



PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

COURSE: CHEMISTRY AND CHEMICAL ENGINEERING LABORATORY III

SUBJECT MATTER: Materials Science and Technology

MODULE: Core Topics of Industrial Engineering

PROGRAM: Degree in Chemical Engineering

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GENERAL CHARACTERISTICS

Type: Basic Formation, Compulsory, Elective

Final Degree Project, Internship

Duration: Annual

Semester/s: 5 and 6

Number of ECTS credits: 5

Language/s: Spanish, Catalan, English

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION

Subject of eminently practical nature in which the student, through the performance of individual or small group work, must acquire the ability to design and perform synthesis experiments of organic products and materials science.

The work in the laboratory of Organic Chemistry is directed to the learning of the experimental techniques in organic synthesis, such as liquid-liquid extraction, drying, distillation, recrystallization, determination of physical constants, thin-layer chromatography, column chromatography, IR spectroscopy and ¹H-NMR. These techniques are worked in special activities or as part of the synthesis of simple organic compounds.

Experimentation in Materials Science is designed in a series of practices in which some of the main concepts to be developed during the theoretical subject will be seen. First, we will proceed to study the solidification concept. The study of polymers and their synthesis and conductive capacity will be another important part of the laboratory. On the other hand, the mechanical properties of different metallic compounds such as an alloy of copper and steel will be studied. The effect of cold working and annealing and its relationship with hardness will be studied. A rheological study of different compounds will also be made.

In all cases, students will improve their training to assess and control the risks associated with their activity. Students will be able to assess the need to recycle chemical and biological products and to conveniently manage waste.

COMPETENCES

- Be able to perform experiments to meet the requirements established in the activity to be performed in the practice of different fields of Chemical Engineering. (CB2, E5)
- Be able to analyze, integrate and interpret data and information from the field of Chemistry (CB3, E8).

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- To be able to assess the risks in the use of chemical and biological substances and the processes in which they are involved. (E11)
- That students are able to convey information, ideas, problems and solutions to both specialized and non-specialized audiences. (CB4)
- Knowledge of the fundamentals of science, technology and chemistry of materials. Understand the relationship between microstructure, synthesis or processing and material properties. (CRI3)

PREREQUISITES

According to the program planning and academic regulations.

CONTENTS

- 1. Synthesis of organic compounds.**
- 2. Separation and purification of organic compounds.**
 - 2.1. Recrystallization.
 - 2.2. Distillation.
 - 2.3. TLC and column chromatography.
 - 2.4. Liquid-liquid extraction.
- 3. Characterization of organic compounds.**
 - 3.1. Determination of physical constants.
 - 3.2. IR and ¹H-NMR spectroscopy.
- 4. Relationship between materials structure and properties**
 - 4.1. Structure of the materials.
 - 4.2. Solidification.
- 5. Mechanical properties of materials**
 - 5.1. Cohesion, elasticity, plasticity and tenacity.
 - 5.2. Tension / elongation diagram.
 - 5.3. Hardness, definition and measurement.
 - 5.4. Resilience: Definition and measurement
- 6. Mechanical behavior of the material in service**
 - 6.1. Fragile fracture.
 - 6.2. Ductile fracture.
 - 6.3. Thermal creep
 - 6.4. Fatigue.
- 7. Metallic materials.**
 - 7.1. Ferrous materials. Steels.
 - 7.2. Copper based alloys.
- 8. Polymers. Conductive polymers.**



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METODOLOGY

LEARNING ACTIVITIES

Learning activities	Hours	ECTS Credits	Competences
Lectures	3	0,1	CB2, E5, CRI3
Case and Problem-Solving Sessions		-	-
Seminars		-	-
Practical & Lab Work	116	4,3	CB2, E5, CB3, E8, E11, CB4, CRI3
Presentations	5	0,2	CB3, E8, CB4, CRI3
Personal study	5	0,2	CB2, E5, CB3, E8, E11, CRI3
Assessment Tasks (Exams, Continuous Assessment...)	5	0,2	CB2, E5, CB3, E8, E11, CB4, CRI3
TOTAL	134	5,0	

TEACHING METHODOLOGY

Lectures/Sessions of exposition of concepts: Exhibition of contents by means of presentation or explanation (possibly including demonstrations) by a professor.

Practical & lab work: Time of accomplishment of activities of laboratory or similar (practices with computer, projects, etc.), under the direct supervision of a professor.

Presentations: Oral presentation of the work accomplished by the student, accompanied by the relevant graphic material, content and duration to be determined in each case.

