Degree competences to which the subject contributes

Specific:
- CE4. Ability to understand and apply the basic knowledge principles of general chemistry, organic and inorganic chemistry and their applications in automotive engineering.

General:
- CG10. Ability to work in a multilingual and multidisciplinary environment.

Transversal:
- 1. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Teaching methodology

MD1 Master class or lecture (EXP)
MD2 Problem solving and case study (RP)
MD3 Practical work in laboratory or workshop (TP)
MD5 Small-scale project, activity or assignment (PR)
MD7 Assessment activities (EV)

Learning objectives of the subject

After this course, students should be able to do the following:
- Understand the concept of reaction, and calculate and apply different ways of expressing the amount of material.
- Recognise the chemical structure of the elements and chemical compounds and relate it to their properties.
- Understand the different types of chemical bonds, how molecules are formed through chemical bonding, and the properties of the molecules formed.
- Describe states of matter.
- Distinguish and analyse the main types of chemical reaction. Identify and apply the most important parameters.
- Describe, express and apply chemical equilibrium.
- Understand the basic pollutant processes in environmental chemistry.
- Use tools to seek and select information, and think about this information using their own judgement.
- Understand the impact of chemicals on the environment and sustainable development.
- Use and understand the chemical language typical of the automotive world.
### Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time:</td>
<td>150h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours medium group:</td>
<td>0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>30h</td>
<td></td>
<td>20.00%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>90h</td>
<td></td>
<td>60.00%</td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Topic 1: Introduction to automotive chemistry</th>
<th>Learning time: 36h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 8h</td>
</tr>
<tr>
<td></td>
<td>Self study : 20h</td>
</tr>
</tbody>
</table>

### Description:
This topic deals with the following:
- Introduction to the language of chemistry in the automotive field
- Expression of concentration
- Elements, compounds and mixtures
- The chemical equation
- Combustion and fuels
- Reaction stoichiometry
- Stoichiometric calculations

### Related activities:
- Lectures with active student participation (large group). Problem solving exercises in the classroom (small group).
- Problems and/or exercises (part of the assessed activity).
- Individual work (part of the assessed activity).

<table>
<thead>
<tr>
<th>Topic 2: Atomic structure, chemical bonds and states of matter</th>
<th>Learning time: 54h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 12h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 12h</td>
</tr>
<tr>
<td></td>
<td>Self study : 30h</td>
</tr>
</tbody>
</table>

### Description:
This topic deals with the following:
2.0 Atomic structure. Light and radiation.
2.1 The periodic table of elements and periodic properties.
2.2 Chemical bonds: ionic bonds, covalent bonds, metallic bonds, properties of substances and chemical bonding.
2.5 Solid state. Types and properties of solids: molecular, ionic, covalent and metal.
2.6 Phase diagrams. Solutions and colligative properties. Antifreeze.

### Related activities:
- Lectures with active student participation (large group). Problem solving exercises in the classroom (small group).
- Problems and/or exercises (part of the assessed activity).
- Individual work (part of the assessed activity).
### Topic 3: Chemical reaction balances

**Learning time:** 34h
- Theory classes: 7h
- Laboratory classes: 7h
- Self study: 20h

**Description:**
3.1. Proton transfer reactions

**Related activities:**
- Lectures with active student participation (large group). Problem-solving exercises in the classroom (small group).
- Problems and/or exercises (part of the assessed activity).
- Individual work (part of the assessed activity).

### Topic 4: Environmental chemistry

**Learning time:** 16h
- Theory classes: 3h
- Laboratory classes: 3h
- Self study: 10h

**Description:**
4.1 Atmospheric chemistry. Atmosphere. Composition and pollution.
4.2. Water chemistry and pollution

**Related activities:**
- Lectures with active student participation (large group). Problem-solving exercises in the classroom (small group).
- Problems and/or exercises (part of the assessed activity).
- Individual work (part of the assessed activity).
### Planning of activities

<table>
<thead>
<tr>
<th>Activity 1: Lectures</th>
<th>Hours: 75h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 25h</td>
</tr>
<tr>
<td></td>
<td>Self study: 50h</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td></td>
</tr>
<tr>
<td>Textbooks and complementary bibliography.</td>
<td></td>
</tr>
<tr>
<td>Teacher notes (Atenea).</td>
<td></td>
</tr>
</tbody>
</table>

**Descriptions of the assignments due and their relation to the assessment:**
This activity is assessed together with the second activity through three mid-semester or final written tests, according to the EPSEM's scheduling. A continuous assessment activity will also be specified at the beginning of the academic year.

