Degree competences to which the subject contributes

Generic:
1. Adapt to changes, being able to apply new and advanced technologies and other relevant processes, initiative and entrepreneurship
2. Communicate and discuss proposals and conclusions in forums multilingual, skilled and unskilled, in a clear and unambiguous
3. Conceive, design, calculate and design processes, equipment, facilities and plants related to the design and manufacture of vehicles and their systems
4. Develop independent learning skills to maintain and enhance the powers of Automotive Engineering, to allow the continued development of the profession.

Teaching methodology

1. Teaching methodology: FACE-TO-FACE TEACHING (18h)
In each lesson of the subject, a fact related to the interrelation automobile-design-environment will be presented
Each one of the lessons includes:
   i) A theory exposition by the Professor (expositive class)
   ii) Expositive class with the participation of the students, as part of the application of the theory, current analysis
   iii) Teamwork
   iv) Oral exposition of the results of the teamworks
   v) Visits to facilities
2. NON FACE-TO-FACE ACTIVITIES OF THE STUDENT. Cooperative learning
Carry out common work (delivery). Definition of the problem to be studied, research, and analysis of information, development of the topic, document drafting and presentation
Study of the contents related to what has been studied in class, specially legislation topics and design tools by complementary lectures

Learning objectives of the subject

The aim of the course is to provide the student of basic knowledge about design and sustainability which will allow him/her, along its professional life, to use them as design criteria and acceptance of solutions. It is expected that once the course is finished, the student:
Objective 1: Is able to define and apply the sustainability concepts and design for its sustainability.
Objective 2: Identify its environment variables which can influence in the design in the automobile: legislation, infrastructure, reuse, recyling...
Objective 3: Know the concept of analysis of the life cycle, the methodology for application and the rules regulating it and
be able to apply the study of automobile pieces or components.

Objective 4: Know where to find or how to use the environmental information and needed infrastructure.

Objective 5: Have the ability to describe and defend the ideas and solutions with sustainability criteria.

### Study load

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group</th>
<th>Hours medium group</th>
<th>Hours small group</th>
<th>Guided activities</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong></td>
<td><strong>75h</strong></td>
<td>0h</td>
<td>18h</td>
<td>9h</td>
<td>48h</td>
</tr>
<tr>
<td></td>
<td>0.00%</td>
<td>24.00%</td>
<td>12.00%</td>
<td>0.00%</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
# 240AU242 - Design for Sustainability

## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
<th>Related activities</th>
<th>Specific objectives</th>
</tr>
</thead>
</table>
| 1. Introduction | 3h | Theory classes: 1h 30m  
Practical classes: 0h 30m  
Self study : 1h | Basic knowledge (environmental impact, sustainability, indicators, ACV...)  
Automotive frame:  
· Environmental aspects of the automobile  
· The vehicle as a source of waste  
· General regulation and legislation  
The importance of the design in sustainability | Open questions in the class  
The student must know the specific terminology related to the sustainability and the design and know how to use it rigorously |
| 2. End of life of vehicles | 4h | Theory classes: 1h 30m  
Practical classes: 0h 30m  
Self study : 2h | Management system of the automobiles out of use  
Possible destinations of the components and materials of automobiles  
Procedures and treatments  
Specific legislation and regulation | Work in class on the assigned project and related to the theory  
The student knows the legislation and knows to apply it on the design  
The student knows the treatment systems of the waste and its interest from the point of view of the design |
### 3. Fuels and emissions

**Learning time:** 4h  
Theory classes: 1h 30m  
Practical classes: 0h 30m  
Self study: 2h

**Description:**  
Evolution of the emissions and the atmospheric pollution related to fuels.  
Factors which influence in the emissions  
Current state and future trends  
Specific legislation and regulation

**Related activities:**  
Work in the class on the assigned project and related to the theory

**Specific objectives:**  
Know the factors concerning the emission of vehicles (gas and noises)  
Be able to convert it into the design criteria

### 4. General design criteria

**Learning time:** 3h  
Theory classes: 1h 30m  
Practical classes: 0h 30m  
Self study: 1h

**Description:**  
Introduction to the design  
Creativity and innovation  
Basic aspects of the design for sustainability  
* Design from the cot to the grave  
* Design from the cot to the cot

**Related activities:**  
Work in class on the assigned project and related to the theory

**Specific objectives:**  
The student knows the general criteria applied to the design for the sustainability in both theory models for the design of products
### 5. Analysis of the life cycle

**Description:**
- What is it?
- How is it carried out?
- Methodologies
- Tools

**Related activities:**
Work in class on the assigned project and related to the theory

**Specific objectives:**
The student is able to understand the importance of the ACV as a tool to make decisions, specially in factors concerning to the design. That the student knows and is able to use the basic knowledge for the development of an ACV study, and the methodologies and existing tools for it

