Universidad Zaragoza

Academic Year/course: 2024/25

66211 - Advanced Reactor Design

Syllabus Information

Academic year: 2024/25
Subject: 66211 - Advanced Reactor Design
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 531 - Master's in Chemical Engineering
ECTS: 6.0
Year: 1
Semester: First semester
Subject type: Compulsory
Module:

1. General information

This subject is oriented towards the correct choice of the type of chemical reactor for a given reaction process involving several phases (heterogeneous character), both catalytic and non-catalytic. The objectives are also the sizing of the reactor, the determination of its optimal operating conditions, the prediction of its behaviour in the face of alterations in the values of the operating variables and the safety measures to be adopted towards its environment. The aim is to complement training in the design of heterogeneous reactors with an analysis of existing trends with a view to improving their performance and selectivity and with a view to the intensification of processes. The student will also acquire basic notions on additional aspects of chemical reactor design such as: change of scale, mechanical design considerations, control and safety.

2. Learning results

- To know how to select the most suitable type of chemical reactor for a particular heterogeneous process. -

- To set up and solve models of heterogeneous reactors based on the balances of matter, energy and quantity of movement, as well as the type of flow and contact between the phases.

- To design multiphase chemical reactors by determining the most appropriate configuration and size and the sensitivity of their performance to a variation of the operating parameters and consequently their stability, optimum operating conditions and control.

3. Syllabus

BLOCK 1.- INTRODUCTION

1. 1. General design considerations for heterogeneous reactors. Design confidence levels.

2. Fixed-bed catalytic solid-fluid reactors.

BLOCK 2.- TWO-PHASE HETEROGENEOUS REACTORS

3. Catalytic solid-fluid reactions. Fluidised bed reactors. Design models. Reactors with catalyst deactivation.

4. Fluid-fluid reactions. Gas-liquid and liquid-liquid reactors. Real and rigorous flow models.

BLOCK 3.- HETEROGENEOUS MULTIPHASE REACTORS

5. Fixed bed solid phase reactors

6. Reactors with the solid phase in suspension.

BLOCK 4.- OTHER REACTORS

7. Specific reactors (photoreactors, polymerisation, electrochemical, biochemical). Innovations in reaction units in industry

8. State-of-the-art reactors Process intensification.

BLOCK 5. ADDITONAL ASPECTS

9. Control and safety Scale switch. Mechanical design.

4. Academic activities

Master classes: 30 hours

The theory of the different topics of the subject will be taught and model problems will be solved.

Problem solving and case studies classes. 25 hours

Problems will be solved by the student under the supervision of the teacher. The problems or cases will be related to the theoretical part explained in the master classes.

Laboratory sessions: 3 hours

Through a practical exercise, the student will reinforce the contents covered in the master classes.

Special practice sessions: 2 hours

They correspond to a visit to a company, expert talk, thematic seminar or similar.

Tutored works 14 hours

2-3 individual or group will be proposed. These will be tutored by teachers.

Tutored and personal study: 70 hours.

- Assessment tests: 6 h.

5. Assessment system

OPTION 1:

Assessment is global and includes:

1.Written tests with open answers Final exam at the end of the subject. This test will consist of: (a) reasoned theoretical-practical questions and issues in which the application of theory to specific cases and examples will be requested, and (b) problem solving. 60% of the final grade.

2. Academic assignments It includes the notes for the lab practice, tutored works as well as proposed problems and cases. 30% of the final grade.

3. Assessment of oral presentations and debates. Some of the students works will be presented orally. 5% of the final grade.

4.- Observation. The control tests and class participation will be valued. 5% of the final grade.

A minimum grade of 4.0 out of 10 in the Final exam is required to pass the subject.

OPTION 2:

Those students who do not want to follow the evaluation according to option 1 can choose to take the official call exam (100% of the final grade) which will have the same sections as the final exam of option 1 with possible differences in content. This option is available in both calls.

6. Sustainable Development Goals

7 - Affordable and Clean Energy
9 - Industry, Innovation and Infrastructure
12 - Responsible Production and Consumption