Study activities: Personal work of the student necessary to acquire the competences of each Subject and assimilate the concepts involved in the performance of the Laboratory activities, using, when necessary, the recommended material for consultation.

Evaluation activities (exams, follow-up controls): Oral and/or written tests taken during the academic period of a subject or when it has finished.



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ASSESSMENT

ASSESSMENT METHODS

Assessment Methods (Organic Chemistry).	Weight (%)	Competences
Final exam	10	CB2, E5, E11, CB4, CRI3
Continuous Assessment Activities	10	CB2, E5, CB3, E8, E11, CB4, CRI3
Reports and Presentations	20	CB2, E5, CB4, CRI3
Lab or Field Work	60	CB2, E5, CB3, E8, E11, CRI3

Assessment Methods (Materials Science).	Weight (%)	Competences
Final exam	-	
Continuous Assessment Activities	54	CB2, E5, CB3, E8, E11, CB4, CRI3
Reports and Presentations	10	CB2, E5, CB4, CRI3
Lab or Field Work	36	CB2, E5, CB3, E8, E11, CRI3

LEARNING OUTCOMES

1. To know how to use the typical experimental techniques of Organic Chemistry, including the realization of simple synthesis and the Science of Materials. (CB2, E5)
2. To have the ability to analyze, integrate and interpret data and information from the field of Chemistry. (CB3, E8)
3. To understand the environmental and safety aspects (including the manipulation of compounds) related to the practice of Organic Chemistry and the Science of Materials. (E11)
4. To know how to communicate efficiently both orally and in writing (CB4)

QUALIFICATION

The grade is the average of the grades obtained in each of the two laboratories, weighted by the following percentages: 80% Organic Chemistry Laboratory and 20% Materials Science Laboratory.

The qualification corresponding to the Organic Chemistry laboratory is obtained by means of the weighted average of the different evaluation methods indicated in the previous corresponding table:

- 10% Final exam
- 10% Continuous Assessment Activities
- 20% Reports and Presentations
- 60% Lab or Field Work

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The qualification corresponding to the Material Science Laboratory is obtained by means of the weighted average of the different evaluation methods indicated in the previous corresponding table

- 54% Continuous Assessment Activities
- 10% Reports and Presentations
- 36% Lab or Field Work

Each practice of the Materials Science laboratory will be evaluated as follows:

- 40% Preliminary Report or Final Report
- 30% Laboratory diary
- 20% Practice test
- 10% Attitude

The weighted average grade of all the practices corresponds to 90% of the final grade of the subject. The remaining 10% corresponds to the evaluation through an oral presentation.

It is stated that the grade obtained in the Materials Science Laboratory ponders 20% on the final grade of the Materials Science and Technology Subject.

To be able to average, the grade of the final exam of the Laboratory of Organic Chemistry must be equal or superior to 4.0 and the weighted average of the notes of the follow-up activities carried out in class time, of the Works and presentations and of the experimental work of each Laboratory must be equal to or greater than 5.0; otherwise, the final grade will be directly the lowest of the partial grades.

ASSESSMENT OF THE COMPETENCES

For the evaluation of the CB2, E5 and E11 competences, the final exam grade, the follow-up activities and the experimental work will be used as an indicator, weighted analogously to what is specified in the "qualification" section (10:10:60) for the laboratory of Organic Chemistry and (0:54:36) for the laboratory of Materials Science, weighted these by 8 (Organic Chemistry) to 2 (Materials Science).

For the evaluation of the CB4 competence, the final exam grade, the follow-up activities and the work and presentations will be used as an indicator, weighted analogously to what is specified in the "qualification" section (10:10:20). For the laboratory of Organic Chemistry and (0:54:10) for the laboratory of Materials Science, weighted these by 8 (Organic Chemistry) to 2 (Materials Science).

For the evaluation of the CB3 and E8 competences, the indicator of the activities of follow-up and experimental work will be used as an indicator, weighted analogously to what is specified in the section "qualification" (10:60) for the Organic Chemistry laboratory and (54:36) for the



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Materials Science laboratory, weighted these by 8 (Organic Chemistry) to 2 (Materials Science)

For the evaluation of the CRI3 competence, the final grade of the subject will be used as an indicator.

BIBLIOGRAPHY

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- W. D. Callister, David G. Rethwisch. *Materials Science and Engineering*. Edition 9.
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DOCUMENT HISTORY

PREVIOUS REVISIONS

September 7 2017, Dr. Xavier Batllori and Dr. Manuel Abad

CURRENT REVISION

September 6 2018, Dr. Xavier Batllori and Dr. Manuel Abad