Course edition	1	Academic Year	2023-24

Ref.	MBUILD M33
MODULE	NEW TRENDS FOR CONSTRUCTION DEVELOPMENT AND RESEARCH
ECTS	6
Year/Semester	Y2/S1
Class hours	60h (10h per ECTS according to Spanish law)
Teaching location	UC, Santander, Spain

1. OBJECTIVES

- To make the students acquire knowledges and the sufficient abilities to apply them in a basic level in the field of research methodology, such as: to look for funding calls, to carry out a state of the art including relevant references, to write a scientific article, to plan a test campaign using standard test procedures, to undertake a Design of Experiments and analyse statistically the results, to write a research proposal, to be aware on ethics on research, etc
- To make the students acquire knowledges in the field of new trends of ICT and digitalisation in the AEC sector, such as: 3D printing, laser scanning, virtual reality, big data and machine learning, digital twins, etc.
- To make the students acquire knowledges in the field of new trends of sustainable materials and technologies in the AEC sector, such as: innovative materials and components (hybrid solutions, CLT, other composites), offsite construction, modular construction, etc.

2. LEARNING OUTCOMES AND COMPETENCES

Learning outcomes

1. To carry out a SOA in a specific field of knowledge including references to relevant sources of information.
2. To be familiar with the main funding mechanisms for research in EU and to be able to fulfil the requirements from a specific call.
3. To be familiar with the main instruments of intellectual property (IP) and to know the main specifications concerning IP.
4. To be able to propose a test campaign to prove a hypothesis, selecting the adequate test procedures, using the Design of Experiments technique to optimise its number, and developing relevant regression models.
5. To be able to develop a research proposal to submit to a call, including a SOA, a list of activities, a test campaign, a budget and a chronogram.
6. To be aware of ethics in research.
7. To be familiar with the new challenges in ICT & digitalization in the AEC sector, such us: 3D printing, laser scanning, virtual reality, big data and machine learning, digital twins, etc.
8. To be familiar with the new challenges in material & technologies in the AEC sector, such us: innovative materials and components (hybrid solutions, CLT, other composites), offsite construction, modular construction, etc.

Specific competences:

- Be able to develop a research proposal and to carry out a research project including topics related with new sustainable construction technologies & materials and digitalization strategies in the AEC sector, in a basic level.

3. SYLLABUS/TOPICS

Block 1 (30h). Elena Blanco:
Introduction to research.
Data bases, referencing.
Scientific article.
State of the Art.
Funding mechanisms for research within Europe.
Intellectual property: copyright and industrial property (trademarks, design models, patents).
Test campaigns. Definition of relevant properties to be measured, selection of standard test.
Design of Experiments (DOE) and Response surface using Minitab.
Structure of a research proposal: Objectives, state of the art, activities, budget, chronogram.
Ethics in research.

Block 2 (15h). Christian Baier:
3D printing.
Laser scanning.
Augmented / virtual reality.
Big data (CDE).
Machine learning.
Digital twins.

Block 3 (15h). Jose Faria:
Innovative materials and components (hybrid solutions, CLT, other composites).
Off-site construction.
Modular construction - Searching for 100% prefabricated solutions.
Urban plan integration – Trends.
Example of solutions (CREE; Tree House by Jular; ...).

4. MANDATORY REFERENCES

- Class notes provided by the lecturers

5. ADDITIONAL REFERENCES

- EU Funding mechanisms (Horizon Europe): https://commission.europa.eu/funding-tenders_en
- EU Funding mechanisms (LIFE +): http://ec.europa.eu/environment/life/project/Projects/
- International Patent Office: http://www.wipo.int/portal/en/index.html
- EU standards database: http://esearch.cen.eu/esearch/
- International standards database http://www.iso.org/iso/catalogue_ics
- Minitab User Manual (2017)
- Bew, M., et al (2008). eWork and eBusiness in Architecture, Engineering and Construction: ECPPM 2008, in: eWork and eBusiness in Architecture, Engineering and Construction. ECCPM 2008, CRC Press.
- Björk, B.-C., Penttilä, H., (1989). A scenario for the development and implementation of a building product model standard. Adv. Eng. Softw. 1978 11, 176–187.

- Bjorkhaug, L., (2003). Use of building product models and reference data libraries for project and quality management, in: International Conference on Construction Project Management Systems: The Challenge of Integration, (CIB W99). in-house publishing, Rotterdam (Netherlands), p. approx. 9 p.
- BSI, 2015a. Committee: B/555 Construction design, modelling and data exchange [WWW Document]. Bsi Stand. Dev. URL https://standardsdevelopment.bsigroup.com/Home/Committee/50061658 (accessed 5.7.15).
- xxxx

6. Assessment Type

- Select one option: (i) Distributed only (courseworks and activities developed during the semester) or (ii) Distributed + Final Exam

- Distributed only (courseworks and activities developed during the semester)

7. Assessment Components and Calculation of Final Grade

7.1. Normal assessment (two opportunities)

The module will be assessed by:

- Exercises /courseworks, to be developed during the teaching period. Some of them will be in groups, some of them individuals. Details will be defined at the beginning of the classes by each lecturer.

	Nr	Weigh in the final grade	Minimum grade
Block 1: exercises /courseworks	1-10	50%	-
Block 2: exercises /courseworks	1-10	25%	-
Block 3: exercises /courseworks	1-10	25%	-
		100%	5.0 (0-10 UC scale) 10.0 (0-20 UP scale) 50.0 (0-100 THM scale)

7.2. Resit assessment

- No minimum grade is required in each specific exercise/coursework or in each block. If the final grade of the module is FAILED, then the student will choose a certain number of exercises/courseworks with the lowest grades of any block to resubmit in order to increase the final grade of the module to obtain a PASS. In those cases where the original exercise/workshop was submitted in group or in pairs, the new submission will be carried out individually; in those situations, lecturer will adapt the exercise to accommodate the working effort for an individual submission.
- Deadline of the re-submission will be done, as latest, during the official resit period of the semester at UC.

8. TEACHING STAFF

Name	Position	University	email
Elena Blanco	Associate Professor	UC	elena.blanco@unican.es
Christian Baier	Associate Professor	THM	christian.baier@bau.thm.de
Jose Faria	Associate Professor	UP	jmfaria@fe.up.pt