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>10h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>3h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>1h</td>
</tr>
<tr>
<td>Self study:</td>
<td>6h</td>
</tr>
</tbody>
</table>

### 6. Design for X

**Description:**
- Design to:
  - Manufacture
  - Minimize the materials
  - Assembly
  - Durability and end of life
  - Energetic efficiency
  - Recycling
  - Disassemble

**Related activities:**
Work in class on the assigned project and related to the theory

**Specific objectives:**
Present the students some design strategies used to solve certain problems in relevant aspects related to the sustainability of the automobile environment

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>8h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>1h 30m</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>0h 30m</td>
</tr>
<tr>
<td>Theory classes:</td>
<td>1h 30m</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>0h 30m</td>
</tr>
<tr>
<td>Self study:</td>
<td>4h</td>
</tr>
</tbody>
</table>
# Planning of activities

## OPEN QUESTIONS IN CLASS

| Description: | Hours: 1h  
Self study: 1h |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Short conceptual test. Discussion on practical cases</td>
<td></td>
</tr>
<tr>
<td>Support materials:</td>
<td></td>
</tr>
<tr>
<td>Paper and pen</td>
<td></td>
</tr>
<tr>
<td>Descriptions of the assignments due and their relation to the assessment:</td>
<td></td>
</tr>
<tr>
<td>Immediately</td>
<td></td>
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<tr>
<td>Specific objectives:</td>
<td></td>
</tr>
<tr>
<td>Guarantee knowledge. That the student leads the autonomous learning to the concepts he/she has answered incorrectly</td>
<td></td>
</tr>
</tbody>
</table>

## PROJECT

| Description: | Hours: 30h  
Practical classes: 3h  
Self study: 27h |
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>The students must carry out the project in groups throughout the course</td>
<td></td>
</tr>
<tr>
<td>Support materials:</td>
<td></td>
</tr>
<tr>
<td>Computer, paper and pen. Library</td>
<td></td>
</tr>
<tr>
<td>Descriptions of the assignments due and their relation to the assessment:</td>
<td></td>
</tr>
<tr>
<td>First delivery the week number 4 and last delivery the last day of class</td>
<td></td>
</tr>
<tr>
<td>Specific objectives:</td>
<td></td>
</tr>
</tbody>
</table>
| Information research  
Written comunication  
Teamwork | |

## PRESENTATIONS

| Description: | Hours: 8h  
Practical classes: 4h  
Self study: 4h |
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Oral presentation of the results of the project</td>
<td></td>
</tr>
<tr>
<td>Support materials:</td>
<td></td>
</tr>
<tr>
<td>Computer/ Projector</td>
<td></td>
</tr>
<tr>
<td>Descriptions of the assignments due and their relation to the assessment:</td>
<td></td>
</tr>
<tr>
<td>First presentation week number 5. Final presentation the following week once the classes have finished</td>
<td></td>
</tr>
<tr>
<td>Specific objectives:</td>
<td></td>
</tr>
</tbody>
</table>
| Oral communication  
Defense of ideas | |
### VISIT TO FACILITIES

**Description:**
Visit to vehicle process facilities out of service

**Specific objectives:**
Provide the real vision of what happens to the vehicles by the end of its useful life, explained from professionals of the field

**Hours:**
- Guided activities: 2h

### Qualification system

The evaluation of the student will be based on its evolution along the course and will take into account the marks obtained in:
- The final exam (50%). Will have a theory and a practical part (conceptual questions, exercises, text analysis).
- Teamwork (30%), obtained by the realization, delivery and defense, within the scheduled dates, of the work proposed by the Professor.
- Individual work (30%), obtained from the individual evaluation of the teamwork, the competences developed and the analysis of articles and proposed texts.

The qualification will be according to what has been described:

\[ N_{\text{final}} = 0.5 \times N_{\text{ef}} + 0.3 \times N_{\text{pc}} + 0.2 \times N_{\text{pi}} \]

- **Nfinal**: Final mark
- **Nef**: Mark of the final exam
- **Npc**: Mark of the practices (teamwork)
- **Npi**: Mark of practices (individual work)

### Regulations for carrying out activities

The final mark will include a theory and a practical part (exercises, problems, text analysis).

Teamwork. Technological and formal aspects will be considered, as well as the structure of the document, the grammar, orthography. The presentation will be valued by its structure, relevance, clarity and rigour and to adjust to the time set. The students will have available the criteria which will be used for its qualification.

The individual work, consists on a written exam which will cover questions related to the teamwork.

Extraordinary exam: in exceptional cases, an extraordinary final exam can be carried out in substitution of the ordinary. To aim for it, a written application must be delivered, duly justified and supported, before the test (whenever the situation allows it). The extraordinary test can be oral and/or written.
Bibliography

Basic:


Complementary:


Others resources: