820530 - QAQ - Analytical Chemistry

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2018
Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Florido Perez, Antonio
Others: Devesa Garriga, Ricard
         Florido Perez, Antonio
         Gibert Agullo, Oriol
         Gimenez Izquierdo, Francisco Javier

Opening hours
Timetable: Each professor will give the information the first day at the classroom and in ATENEA

Prior skills
Chemistry
Aqueous solution chemistry

Degree competences to which the subject contributes

Specific:
CEQUI-19. Understand mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, the design of reactors, and the recovery and processing of raw materials and energy resources.

Transversal:
07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Teaching methodology
The methodology consists on theoretic lessons where the teacher presents the learning objectives in relation to the contents of the subject. The contents are subsequently applied to solve practical problems. In these practical problems students are encouraged to actively participate. Real cases related to both industry and environment are also developed in order to learn choosing the adequate analytical techniques.

The adequate material and tools for the learning process are available for the students. The Digital Campus is also a web tool that is being used in order to give the students different material of the subject and in addition it is a tool to improve the communication between teachers and students.

Learning objectives of the subject
The global objective of Analytical Chemistry is the students to learn the basic principles and applications (industrial and
environmental) of the analytical chemistry, including classic and instrumental techniques. At the end of the lessons, the students should be capable to:
1) Describe the scientific basis and most important applications of classic and instrumental techniques in analytical chemistry.
2) Distinguish the chemical needed pre-treatment of a sample before using any analytical technique.
3) Determine the concentration of any analyt in a sample by using titrating techniques.
4) Select the adequate analytical technique for the determination of the concentration of a solute in a sample.
5) Transform the signal of any instrumental technique in concentration units.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>60h</th>
<th>40.00%</th>
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<tbody>
<tr>
<td>Total learning time: 150h</td>
<td>Hours medium group:</td>
<td>0h</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
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<td></td>
<td>Guided activities:</td>
<td>0h</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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### Content

<table>
<thead>
<tr>
<th>Tema 1. INTRODUCTION TO ANALYTICAL CHEMISTRY</th>
<th>Learning time: 18h</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 8h</td>
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<tr>
<td></td>
<td>Self study : 10h</td>
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</tbody>
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**Description:**

<table>
<thead>
<tr>
<th>Tema 2. CLASSIC METHODS IN ANALYTICAL CHEMISTRY</th>
<th>Learning time: 56h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 20h</td>
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<tr>
<td></td>
<td>Self study : 36h</td>
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**Description:**
- Complexometric titrations: Titration curves. Titrants, metalochromic indicators.
- Precipitation titrations: Titration curves, titrants and indicators.
- Redox titrations: Titration curves, redox titrants and indicators. Pre-treatment of the sample. Titrations with strong oxidants (permanganate and dichromate) and with strong reductants. Redox titrations with iodine.
- Industrial and environmental applications of titrations.

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<tr>
<th>Tema 3. ELECTRONANALYTICAL METHODS</th>
<th>Learning time: 25h</th>
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<tr>
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<td>Theory classes: 10h</td>
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<td></td>
<td>Self study : 15h</td>
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**Description:**
- Classification of electroanalytical techniques.
- Conductimetry: fundamentals, instrumentation and conductimetric titrations.
- Industrial and environmental applications of electroanalytical methods.
**Assessment qualification (NF):**

\[ NF = 0.20 \times AC1 + 0.20 \times AC2 + 0.60 \times EF \]

where
1) AC1: Exam 1
2) AC2: Exam 2
3) EF: Final Exam

There is reevaluation exam. The final qualification is the qualification of the reevaluation exam.

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### Tema 4. SPECTROSCOPIC METHODS

<table>
<thead>
<tr>
<th>Description:</th>
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| - Absorption and emission of light. Classification of the spectroscopic methods.  
- Fluorescence. Fundamentals and instrumentation. Qualitative and quantitative analysis  
- Industrial and environmental applications of spectroscopic methods. |

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<thead>
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<th>Learning time:</th>
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<tbody>
<tr>
<td>27h</td>
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<tr>
<td>Theory classes: 12h</td>
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<td>Self study : 15h</td>
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### Tema 5. CHROMATOGRAPHY

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<th>Description:</th>
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| - Fundamentals. Parameters of the columns. Classification.  
- Gas-chromatography (GC). Instrumentation.  
- Qualitative and quantitative analysis. Industrial and environmental applications. |

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<th>Learning time:</th>
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<tr>
<td>24h</td>
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<td>Theory classes: 10h</td>
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<td>Self study : 14h</td>
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Bibliography

Basic:


Complementary:


Others resources:

The professors provide some support notes to the students as a study aid. Thus, the contents of these notes is:
- A collection of problems of each topic.
- Tables, graphs and figures.
- Articles, interesting Web pages, solved past papers, etc.
Furthermore, additional information about activity dates or examination grades are also given.