Universidad Zaragoza

Academic Year/course: 2021/22

29926 - Reactor Design

Syllabus Information

Academic Year: 2021/22
Subject: 29926 - Reactor Design
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 330 - Complementos de formación Máster/Doctorado
435 - Bachelor's Degree in Chemical Engineering
ECTS: 6.0
Year: 435 - Bachelor's Degree in Chemical Engineering: 3
330 - Complementos de formación Máster/Doctorado: XX

Semester: Second semester
Subject Type: 435 - Compulsory
330 - ENG/Complementos de Formación
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process has been proposed to encourage continuous student work and focuses on the basic theoretical aspects to be able to understand, analyze and apply that knowledge to solve real problems.

For the development of the subject, on the one hand, theoretical sessions will be held with the whole group, in which the theoretical foundations of the subject will be presented in the form of a lecture. These classes are complemented with problem solving-type classes of problem-based learning. In these classes, the students, in smaller groups, will be tutored by the teacher.

In parallel, during the 15 weeks of the semester, students will have to solve assignments tutored by the professor and reflected in some deliverables that will be corrected and assessed work.

Finally, a written exam will be held at the end of the class period.

4.2. Learning tasks

The program offered to the student will help to achieve the expected results and includes the following activities:

Classroom activities (60 hours), distributed as follows:

- *Lectures* (M1). 40 hours. In these sessions, exposition and explanation of theoretical contents related to the design of chemical reactors will be conducted according to the program of the course set out in paragraph 4.3 Program.

The student will have teaching materials prepared by the teacher as well as an agenda of the evolution of the subject accessible via Web (ADD Zaragoza University) to help the monitoring of the lectures.

- *Practice session* (M4). 20 hours. In coordination with the theoretical contents, problems and case studies related to these theoretical presentations will be developed. Students will address problems under the supervision of a tutor.

Tutorials (28 hours Non-contact). During the development of the course, in relation to the contents of some of the topics, students will be proposed performing work for application and extension of the concepts studied. These will be related to literature searches, development of case studies, preparation of presentations, etc... These assignments will be distributed during the course (with a total number of around four to five) and will be performed individually or in small groups (2-3 students) and will be reflected in a deliverable that will be corrected and qualified.

Autonomous work and study (59 hours Non-contact) spread over the 15-week course. The ongoing work of the student will be promoted by the even distribution of the various learning activities throughout the semester

Assessment test (3 contact hours). Besides having a qualifying function, evaluation is also a learning tool with which the student checks the degree of understanding and assimilation of knowledge and skills achieved.

4.3. Syllabus

The program is divided into five sections that develop basic concepts about reactor design and are the following:

- Section 1. Fundamentals and concepts about reactor design
- Section 2. Homogeneous reactions in ideal flow reactors
- Section 3. Non-ideal flow homogeneous reactors
- Section 4. Two phase heterogeneous reactors
- Section 5. Additional aspects

The sequence of the contents intends to guide the students starting with the fundamentals of design and types of reactors, after that addressing the design and the particularities of the simplest case, as will be homogeneous reactors. Once the student has become familiar with the ideal design a deviation from the ideality will be introduced; the non-ideal flow, and how to take it into account in the design will be discussed. The next block will address the design for heterogeneous systems, focusing on solid-gas processes which are the most common and trying to combine the intrinsic kinetic design of each system with the physical transfer processes. The end of the course is done with a block in which attention to a specific type of reactor will be provided such as bioreactors. Finally, the aspect of thermal stability in the design and operation of reactors will be considered.

The corresponding 16 chapters of this subject are distributed as follows:

Section 1. Fundamentals and concepts about reactor design

1.-Concept, steps in the design and type of reactors. Design equations

Section 2. Homogeneous reactions in ideal flow reactors

2.1 Types of ideal reactors

2.-Batch Stirred Tank Reactor BSTR

3.-Continous Stirred Tank Reactor CSTR

4.-Plug Flow Reactor PFR

5.-Semicontinuos stirred tank reactor

2.2 Reactor selection and operating conditions

6.-Design for irreversible single reactions

7.-Design for multiple reactions

8.-Temperature regimes

Section 3. Non-ideal flow homogeneous reactors

9.-Basics of non-ideal flow

10.-Non ideal flow models

Section 4. Two-phase Heterogeneous reactors

11.-General considerations for heterogeneous reactor design

4.1 Fluid-solid catalytic reactions

12.-Fixed bed reactors. Pseudo-homogeneous and heterogeneous models

13.-Fluidized bed reactors. Design models.

4.2 Fluid-solid non-catalytic reactions

14.-Fixed bed, circulating bed and fluidized bed reactors

Section 5. Additional aspects

15.-Specific reactors. Bioreactors

16.-Autothermal regime

4.4. Course planning and calendar

Schedule of sessions and presentation of assignments

Lectures and solving problems classes are held according to the schedule established by the EINA. Furthermore, each teacher will also inform about office hours for tutorials.

4.5. Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=29926&year=2019