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330504 - QAU - Car's Chemistry

Coordinating unit: 330 - EPSEM - Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
ECTS credits: 6 Teaching languages: English

Teaching staff

Coordinator: Heras Cisa, Francesc Xavier De Las

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. 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.

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Study load

Total learning time: 150h	Hours large group:	30h	20.00%
	Hours medium group:	0h	0.00%
	Hours small group:	30h	20.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

Topic 1: Introduction to automotive chemistry

Learning time: 36h

Theory classes: 8h
Laboratory classes: 8h
Self study : 20h

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).

Topic 2: Atomic structure, chemical bonds and states of matter

Learning time: 54h

Theory classes: 12h
Laboratory classes: 12h
Self study : 30h

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.
2.3 Gases: fundamental laws of gases. The equation of state of an ideal gas. Airbags.
2.4 Liquid state: intermolecular forces in liquids. Properties of liquids: steam pressure, viscosity, surface tension. Paints and detergents.
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).

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Topic 3: Chemical reaction balances	Learning time: 34h Theory classes: 7h Laboratory classes: 7h Self study : 20h

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. Corrosion.

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).

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Planning of activities

Activity 1: Lectures

Hours: 75h
Theory classes: 25h
Self study: 50h

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

Support materials:
Textbooks and complementary bibliography.
Teacher notes (Atenea).

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.

Activity 2: Class problems

Hours: 45h
Self study: 20h
Laboratory classes: 25h

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.

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Activity 3: Monographic seminars	Hours: 15h Laboratory classes: 5h Self study: 10h

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.

Activity 4: Individual continuous assessment tests	Hours: 15h Theory classes: 5h Self study: 10h

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.

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Qualification system

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:

Bowers, Geoffrey M.; Bowers, Ruth A. Understanding chemistry through cars. Boca Raton: Taylor & Francis, 2015. ISBN 9781466571839.

Chang, Raymond; Goldsby, Kenneth A. Química: undécima edición. 11ª ed. México: McGraw-Hill / Interamericana, 2013. ISBN 9786071509284.

Complementary:

Kotz, J. C.; Treichel, P. M.; Harman, Patrick A. Química y reactividad química. 5ª ed. México: International Thomson, 2003. ISBN 9706863079.

Petrucci, Ralph H., i altres. Química general: principios y aplicaciones modernas [on line]. 10ª ed. Madrid: Pearson Prentice Hall, 2011 [Consultation: 02/07/2019]. Available on: <https://discovery.upc.edu/iii/encore/record/C__Rb1510237?lang=cat>. ISBN 9788483226803.

Bell, Jerry, i altres. Química: un proyecto de la American Chemical Society. Barcelona: Reverté, 2005. ISBN 8429170014.

Others resources: