820522 - ERQQ - Chemical Reaction Engineering

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6 Teaching languages: Catalan

Teaching staff

Coordinator: AURELIO CALVET TARRAGONA
Others: Primer quadrimestre:
AURELIO CALVET TARRAGONA - M10
FRANCISCO ESTRANY CODA - M10
Segon quadrimestre:
FRANCISCO ESTRANY CODA - T10
VICENÇ MARTI GREGORIO - T10

Opening hours

Timetable: Requesting a preview appointment by email

Prior skills

Those ones established in accordance with the knowledge acquired about chemistry, physics, mathematics, thermodynamics, material transfer and heat transmission

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.
CEQUI-20. Analyse, design, simulate and optimise processes and products.

Transversal:
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Teaching methodology

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Learning objectives of the subject

Provide the fundamental knowledge of stoichiometry, kinetics and equilibrium of complex systems with chemical
reactions multiple
Apply the knowledge acquired to design chemical reactors' installations with the most appropriate configuration for a specific reaction

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>60h</th>
<th>40.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
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<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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<tr>
<td>Theme 1: Introduction to Chemical Reactors</td>
<td>Learning time: 35h</td>
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<td><strong>Description:</strong> The chemical reactor in the chemical industry. Criteria and techniques for the design of reactors. Definitions and general concepts. Relations of the stoichiometry. Stoichiometric models. Invariant of reaction.</td>
<td><strong>Theory classes:</strong> 14h</td>
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<tr>
<td><strong>Related activities:</strong> Initial test, Exercises, Test of monitoring, Problems, Final Test, Study of the theory, First report of non-attendance work.</td>
<td><strong>Self study:</strong> 21h</td>
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<tr>
<td><strong>Specific objectives:</strong> To acquire knowledge for calculation of stoichiometric models of chemical reactions with multiple chemical equations, known initial and final composition of the reactant system.</td>
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<tr>
<th>Theme 2: Homogeneous kinetics</th>
<th>Learning time: 40h</th>
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<td><strong>Related activities:</strong> Initial test, Exercises, Test of monitoring, Problems, Final Test, Study of the theory</td>
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<tr>
<td><strong>Specific objectives:</strong> To acquire knowledge for calculation of kinetic equations of homogeneous chemical reactions from the experimental results by fitting kinetic models proposed.</td>
<td><strong>Self study:</strong> 24h</td>
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</table>
| Theme 3: Heterogeneous kinetics and applications | Learning time: 22h 30m  
Theory classes: 9h  
Self study: 13h 30m |
|-----------------------------------------------|----------------------------------|
| **Description:**  
Heterogeneous kinetics non catalytical: definition and general concepts. The processes of matter transfer.  
**Related activities:**  
Study of the theory  
**Specific objectives:**  
To acquire knowledge for calculation about heterogeneous kinetics equations of chemical reactions from the models used to address the study of reaction mechanisms. |

| Theme 4: Ideal reactors | Learning time: 30h  
Theory classes: 12h  
Self study: 18h |
|------------------------|----------------------------------|
| **Description:**  
Batch reactor (BR). Calculating the volume in a BR from a reaction and a specific production needs. Macroscopic energy balance in a BR: Isothermal system / Non-isothermal system (adiabatic reaction). Continuous stirred tank reactor (CSTR). Comparison between a BR and a CSTR for the same reaction and the same productivity.  
**Related activities:**  
Exercises  
Problems  
Study of the theory  
**Specific objectives:**  
To acquire knowledge for calculation and design of chemical reactors based on kinetic and stoichiometric models of the proposed chemical reaction, using the models of ideal chemical reactors. |
**Theme 5: Design of installations of industrial reactors**

**Learning time:** 22h 30m
- Theory classes: 9h
- Self study: 13h 30m

**Description:**

**Related activities:**
- Exercises
- Problems
- Study of the theory
- Second report of non-attendance work

**Specific objectives:**
To acquire knowledge of optimization of design parameters of chemical reactor according to criteria of economic profitability, safety and the minimizing environmental impact.

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**Qualification system**

**Regulations for carrying out activities**

The realization of the activities is subject to the academic regulations established by the Technical University of Catalonia

**Bibliography**

**Basic:**

**Complementary:**