Bachelor´s Degree in Chemistry

Subject Guide

1. Information about the subject

SUBJECT	Chemical Engineering	**CODE**	GQUIMI01-2-008
EDUCATIONAL OFFER	Bachelor´s Degree in Chemistry	**CENTER**	Facultad de Química
TYPE	Compulsory	**N° TOTAL CREDITS**	6.0
PERIOD	First Semester	**LANGUAGE**	Spanish

COORDINATORS/ES	**EMAIL**
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LECTURERS	**EMAIL**	
Marín González Pablo	marinpablo@uniovi.es	(English Group)
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2. Context

The course “Chemical Engineering” belong to the second year of the Bachelor in Chemistry. The course is compulsory and belong to the fundamental module.

This course is taught by the Chemical Engineering area, ascribed to the Chemical and Environmental Engineering Department. The English version of the course is taught by PhD Eng. Pablo Marín González, while the Spanish version is taught by PhD Ignacio Medina Castaño.

The aim of the course is to cover the fundamental of the industrial processes of the chemical industry from the perspective of the Chemical

Engineering discipline. To accomplish this goal a special emphasis is put into the understanding of the chemical operations and processes at industrial scale and the solving of problems based on mass and energy balances.

3. Requirements

The requirements of this course are two courses of the first year: General Chemistry and Laboratory operations and informatics.

4. Competencies and learning results

The competencies of this course are distributed in a series of learning outcomes, according the verification memory approved by ANECA. These learning outcomes are the following (the corresponding competence is indicated in parenthesis):

1. Consult and use scientific information effectively (CG-1, CG-6, CG-8, CG-9, CG-17).

2. Recognize and analyse problems in the scope of the course and plan strategies to solve them (CG-1, CG-2, CG-5, CG-6, CG-9, CG-17, CG-18, CE-20, CE-33, CE-34, CE-35).

3. Elaborate and present oral and written reports (CG-1, CG-6, CG-8, CG-9, CG-12, CG-17, CG-18, CE-33, CE-34, CE-35).

4. Demonstrate knowledge and understanding of the facts, concepts, principles and theories related to the course and the application to solve problems (CG-1, CG-2, CG-6, CG-9, CG-12, CG17, CE-1, CE-16, CE-20, CE-33, CE-34, CE-35).

5. Contents

The contents of the course are distributed in the following lessons; a brief description of the topics addressed in each lesson is included.

1. Introduction to Chemical Engineering

Chemical engineering. Chemical processes. Process flowsheets. System of units.

2. Mass balances

Basic concepts. Mass balances without reaction. Mass balances with reaction.

3. Mass balances to multiunit systems

Sequential multi-unit systems. Recycle systems. Purge. Bypass systems.

4. Unit operations I

Introduction. Fluid flow unit operations. Storage. Internal flow. External flow. Heat transfer unit operations.

5. Unit operations II

Mass transfer unit operations. Equilibrium based operations. Combined mass and heat transfer. Rate-based operations. Solid unit operations.

6. Chemical reactors

Chemical reaction engineering. Chemical kinetics. Discontinuous reactor. Continuous reactors. Perfect mixture reactor. Plug flow reactor. Reactor design.

7. Energy balances

Types of energy. Energy balance without reaction. Energy balance with reaction. Combustion processes.

8. Energy production

Energy sources. Steam power plant. Carnot-engine cycle. Rankine cycle.

9. Refrigeration and liquefaction

Carnot refrigerator. Vapour recompression cycle. Liquefaction of gases.

10. Humidification

Terminology. Psichrometric chart. Temperature definitions. Water-air operations.

11. Process engineering

Economic evaluation. Process optimization. Process control.

12. Environmental engineering: air pollution

Air pollution. Criteria air pollutants. Sampling of pollutants. Air treatment techniques.

13. Environmental engineering: water pollution

Water pollution. Main water pollutants. Treatment of domestic wastewater. Treatment of industrial wastewater

14. Environmental engineering: solid wastes

Domestic wastes. Hazarous wastes.

6. Methodology and working plan

The course has the following learning methodologies:

- Classroom practices (PA) 7 h
- Group tutorials (TG) 4 h
- Lectures (CE) 42 h
- Transversal activities (OA) 4 h
- Exam (SE) 3 h

The lectures consists of the presentation of the theoretical background of the lessons, supported with examples and problems. All the material (PowerPoint presentations and problems statements) will be available for the students before the lessons.

The classroom practices and group tutorials are focused on developing problem solving skills. The students work in advance (individually or in groups) with the problems proposed by the instructor, and during the classroom practices and group tutorials the students make oral presentation of their results. The instructor solves the doubts and questions found by the students.

7. Evaluation of the student's learning results

The evaluation of the course in the ordinary period of January is divided into “Final exam” and “Classroom practices and group tutorials”,

according to the verification memory approved by ANECA. Each part is evaluated with a mark from 0 to 10 points. To pass the course, the total averaged mark, calculated using the following ponderations, must be more than 5 points.

- **Final exam: 80% of the final mark**

  The minimum mark of the exam required to pass the course is 4 points.

- **Classroom practices and group tutorials: 20% of the final mark**

  The attendance to classrroom practices and group tutorials is compulsory (in duly justified situations, an attendance to a minimum of 80% of the hours will be accepted).

The evaluation in the extraordinary periods of May and June is carried out by an exam corresponding to 100% of the final mark.

8. Resources, bibliography and complementary documentation

Reference bibliography:

Himmelblau, D.M.; Riggs, J.B. Basic Principles and Calculations in Chemical Engineering. 8th ed. Pearson.

Calleja."Introducción a la Ingeniería Química" Ed.Síntesis.

Additional bibliography:

Levenspie lO. Chemical Reaction Engineering, 3rd ed, Wiley.

Smith, J.M.; Van Ness, H.C; Abbott, M.M. Introduction to Chemical Engineering Thermodynamics 6th ed. McGraw-Hill.

Elliott, J.R.; Lira, C.T. Introduction to Chemical Engineering Thermodynamics 2nd ed. Prentice-Hall.

Towel, G.; Sinnott, R. Chemical Engineering Design. Elsevier (2008)

Seborg, D.E., Edgar, T.F., Mellichamp, D.A., Doyle, F.J. Process Dynamics and Control. 3rd ed. Wiley (2011)

Kiely, G. Ingeniería Ambiental. McGraw-Hill (1999)