UAB
Universitat Autònoma de Barcelona

Advanced Chemistry

2026/2027

Code: 42429
Credits: 9

Degree programme	Type	Course
Industrial Chemistry and Introduction to Chemical Research	OP	1

Contact lecturer

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Group languages

You can consult this information at the end of the document.

Prerequisites

The student must hold a Bachelor's degree in Sciences or Biosciences, preferred Chemistry, Material Science, Nano-science, Biotechnology or Environmental Sciences

- Intermediate english level

Objectives

Advanced essential chemistry topics are studied for carrying out interdisciplinary chemical research.

Learning outcomes

1. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
2. Identify information in the scientific literature using the appropriate channels and integrating said information to approach and contextualise a research issue.
3. Use scientific terminology in the English language to defend experimental results in the context of the chemistry profession.
4. Correctly apply new information capture and organisation technologies to solve problems in professional activity.
5. Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
6. Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent
7. Evaluate responsibility in the management of information and knowledge in the field of Industrial Chemistry and Chemical Research.
8. Students should know how to apply the knowledge acquired and the capacity to solve problems in new or little-known areas within broader (or multidisciplinary) contexts realted to thier area of study
9. Use numeric methods in the study of chemical reactions.
10. Elucidate the structure of complex chemical compounds on the basis of the appropriate chemical analysis and structural determination techniques.
11. Recognize properties of conventional solvents, ionic liquids and supercritical fluids.
12. Interfaces characterize and describe the chemical reactions on the surface
13. Recognize special catalytic processes applied to the synthesis.
14. Implement strategies for chemical analysis for the study of specific systems.
15. Using different microscopy and spectroscopy techniques to the study of materials and biomolecules

Contents

- Chemical speciation, non destructive analysis, miniaturization

- Chemometrics

- Surface chemistry (heterogeneous catalysis, self-assembled monolayers)

- Conventional and non-conventional solvents

- Applications of computational techniques in chemistry.

- Structure determination in chemistry (NMR, EPR, Microscopy)

- Synthesis and catalysis (Basic principles and strategies in the design of organic synthesis, Stereoselective synthesis, Homogeneous catalysis, Non-aromatic and aromatic carbo- and heterocycles, Total synthesis)

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Theoretical and exercise lectures	137	5.48	
Collaborative activities and seminars	56	2.24	
Design and train of oral presentations	6	0.24	

Design and train of oral presentations

Theorical and excersise lectures

Collaborative activities and seminars

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Exams, oral presentations and reports	100	26	1.04	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

Assessment

All subjects are compulsory attendance, and are evaluated separately by different evaluating procedures including writing exams, theoretical and practical tests, oral presentations, research papers understanding, in-class brief questions, written works, etc.

Genneral Regulations of the Master:

- Every professor decides the number and typology of evaluation activities: oral presentations, written exams, delivery of discussed articles, tests.

- The final mark of the module will be the sum of the marks of every professor multiplied by the percentage of his classes in the total teaching of the module.

- To pass a module, it is mandatory a mark of 3.5 or higher in a 75% of all the activities in order to average with other marks of the professor and/or the module.

- There will be a period in January to repeat written exams with marks under 5. In the case of exams under 3.5, it will be mandatory to the student. In the case of exams between 3.5 and 5 it would be optional.

- The marks of other evaluations activities (i. e. oral presentations) will average with the rest of the marks of the professor/module independently of the value. There will be not option of repeating these evaluation activities.

VERY IMPORTANT: Partial or total plagiarising will immediately result in a FAIL (0) for the plagiarised exercise and the WHOLE subject. PLAGIARISING consists of copying text from unacknowledged sources -whether this is part of a sentence or a whole text - with the intention of passing it off as the student's own production. It includes cutting and pasting from internet sources, presented unmodified in the student's own text. Plagiarising is a SERIOUS OFFENCE. Students must respect authors' intellectual property, always identifying the sources they may use; they must also be responsible for the originality and authenticity of their own texts.

For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks, such as literature or information searches, text proofreading, or translations. Students must clearly identify which parts of their work were generated using these technologies, specify the tools used, and include a critical reflection on how these tools influenced both the process and the final outcome of the activity. Failure to disclose the use of AI in this assessed activity will be considered a breach of academic integrity and may result in a partial or full penalty in the activity's grade, or more severe sanctions in serious cases.

Any irregularity committed during an assessment activity (including academic fraud, plagiarism, or the improper use of AI, unless such use is expressly authorized in the course syllabus) that may lead to a significant change in the assessment outcome will result in a grade of 0 for that assessment. If the course syllabus stipulates that obtaining a minimum grade on this assessment is a mandatory requirement to pass the course, or if multiple irregularities occur across assessment activities within the same course, the final grade for the course will be 0. In addition, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

Bibliography

- S. Warren, *Organic Synthesis: The Disconnection Approach*,John Wiley & Sons, 1982
- E.J. Corey, X.-M. Cheng: *The Logic of Chemical Synthesis*, Wiley - Interscience, 1989
- Paul Wyatt, S. Warren: *Organic Synthesis: Strategy and Control*, John Wiley & Sons, 2007
- J. Clayden, N. Greeves, S. Warren: *Organic Chemistry*, Chap. 30, Oxford University Press, 2nd Edition, 2012
- Nicolaou, K. C.; Sorensen, E. J. *Classics in Total Synthesis. Targets, Strategies, Methods*, VCH, Weinheim, 1996
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- T. D.W. Claridge, High-Resolution NMR Techniques in Organic Chemistry (Third Edition), Elsevier, 2016
- J. A. Weil, J.R. Bolton, E. Wertz. \"Electron Spin Resonance, Elementary Theory and Practical Applications\". 2ª Ed., John Wiley & Sons, Hoboken, New Jersey, 2007.
- Victor Chechik, Emma Carter, Damien Murphy. Electron Paramagnetic Resonance Oxford University Press, 2016.
- Introduction to Surface Chemistry and Catalysis, 2nd Edition, G.A. Somorjai, Y. Li, Wiley, 2010, ISBN: 978-0-470-50823-7
- G. Ramis y M.C. García. Quimiometría, Síntesis, España (2001).
- C.Mongay, Quimiometría,U. Valencia, 2005
- J.C. Miller and J.N. Miller. Statistics and chemometrics for analytical chemistry 4rd ed., Prentice Hall, Essex, England (2000). Versión traducida (2002).
- D.L. Massart, B.G.M. Vandegiste, L.M.C. Buydens, S.Dejong, P.J. Lewi and J. Smeyers- Verbeke. Handbook on Chemometrics and Qualimetrics, Elsevier, Amsterdam (1997).
- Introduction to Computational Chemistry, F. Jensen, 3rd Ed, Wiley 2017
- Computational Chemistry, J. Harvey,Oxford University Press 2018
- Essentials of Computational Models, Theories and Models, CJ Cramer, Wiley, 2004

Software

ChemDraw Professional 17.0

https://chemaxon.com/products/marvin

https://www.acdlabs.com/resources/freeware/chemsketch/index.php

Gaussian

COPASI

TopSpin 4.0 - NMR software for academia

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TEm) Theory (master)	1	English	first semester	morning-mixed