**Specific objectives:**
At the end of these lectures, students should have a good grasp of the knowledge set out above in the learning objectives.

<table>
<thead>
<tr>
<th>Activity 2: Class problems</th>
<th>Hours: 45h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self study: 20h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 25h</td>
</tr>
</tbody>
</table>

**Description:**
Methodology: small group.
In each area the teacher presents the students with a series of questions, exercises and problems that must be solved. In the classroom the work done by the students is checked, queries are answered, and different approaches or solutions to a problem or exercise are discussed.

**Support materials:**
Compulsory and recommended reading.
Teacher notes (Atenea).

**Descriptions of the assignments due and their relation to the assessment:**
This activity is assessed together with the first by completion of three mid-semester or final written tests, according to the EPSEM's scheduling. A continuous assessment activity will also be specified at the beginning of the academic year.

**Specific objectives:**
At the end of these classes, students should be able to apply theoretical knowledge of the subject to practical cases.
They should also be able to do the following:
- Analyse the problem: understand the statement.
- Develop a plan for solving the problem.
- Solve the problem.
- Check the solution: see whether it is a logical and reasonable answer.
- Check whether units and significant numbers are correct.
### Activity 3: Monographic seminars

**Description:**
Methodology: small group. The student group should develop a topic, search the literature, write it up and make an oral presentation to the group.

**Support materials:**
Literature found on the internet.

**Descriptions of the assignments due and their relation to the assessment:**
A text and a slide show at the end of the preparation process.

**Specific objectives:**
Ability to seek information independently and communicate it with the right tools.

<table>
<thead>
<tr>
<th>Hours: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory classes: 5h</td>
</tr>
<tr>
<td>Self study: 10h</td>
</tr>
</tbody>
</table>

### Activity 4: Individual continuous assessment tests

**Description:**
Individual tests in the classroom with some theoretical concepts and problem solving and/or issues related to the subject. There will be three tests lasting approximately 1 hour 30 minutes.
- Test 1. Content (25%)
- Test 2. Content (25%)
- Test 3. Contents 3 and 4 (20%)

**Support materials:**
Test papers and calculator for doing the tests.

**Descriptions of the assignments due and their relation to the assessment:**
Completed tests. Represents 70% of the final mark for the subject.

**Specific objectives:**
The assessment process must do the following:
- Provide indicators for monitoring the students' learning.
- Show whether students have obtained a general understanding of the content and applicability of automobile chemistry.
- Identify weaknesses to improve their learning.

<table>
<thead>
<tr>
<th>Hours: 15h</th>
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<tbody>
<tr>
<td>Theory classes: 5h</td>
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<tr>
<td>Self study: 10h</td>
</tr>
</tbody>
</table>
The mark for this subject is based on continuous assessment. The pass mark is 5 or more resulting from the weighted average of:
- The theoretical content (70%) with a mark greater than or equal to 4.5
- Additional assessment activities (10%)
- Seminar tests (20%)

Overall mark = 0.25 x N1P + 0.25 x N2P + 0.20 x N3P + 0.20 x NS + 0.10 x NC, where:
N1P corresponds to the mark of the partial exam
N2P corresponds to the mark of the partial exam
N3P corresponds to the mark of the partial exam
NS corresponds to the mark of the seminars.
NC corresponds to the additional mark for classroom problems.

Students who have not passed the exams must retake them at the end.

Regulations for carrying out activities
- Answer and hand in the three individual exams corresponding to the content (70%).
- Hand in the problems and/or continuous assessment exercises under the conditions required by the professor.
- Students must attend the small-group sessions (seminars) and carry out and deliver the related assessable activities.

Bibliography

Basic:

Complementary:

Others resources: