

Name of the module (English): Sustainable Construction Materials and Techniques					
Module code (UP): M34 (provisional)		Name of the module (Portuguese): Materiais e Tecnologias de Construção Sustentáveis			
Module code (THM): IMTM (provisional)		Name of the module (German): Nachhaltige Baustoffe und Technologien			
Module code (UC): M34 (provisional)		Name of the module (Spanish): Materiales y tecnologías de construcción sostenibles			
Credits: 6 ECTS	Module status: Obligatory	Duration: 1 semester	Semester: 2	Year: 1	Frequency: Every year
Type of tuition: Classroom-based		Workload: 180 h	Attendance time: 60 h	Self-study time: 120 h	
Usability: Master (Degree in Sustainable Design, Construction and Management of the Built Environment)			Classification: Engineering / Architecture	Teaching language: English	
Module responsibility: Pablo Pascual Muñoz (UC)		Lecturers: Julian Robert Walter Kümmel (THM)			
Description / Observations: In order to make sure that students reach all the learning outcomes, the same structure has been used for syllabus in such a way that a successful development of the student in a unit will definitely result on the achievement of the related learning outcome/s. Thus, by following the syllabus students will be taught about the increasing importance of energy and resource efficiency in construction as well as about the harmful effects in the environment caused by the infrastructures along its life cycle, including construction, maintenance and rehabilitation stages. The students will also be taught about the most important and up to date sustainable materials, techniques and procedures, whose use would eventually mitigate those pernicious effects. Given a new construction project, this knowledge would eventually allow them to provide a basic Life Cycle Assessment at an initial stage and to select the most suitable materials and techniques that ensures the sustainability of the new infrastructure along its whole life cycle.					
Recommended Requirements: Basic knowledge about sustainable concepts in design, construction and managements of buildings and infrastructures.					
Basic competences: <ul style="list-style-type: none"> • Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context. • Students are able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study. • Students are able to integrate knowledge and deal with the complexity of making judgments based on information that is incomplete or limited, including reflections on the social and ethical responsibilities associated with applying their knowledge and judgments. • Students are able to communicate their findings and the ultimate knowledge and reasons behind them to specialist and non-specialist audiences in a clear and unambiguous manner. • Students possess the learning skills to enable them to continue studying in a largely self-directed or autonomous manner. 					
Transverse competences: To reach the proposed learning outcomes, the students will have to develop master level skills such as team working, time management, search for innovation, leadership, decision making, interdisciplinarity and communication skills. The teaching methodologies proposed will enable this by including theoretical lectures with higher level of interaction with students and practical classes in which they will have to work in groups and present the results of study cases to the other students, professors and/or panel of experts.					
Specific competences: To be able to identify and evaluate the most suitable sustainable materials for the construction of infrastructures applying the LCA (Life Cycle Analysis) methodology.					

Learning outcomes:

After the successful completion of this module, the students will have aggregated the information received and worked in many of the other modules (namely IP 1, 2, 3) regarding the knowledge of sustainable materials and technologies, with a stabilized capability to:

- Understand and assess the impact on design development of the principles of the LCA and LCCA techniques.
 - Be able to read and interpret a professional LCA or LCCA as well as to provide their own basic analysis.
 - Be familiar with the sustainability and durability of the main construction materials and be able to frame the information gathered through the course in this field.
 - Be able to propose the use of construction materials that improves the sustainability of the infrastructure.
- Be acquainted with the emerging latest sustainable construction materials, technologies and procedures.

Content

Unit 1: Sustainable materials for building construction.
Unit 2: Sustainable construction materials for infrastructures.
Unit 3: Sustainability assessment of enhanced construction technologies.
Unit 4: Resources and energy efficiency in construction: LCA & LCCA.

Teaching methodology:

The theoretical concepts will be presented to students through oral presentation and other more interactive methods such as video discussion or promoting debates among them.
The practical part of the course will include the development by the students of exercises related to the theoretical classes and the presentation of their results in the form of workshops or more conventional works. Students will be evaluated on the basis of their performance in class (70%) and the oral presentation in groups of a final paper (30%).

Training activities:

	Number of hours	% Attendance
Theory	30	100
Classroom practice	30	100
Tutorials	5	100
Evaluation	5	100
Group work	30	0
Self-directed work	50	0

Assessment method:

	Minimum weighting	Maximum weight
Continuous classroom evaluation	20%	30%
Oral presentation	30%	30%
Practical exercises	40%	50%

Grading system:

U.PORTO	20	19	18	17	16	15	14	13	12	11	10	9	...	0
Portugal	Very Good with distinction			Good with distinction		Good		Sufficient				Fail		
U.CANTABRIA	10.0	9.9	9.0	8.9	...		7.0	6.9	...		5.0	4.9	...	0.0
Spain	Sobresaliente			Notable				Aprobado				Suspenso		
THM	100	...	88	87	73	72	58	57	...		50	49	...	0
Germany	Excellent			Good with distinction		Satisfactory		Sufficient				Fail		

Bibliography:

ISO 14040:2006 -- Environmental management -- Life cycle assessment -- Principles and framework.
Horne, R; Grant, T; Verghese, K (2011). Life cycle assessment: principles, practice, and prospects. Collingwood, Australia.
Curran, M A (2012). Life cycle assessment handbook: a guide for environmentally sustainable products. Scrivener/Wiley, Hoboken, New Jersey, USA.
Dhir, R K et al (2016); Sustainable Construction Materials. Woodhead Publishing, October 2016.
Khatib, J (2016). Sustainability of Construction Materials. Woodhead Publishing, August 2016.
Updated scientific publications related to new materials, techniques and procedures for the construction of infrastructures, provided by the teacher.