR).
2.7 Environmental indicators (IA).
2.8 Interpretation of an LCA.

Related activities:
Activities within the classroom:
M2 ACT1 Class. Group Work, Make a Poster, Peer Evaluation.
Activities outside the classroom:
M2 ACT1 House. Individual work outside of class.
M2 ACT2 House. Group work outside of class, Positive interdependence.
Test: M2. Multiple choice test evaluation.
Class forum.
Real Case Work.

Full-or-part-time: 26h 30m
Theory classes: 10h
Practical classes: 2h
Guided activities: 9h
Self study : 5h 30m

Module 3 ANALYSIS OF THE LIFE CYCLE IN CONSTRUCTION

Description:
In this content we work:
3.1 Production or cradle-door stage, A1-3 (supply of raw materials, transport and manufacturing).
3.2 Construction process stage, A4-5 (transportation and construction).
3.3 Use stage, B1-7 (use, maintenance, repair, replacement, rehabilitation, energy use and use of service water).
3.4 End of life stage, C1-4 (deconstruction, transport, waste treatment and waste disposal).
3.5 Stage of benefits and charges beyond the system boundary, D (potential for reuse, recovery and recycling).

Related activities:
Activities within the classroom:
M3 ACT1. Active learning.
Test: M3. Multiple choice test evaluation.
Class forum.
Real case work.

Full-or-part-time: 15h 30m
Theory classes: 5h
Practical classes: 2h
Guided activities: 3h
Self study : 5h 30m

Module 4 RESEARCH AND PRAXIS

Description:
In this content we work:
4.1 Documented practical cases.
4.2 Realization and presentation of research work (practical use of real case with computer program).

Related activities:
Real-life case analysis.

Full-or-part-time: 9h 30m
Theory classes: 2h
Self study : 7h 30m

GRADING SYSTEM

The evaluation system that will be applied is continuous evaluation throughout the course; all evaluations will have rubrics that will establish the weighting criteria of the type: formal and format, as well as technical and content. The rubrics will have a minimum progressive scale of three levels for each item.
The types of evaluations will be:
1. Equal Assessment (EI).
2. Positive Active Participation (PAP).
3. Work Inside the Classroom (TDA).
4. Work Outside the Classroom (TFA).
5. Multiple Response Test (TRM).
6. Real Case Work (TCR).
7. Exhibition of Real Cases Work (ETCR).

Final Course Grade = (EI x 5%) + (PAP x 15%) + ((TDA + TFQ) x 25%) + (TRM x 30%) + ((TCR + ETCR) x 25%)

SPECIAL NOTE:
Since the subject is evaluated continuously, it can only be evaluated in the scheduled deliveries, there will NOT be a recovery exam for the same.

EXAMINATION RULES.

If any of the activities of the continuous evaluation are not carried out, it will be considered as not scored.
Demonstrable attendance is required during face-to-face classes (80% minimum to validate grade)

