Course guide
330504 - QAU - Car's Chemistry

Last modified: 04/05/2023

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

Type	Hours	Percentage
Hours small group	30,0	20.00
Self study	90,0	60.00
Hours large group	30,0	20.00

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
Acid-base theories. Strength of acids and bases. The acid-base chemistry of water. The concept and calculation of acidity. Acid-base titration.
3.2. Basic concepts in electron transfer reactions. Galvanic cells. Electrolytic cells. The Nernst equation. Faraday's law.

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: ENVIROMENTAL 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:
- Chang, Raymond; Goldsby, Kenneth A. Química [on line]. 11ª ed. México: McGraw-Hill / Interamericana, 2013 [Consultation: 02/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=10619. ISBN 9786071509284.
- Bowers, Geoffrey M.; Bowers, Ruth A. Understanding chemistry through cars. Boca Raton: Taylor & Francis, 2015. ISBN 9781466571839.

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

2011 [Consultation: 07/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6751. ISBN 9788483226803.
- Bell, Jerry, i altres. Química: un proyecto de la American Chemical Society [on line]. Barcelona: Reverté, 2005 [Consultation: 08/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8079. ISBN 8429170014.
- Kotz, J. C.; Treichel, P. M.; Harman, Patrick A. Química y reactividad química. 5ª ed. México: International Thomson, 2003. ISBN 9706863079.

RESOURCES

Other resources:
Digital teaching material, mostly in Atenea: Notes, in format Power Point Presentations; Exercse collections; Vídeos, about chemical characteristic techniques & questionaires, 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 stablished to each teacher and digital virtual support (Atenea).