

## 27222 - Chemical Industry: Processes, Hygiene and Safety

### Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	452 - Degree in Chemistry
ECTS	6.0
Year	4
Semester	First semester
Subject Type	Compulsory
Module	---

### **1.General information**

#### **1.1.Introduction**

#### **1.2.Recommendations to take this course**

#### **1.3.Context and importance of this course in the degree**

#### **1.4.Activities and key dates**

### **2.Learning goals**

#### **2.1.Learning goals**

#### **2.2.Importance of learning goals**

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

#### **3.2.Competences**

### **4.Assessment (1st and 2nd call)**

#### **4.1.Assessment tasks (description of tasks, marking system and assessment criteria)**

### **5.Methodology, learning tasks, syllabus and resources**

#### **5.1.Methodological overview**

The methodology followed in this course is oriented towards the development of the skills and capabilities for the analysis of industrial chemical processes with emphasis on raw materials and energy consumption, process design and main operation units, environmental issues, loss prevention, occupational safety and regulatory framework.

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It is based on active participation, case studies, teamwork that also favours the development of communicative skills and critical thinking. Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other learning resources such as multimedia and solved exercises. Further details regarding the project assignment and additional information about the course will be provided on the first day of class.

### 5.2.Learning tasks

A wide range of teaching and learning tasks are implemented, such as lectures, problem-solving activities, guided assignments, autonomous work and tutorials.

The course includes 6 ECTS organized according to:

- Lectures (4 ECTS): 40 hours (theory sessions-and case studies whole group).

Part I: Industrial Chemical Processes 20 hours

Part II: Loss Prevention in the Process Industries and Occupational Safety 20 hours

- Problem-solving Sessions (2 ECTS): 20 hours (whole group)

Part I: Industrial Chemical Processes 10 hours

Part II: Loss Prevention in the Process Industries and Occupational Safety 10 hours

### 5.3.Syllabus

The course will address the following topics:

PART I. Industrial Chemical Processes

- Integrated Pollution, Prevention and Control in the Chemical Industry: IPPC Directive, national policy and regional regulations. BREF Documents. Best Available Techniques for the Production of Pulp. Case Study: Kraft Pulping Process in Torras Papel (Zaragoza- Spain).

- Fundamentals of flow sheeting, control and instrumentation for chemical processes. Stationary Material and Energy Balances: problems solving.

- Hydrogen production: basic data, main routes from fossil fuel and renewable energies. The H<sub>2</sub> economy: present and future, pros and cons.

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- Synthesis Gas Production from natural gas: reactions and thermodynamics, steam reforming process, advances, autothermal reforming, novel developments, purification and adjustment of synthesis gas.
- Synthesis Gas Production from coal gasification: coal characterization, coal classification, gasification reactions and thermodynamics, main parameters, current gasification processes.
- Production of lower alkenes by steam cracking: introduction, cracking reactions, industrial process, product processing, current and future developments.
- Polyethylene production: introduction, general properties, polymerization chemistry, production processes, environmental aspects.

### PART II. Loss Prevention in the Process Industries and Occupational Safety

- Types of hazards. Statistics. Risk perception. Major accident hazards.
- Flammability: definitions and basic concepts. Fires and Explosions. Estimation of consequences.
- Release of toxic and flammable substances. Estimation of concentrations.
- Industrial hygiene: introduction and main concepts. Chemical, biological and physical hazardous agents.
- Evaluation of chemical agents in the workplace. Exposure limits.
- Biological and physical agents in the workplace.
- Engineering Control: design of general and local ventilation.

### 5.4.Course planning and calendar

### 5.5.Bibliography and recommended resources

BC	Bartholomew, Calvin H.. Fundamentals of industrial catalytic processes / Calvin H. Bartholomew, Robert J. Farrauto . - 2nd ed. Hoboken, New Jersey : Wiley, cop. 2006
BC	Higiene industrial / autores, Félix Bernal Domínguez...[et al.] . - 3a ed. act. Madrid : Instituto Nacional de Seguridad e Higiene en el Trabajo, D. L. 2005

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- BC** Manual de higiene industrial / Fundación Mapfre . - 4a. ed. Madrid : Mapfre, 1996
- BC** Manual de seguridad en el trabajo / Fundación Mapfre Madrid : Mapfre, D.L. 1992
- BC** Moulijn, Jacob. A.. Chemical process technology / Jacob A. Moulijn, Michiel Makkee, Annelies van Diepen . - Repr. with corr. Chichester [etc.] : John Wiley, 2005
- BC** Santamaría Ramiro, J. M.. Análisis y reducción de riesgos en la industria química / J. M. Santamaría Ramiro, P. A. Braña Aísa . - 2ª ed. Madrid : MAPFRE, 1998
- BC** Ullmann's encyclopedia of industrial chemistry / executive editor, Wolfgang Gerhartz ; senior editor, Y. Stephen Yamamoto ; editors, F. Thomas Campbell, Rudolf Pfefferkorn, James F. Rounsaville. - 5th completely rev. ed. Weinheim : VCH Publishers, 1985-1996

### Online resources:

Instituto Nacional de Seguridad e Higiene en el Trabajo - [<http://www.insht.es>]

Registro Estatal de Emisiones y Fuentes Contaminantes. Documentos de Mejores Tecnologías Disponibles - [<http://www.prtr-es.es>]