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|---|-------------------------------------|---|---|--------------------------------------|---------------------------------|
| <b>Name of the module (English):</b><br>Sustainable Infrastructures and Circular Economy  |                                     |   |   |                                      |                                 |
| <b>Module code (UP):</b><br>M31 (provisional)   |                                     | <b>Name of the module (Portuguese):</b><br>Infraestruturas Sustentáveis e Economia Circular |   |                                      |                                 |
| <b>Module code (THM):</b><br>IMTM (provisional)   |                                     | <b>Name of the module (German):</b><br>Nachhaltige Infrastruktur und Kreislaufwirtschaft    |   |                                      |                                 |
| <b>Module code (UC):</b><br>M31 (provisional)   |                                     | <b>Name of the module (Spanish):</b><br>Infraestructura sostenible y economía circular      |   |                                      |                                 |
| <b>Credits:</b><br>6 ECTS   | <b>Module status:</b><br>Obligatory | <b>Duration:</b><br>1 semester  | <b>Semester:</b><br>2                                   | <b>Year:</b><br>1                    | <b>Frequency:</b><br>Every year |
| <b>Type of tuition:</b><br>Classroom-based  |                                     | <b>Workload:</b><br>180 h   | <b>Attendance time:</b><br>60 h                         | <b>Self-study time:</b><br>120 h     |                                 |
| <b>Usability:</b><br>Master<br>(Degree in Sustainable Design, Construction and Management of the Built Environment)   |                                     |   | <b>Classification:</b><br>Engineering /<br>Architecture | <b>Teaching language:</b><br>English |                                 |
| <b>Module responsibility:</b><br>Daniel Castro Fresno (UC)  |                                     | <b>Lecturers:</b><br>Borja Alonso Oreña (UC)<br>Hipólito José Campos de Sousa (FEUP)        |   |                                      |                                 |
| <b>Description / Observations:</b><br>The contents of this module have been developed in order to follow the same structure of the learning outcomes. The main goal of this module is that the student learns the relevance of Sustainability of Infrastructures along their useful life, not only during design and construction, but also during the exploitation period. For this reason, the students will learn the main aspects related to infrastructures maintenance and exploitation. Besides, they will learn the importance of applying environmental rating systems during the design and construction, in order to get the optimum cycle of circular economy. Finally, the students will learn the aspect related to sustainable mobility in cities, what will ensure their more rational use. In short, this syllabus will provide the students will the knowledge and tools to reach the learning objectives described, by their attendance to class and the practical exercises and planned works.  |                                     |   |   |                                      |                                 |
| <b>Recommended Requirements:</b><br>Basic knowledge about sustainable concepts in design, construction and managements of buildings and infrastructures.  |                                     |   |   |                                      |                                 |
| <b>Basic competences:</b> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> <li>• Students possess the learning skills to enable them to continue studying in a largely self-directed or autonomous manner.</li> </ul> |                                     |   |   |                                      |                                 |
| <b>Transverse competences:</b><br>The proposed methodologies will ensure the active participation of the students what in turn will make the learning of the theoretical concepts easier. On the other hand, with the practical exercises the students will learn different tools. Finally, through the case studies the students will transfer the concepts learned to real problems. Moreover, the students will be pushed to participate in class and work individually or in teams, depending on the task to develop. This will endow the students will other transverse skills such as communication, work in teams or leadership, relevant in a master programme.   |                                     |   |   |                                      |                                 |

The assessment of the subject will be done continuously, through the participation of students in the discussions proposed during the theoretical classes, as well as through the assessment of the practical exercises proposed and the performance of small works in which the concepts taught will be applied to real cases.

**Specific competences:**

To be able to sustainably manage the maintenance and operation of urban infrastructure.

**Learning outcomes:**

1. To understand the importance of maintenance in the management of infrastructures (IS), in view of Circular Economy (CE).
2. To learn the different types of preventive or corrective maintenance (P/CM). To be able to develop a planning of IS maintenance activities. Learn the different types of P/CM and be able to plan its tasks.
3. To be able to identify the most common pathologies and failures and to know the different technologies for the maintenance of roads and urban IS
4. Understand the importance of carrying out an environmental rating system (ERS) into a company, in view of CE.
5. Be familiar with the general concepts of the most common ERS: CEEQUAL, LEED, ENVISION, SIRSDEC, Etc.
6. To understand the mobility needs of citizens and the role of transport planning in IS planning and managing systems.
7. To learn the most common sustainable mobility policies and traffic management measures.
8. To know how Intelligent Transport Systems (ITS) work and their benefits.

**Content:**

Unit 1. Sustainable maintenance and rehabilitation of infrastructures.

- General concepts. Relation between the Circular Economy and the maintenance.
- The preventive and corrective activities of maintenance.
- The most common pathologies and the different technologies for their maintenance.

Unit 2. Sustainability of new infrastructures. ENVIRONMENTAL RATING SYSTEMS.

- Introduction, General concepts. The Circular economy and the Environmental Rating Systems.
- Main aspects to take into account for their implementation in a company.
- General characteristics of the most common environmental rating systems, e.g. CEEQUAL, LEED, ENVISION, SIRSDEC, Etc. Case studies.

Unit 3. Urban mobility: Intelligent Transport Systems (ITS) and Traffic Management

- Urban mobility: transport needs and transport modelling steps.
- Traffic management and transport policies.

ITS and best practices on public transport design.

**Teaching methodology:**

During the theoretical hours, the main concepts of the different topics will be covered in the program to be presented. Conventional presentations and interactive methods will be used. Students' participation will be encouraged: they will participate with news discussion, web blogs and video analysis related to the technologies used.

The practical activities will consist of practical exercises related to the concepts explained during the theoretical classes. In addition, students will study real cases, to which they will apply the contents learned. As far as possible, during the teaching hours there will be conferences organized with experts in each area of this module: e.g. Circular Economy in the Basque Country; a professional responsible for a Maintenance Department of a construction company; a technician responsible for the Santander City Council who will comment on Smart Cities and Urban Mobility.

**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 | 40%               | 60%            |
| Final written work              | 40%               | 60%            |

**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 |     |   |

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