Universidad Zaragoza

Year : 2019/20

60803 - Analysis and Design of Chemical Processes

Syllabus Information

Academic Year: 2019/20
Subject: 60803 - Analysis and Design of Chemical Processes
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 532 - Master's in Industrial Engineering
ECTS: 4.5
Year: 1
Semester: First semester o Second semester
Subject Type: Compulsory
Module: ---

1.General information

1.1.Aims of the course

THe objective is that the student would be able to analyze a chemical process and get the skill to design basic equiments of a chemical industry, such as chemical reactors, where a change in chemical composition occurs and separation operations, where streams of different composition are obtained without change in the chemical nature.

1.2.Context and importance of this course in the degree

In the framework of Industrial Engineering, the focus of this subject is the comprehension of chemical industry processes, which can involve or not a chemical reaction. The aim is that the future Industrial Engineer can deepen in to the analysis of chemical processes as well as in the design of the different parts it is composed of. Moreover, he/she should be ready to interact with other engineers, specialists in different fields. Finally, the knowledge and skills to be learn in this course will servto to integrate production processes with the field of Environmental Engineering as well as other fields as Control, or Fluid Dynamics.

1.3.Recommendations to take this course

In order to follow this course, it is advisable that the student has previous knowledge in Stoichoimetry, Chemical Equilibrium, fluid flow calculation, and Mass and Energy Balances, as well as integral and diferential calculus.

2.Learning goals

2.1.Competences

After passing the course, the student will adquire the following...

General Competences

CG1.

CG2.

CG5.

2.2.Learning goals

The student, to pass this course, must get the following results...

1. ...to know the representation systems of chemical processe and, from the description of a process, can draw its diagram or obtaind process information from a given diagram.
2. ... to know how to raise the mass and energy convervatin equations of a chemical process and to calculate relevant thermochemical properties to determine relationships between temperature, pressure, flowrate and composition of process streams.
3. ... to know how ton apply reaction kinetic equations to the design of ideal chemical reactors.

4. ... to be able to propose, for a given process stream, a separation process for its components by a unit operation.
5. ... to know how calculate the basic design parameters of a flash distillation, a rectification column and an absorption column, applying the principles of phase equilibrium.

2.3.Importance of learning goals

Chemical industry plays an important rol in the modern society, and it is bounded to the scientic progress.

The future Industrial Engineer will be able to carry out his/her professional carrer in the food industry, new materials development, energy production among many others, where the knowledge of chemical processes is a must.

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The following tasks will be assessed:

1. Simulation laboratory sessions (20%). Students, individually or in small teams, will attend lab sessions where a commercial simulation software will be used. A written report must be handed to the teacher after the session.
2. Partial exam (40 %). Written test to be carried out during the teachin period, with short and application questions, problems of calculus and design of equipments.
3. Final exam (40 %). A similar test to the previous one, to be performed during the official exam schedule of the EINA, with the rest of the subject-matter. If a student has failed any of the previous assessments, the exam will include them, with the same weight in the final qualificationEn el caso de que el alumno no haya realizado o superado las actividades 1 y/o 2, el examen coincidirá con la prueba global donde se evaluarán las partes no superadas con el porcentaje correspondiente. Mediante la realización de esta actividad se alcanzarán los resultados de aprendizaje 1,2,3, 4 y 5.
4. Complementary activies. They will sum up 0.5 points to the final qualification, provided that the student has passed all the different tasks.

All the assessment activities require a minimum of 5 out of 10 to pass.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. Its purpose is to provide the students with the skills for the design and analysis of chemical processes through mass and energy balances, and the design of the most representative chemical industry equipments. Among them, chemical reactors and separation units, as distillation and absorption columns, can be highlighted.

A wide range of teaching and learning tasks are implemented, such as lectures, case studies, problem-solving, computer lab sessions, autonomous work and study.

4.2.Learning tasks

The course includes the following learning tasks:

- **Lectures (25 hours).** Whole group sessions. Presentation of the main theoretical contents combined with problem-solving tasks.
- **Practice sessions** (10 hours). Small group activities where active methodologies could be used, as cases resolution, problems, puzzles, etc.
- **Computer lab sessions** (10 hours). 5 sessions of computer tasks with a commercial process simulator in reduced groups.
- **Autonomous work.** Study of the course and preparation of assignments. This activity is essential in the learning process and to overcome the course. A collection of problems will be given to the students.
- **Tutorials.** Teacher's office hours for students to review and discuss class contents and the follow-up of the learning process of each student.
- **Complementary activities**. If possible, visits to chemical industries or lectures with professional engineers could be scheduled.

4.3.Syllabus

The course will address the following topics:

1. Introduction. Basic concepts of the analysis and design of chemical industry equipment.
2. Stream properties. Estimation of thermodynamical properties and phase equilibrium.
3. Selection of separation operations.
4. Separation of binary mixtures by distillation: batch distillation, flash distillation and tray tower distillation.
5. Absorption. Mass transfer fundamentals. Simplified design methods.
6. Desing of chemical reactors. Ideal reactors design equations: batch reactor, continuous stirred tank reactor and plug flow reactor. Combination of reactors. Thermal effect.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

4.5.Bibliography and recommended resources