BIBLIOGRAPHY

Basic:
- Valencia, Y.; Gómez-Soberón, J.M.; Gómez, C.. "Dynamic life cycle assessment of the recurring embodied emissions from interior walls: cradle to grave assessment". Journal of building engineering [on line]. [Consultation: 03/01/2025]. Available on: https://www.sciencedirect.com/science/article/pii/S2352710222018009.- Valencia, Y.; Gómez-Soberón, J.M.; Gómez, M. C.; Rojas, M.. "Life cycle assessment of interior partition walls: comparison between functionality requirements and best environmental performance". Journal of building engineering [on line]. [Consultation: 03/01/2025]. Available on: https://www.sciencedirect.com/science/article/pii/S2352710221008366.- Yovanna Elena Valencia-Barba; José Mauel Gómez-Soberón; María Consolación Gómez-Soberón; Fernando López-Gayarre. "An Epitome of building floor systems by means of LCA criteria". Sustainability [on line]. MDPI [Consultation: 03/07/2023]. Available on: https://www.mdpi.com/2071-1050/12/13/5442.- Gámez, D.; Gómez-Soberón, J.M.; Corral, R.; Saldaña, H.; Gómez, C.; Arredondo-Rea, S.P. "A cradle to handover life cycle assessment of external walls: choice of materials and prognosis of elements.". Sustainability [on line]. MPDI [Consultation: 03/07/2023]. Available on: https://www.mdpi.com/2071-1050/10/8/2748.- Gámez, D.; Gómez-Soberón, J.M.; Corral, R.; Almaral Sánchez, Jorge Luis; Gómez, M. C.; Gómez, L. "LCA as comparative tool for concrete columns and glulam columns". Journal of sustainable architecture and civil engineering [on line]. [Consultation: 03/07/2023]. Available on: http://sace.ktu.lt/index.php/DAS/article/view/10291.- Gámez, D.; Saldaña, H.; Gómez-Soberón, J.M.; Arredondo-Rea, S.P.; Gómez, C.; Corral, R.. "Environmental challenges in the residential sector: life cycle assessment of Mexican social housing". Energies [on line]. MDPI [Consultation: 03/07/2023]. Available on: https://www.mdpi.com/1996-1073/12/14/2837.- Gámez, D.; Saldaña, H.; Gómez-Soberón, J.M.; Corral, R.; Arredondo-Rea, S.P. "Life Cycle Assessment of residential streets from the perspective of favoring the human scale and reducing motorized traffic flow. From cradle to handover approach". Sustainable cities and society [on line]. [Consultation: 03/07/2023]. Available on: https://www.sciencedirect.com/science/article/abs/pii/S2210670718311946.- Kohler, Niklaus; Moffatt, Sebastian. Industry and environment. Paris: UNEP IE/PAC, 197? -.
- Thiebat, Francesca. Life Cycle Design : An Experimental Tool for Designers. 1st ed. Cham: Springer International Publishing, 2019. ISBN 9783030114961.

Complementary:
- Saldaña, H.; Gámez, D.; Gómez-Soberón, J.M.; Arredondo-Rea, S.P.; Corral, R.; Gómez, C.. "Housing indicators for sustainable cities in middle-income countries through the residential urban environment recognized using single-family housing rating systems". Sustainability [on line]. MDPI [Consultation: 03/07/2023]. Available on: https://www.mdpi.com/2071-1050/11/16/4276.- Gómez-Soberón, J.M.; Saldaña, H.; Gámez, D.; Gómez, M. C.; Arredondo-Rea, S.P.; Corral, R. "A Comparative study of indoor pavements waste generation during construction through simulation tool". International Journal of Sustainable Energy Development [on line]. [Consultation: 03/07/2023]. Available on: https://www.researchgate.net/publication/316597256_A_Comparative_Study_of_Indoor_Pavements_Waste_Generation_During_Construction_through_Simulation_Tool.- Saldaña, H.; Gómez-Soberón, J.M.; Arredondo-Rea, S.P.; Gámez, D.; Corral, R. "Sustainable social housing: the comparison of the Mexican funding program for housing solutions and building sustainability rating systems.". Building and environment [on line]. [Consultation: 03/07/2023]. Available on: https://www.sciencedirect.com/science/article/abs/pii/S0360132318300830.- Saldaña, H.; Gómez-Soberón, J.M.; Arredondo-Rea, S.P.; Almaral Sánchez, Jorge Luis; Gómez, M. C.; Rosell, G.. "The Passivhaus standard in the mediterranean climate: evaluation, comparison and profitability". Journal of green building [on line]. [Consultation: 03/07/2023]. Available on: https://meridian.allenpress.com/jgb/article/10/4/55/116032/THE-PASSIVHAUS-STANDARD-IN-THE-MEDITERRANEAN.- Gómez-Soberón, J.M.; Gómez, M. C.; Gómez, L. "Residues of the construction as new sustainable educational content in the European space of higher education". Educational Research [on line]. [Consultation: 03/07/2023]. Available on: https://www.researchgate.net/publication/261643098_Residues_of_the_construction_as_new_sustainable_educational_content_in_the_European_space_of_higher_education.- Sanhueza, F.; Gómez-Soberón, J. M.; Valderrama, C.; Ossio, F. A. "A comparison of energy efficiency certification in housing: a study of the Chilean and Spanish cases". Sustainability [on line]. MDPI [Consultation: 03/07/2023]. Available on: https://www.mdpi.com/2071-1050/11/17/4771.

RESOURCES

Other resources:
1. Class guides in electronic format used as support for teaching classes.
2. Articles in scientific-technical journals and conferences.
3. Atenea virtual campus with deliverable activities, class forum, notice board, training and evaluation tests, etc.
4. Bibliography available in the bibliographic collections of the UPC.