Course guide
330504 - QAU - Car's Chemistry

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.
Degree: BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Compulsory subject).

Academic year: 2023  ECTS Credits: 6.0  Languages: English

LECTURER
Coordinating lecturer: Xavier de las Heras

Others:

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.

Generical:
CG10. The 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
The subject consists on 4 classroom hours, 2 devoted to explain theoretical fundamental and 2 to the solution of practical problems

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>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>30.0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30.0</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

**Topic 1: INTRODUCTION TO AUTOMOTIVE CHEMISTRY**

**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).

**Full-or-part-time:** 36h
- Theory classes: 8h
- Laboratory classes: 8h
- Self study: 20h

**Topic 2: ATOMIC STRUCTURE, CHEMICAL BONDS AND STATE OF MATTER**

**Description:**
This topic deals with the following:
2.1 Atomic structure. Light and radiation.
2.2 The periodic table of elements and periodic properties.
2.3 Chemical bonds: ionic bonds, covalent bonds, metallic bonds, properties of substances and chemical bonding.
2.4 States of the matter: Gas, liquid & solid.

**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).

**Full-or-part-time:** 54h
- Theory classes: 12h
- Laboratory classes: 12h
- Self study: 30h
### Topic 3: CHEMICAL REACTION BALANCES

**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).

**Full-or-part-time: 34h**
Theory classes: 7h
Laboratory classes: 7h
Self study: 20h

### Topic 4: ENVIRONMENTAL CHEMISTRY

**Description:**
4.1 Atmospheric chemistry. Atmosphere. Composition 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).

**Full-or-part-time: 16h**
Theory classes: 3h
Laboratory classes: 3h
Self study: 10h

### ACTIVITIES

#### Activity 1: Lectures

**Description:**
Methodology: large group
The lectures include student participation.
The material is divided into four thematic areas corresponding to the above topics.

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

**Material:**
Textbooks and complementary bibliography.
Teacher notes (Atenea).

**Delivery:**
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.

**Full-or-part-time: 75h**
Theory classes: 25h
Self study: 50h
**Activity 2: Class problems**

**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.

**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.

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

**Delivery:**
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.

**Full-or-part-time:** 45h
Laboratory classes: 25h
Self study: 20h

---

**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.

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

**Material:**
Literature found on the internet.

**Delivery:**
A text and a slide show at the end of the preparation process.

**Full-or-part-time:** 15h
Laboratory classes: 5h
Self study: 10h
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 2 hours.
- Test 1. Content 1 (25%)
- Test 2. Content 2 (25%)
- Test 3. Contents 3 and 4 (20%)

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.

Material:
Test papers and calculator for doing the tests.

Delivery:
Completed tests. Represents 70% of the final mark for the subject.

Full-or-part-time: 15h
Theory classes: 5h
Self study: 10h

GRADING SYSTEM

A) Continuous assessment
3 individuals (evaluable exercise: content 1): 23 %
( evaluable exercise: content 2): 23 %
( evaluable exercise: content 3 & 4): 23 %
Formulation test: 8%
Group's work (deliverable): 23%

B) Unique assessment
Individual exam (activity assessed from 1 to 4): 100 %

The final score will be the maximum value obtained according to the system A) or B).

EXAMINATION RULES.

- Class attendance
- Carrying out individual tests

BIBLIOGRAPHY

Basic:

Complementary:
- Petrucci, Ralph H., i altres. Química general: principios y aplicaciones modernas [on line]. 10ª ed. Madrid: Pearson Prentice Hall,
RESOURCES

Other resources:
Digital teaching material, mostly in Atenea: Notes, in format Power Point Presentations; Exercise collections; Videos, about chemical characteristic techniques & questionnaires, e.g.: UPCommons "Basic laboratory techniques", http://upcommons.upc.edu/video/handle/2009.2/1241.

Physical room: classroom with blackboard and audiovisual support, to teach. Classrooms to work in group.

Atenció estudiant: physically in the center, in schedule and place established to each teacher and digital virtual support (Atenea).