COURSE DATA

Data Subject	
Code	34213
Name	Advanced experimentation
Cycle	Grade
ECTS Credits	4.5
Academic year	2017 - 2018

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	4	Second term

Subject-matter

Degree	Subject-matter	Character
1108 - Degree in Chemistry	13 - Advanced experimentation	Optional

Coordination

Name	Department
STIRIBA LAKANI, SALAH-EDDINE	325 - Organic Chemistry

SUMMARY

Advanced Experimentation is an optional subject taken during the eighth semester of the Degree in Chemistry. The aims of the course are to strengthen students' general laboratory skills and enable them to assimilate the knowledge they have acquired in each branch of Chemistry (analytical, inorganic, physical and organic). Further aims of the course are to teach students how to adapt a synthetic strategy to prepare an organic compound for use in studies from other fields of chemistry and conduct suitable analytical studies to check its purity. To successfully complete this course, students will need to apply the knowledge they have acquired on all the subjects they have taken during the first three years of the Degree in Chemistry.

Briefly, the objectives to be accomplished on this subject are to:

• strengthen students' knowledge of safety rules, waste treatment, and the handling of materials and reagents in a Chemistry laboratory and to consolidate their ability to browse the literature efficiently and analyse data.

• strengthen students' ability to prepare, conduct and record experimental work in Chemistry (use of laboratory notebooks, practice reports, papers, etc.).

• foster the critical spirit that is required for any scientific activity.

• perform various syntheses of organic products.

• determine compounds using the most suitable analytical technique.

• select the most suitable experimental method for the level of concentration (majority compounds or trace level compounds).

• develop students' ability to solve any problems that may occur in a Chemistry laboratory.

• develop students' ability to analyse results and draw conclusions.

• enhance students' ability to work in a team.

• enhance students' oral and written communication.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

The study and successful completion of Advanced Experimentation are founded on the knowledge students have acquired on the laboratory subjects they have taken during the first years of the Degree in Chemistry. Students should also have successfully completed the basic theoretical subjects in each area of the degree.

OUTCOMES

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Solve problems effectively.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.

- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Learn autonomously.
- Demonstrate the ability to adapt to new situations.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- Handle chemicals safely.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES

The learning outcomes for this course, which are contained in the Degree document under Advanced Experimentation subject area, are:

1. To clearly explain phenomena and processes related to chemistry (CE13).

2. To demonstrate the ability to analyse and synthesise (CG1).

3. To demonstrate inductive and deductive ability (CG2).

4. To demonstrate the ability to organize and plan (CG3).

5. To take decisions with rigour (CG3).

6. To know and implement the means and dynamics of working in team with a serious and professional demeanour and from a gender perspective (CG5, CG6).

7. To demonstrate the ability to creatively integrate one's knowledge to solve a real environmentally sustainable chemical problem (CG3, CG4, CG8, CG9, CG10, CE17).

8. To demonstrate the ability to write professional reports and papers (CT1, CT3).

These learning outcomes should ensure that on successful completion of Advanced Experimentation students will be able to:

- apply safety rules, manage materials and reagents, and treat waste in a chemistry laboratory.

- find, interpret and apply bibliographic information.

- prepare laboratory experiments: analyse and apply experimental procedures.

- select and use suitable materials.

- prepare and purify organic compounds.

- select the right materials for preparing solutions with the right degree of precision depending on their nature (sample dissolutions, standards, reagents).

- perform the calculations needed to transform analytical signals into values of concentration of the compound of interest (in the sample measurement solution).

- perform the calculations needed to transform the concentration of the compound of interest in the sample measurement solution into the concentration of the compound in the study sample.

- correctly record everything observed experimentally.

- deal with a practical problem and attempt to solve it.

- relate the knowledge they have acquired on the course with their daily lives.

DESCRIPTION OF CONTENTS

1. Seminar

Presentation of the subject, the operating rules of an integrated laboratory, and the objectives, content and techniques.

2. Review of the literature

In the computer classroom, students are expected to analyse the literature on the development of processes and determine both the experimental processes to be performed and the subsequent analyses.

3. Organic synthesis

Various organic compounds will be prepared from commercial reagents.

4. Inorganic synthesis

Using the compounds prepared in the previous activity, a series of syntheses will be carried out with various inorganic compounds.

5. Analytical determination

The products of organic and inorganic synthesis, from both the majority compound and from impurities, will be determined using the most suitable analytical techniques in accordance with the nature and level of concentration of the products.

6. Characterization of chemical-physical properties

Various chemical and physical properties of the prepared compounds will be studied.

7. Seminar

The results obtained during the practical sessions will be analysed and discussed.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	36,00	100
Tutorials	9,00	100
Study and independent work	67,50	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

Laboratory work. The experiments are designed to be performed in more than one laboratory session. Students should therefore learn to organize themselves and plan their time accordingly.

To strengthen the students' sense of responsibility in team work and the proper functioning of the laboratory, each week they will be assigned small tasks to help the laboratory run smoothly.

Updating their laboratory notebooks and drafting memoranda and reports are important components of the students' laboratory work.

Students must analyse both the results they obtain in the laboratory and in their calculations.

The results obtained will be analysed and both the problems and how they have been solved or could be solved will be determined. The aim of this stage is to develop the students' analytical ability, encourage the exchange of information, and consolidate team work.

Seminars. All laboratory sessions will require a prior exchange of views whereby the instructor and the students can solve any specific questions on that day's work. The work of the instructor at this stage is to encourage a positive attitude from the students in their scientific work. For this reason a seminar has been arranged for the beginning of each session.

A seminar has also been arranged at the beginning of the course to present the subject, explain the operation of an integrated laboratory, and describe the objectives, content and techniques to be used during the course.

A seminar has also been arranged for the end of the practice sessions. During this seminar the results will be discussed. Any problems that have arisen will be examined and reasoned proposals to solve them will be made.

EVALUATION

FIRST CALL

Learning will be evaluated continuously by the instructor in view of the close contact that will be maintained throughout the course. The following areas will be assessed:

A) SEMINARS, LABORATORY WORK AND RESULTS (60 %): participation, materials handed in during the seminars, assignments and any oral presentations will be assessed. Also assessed will be work conducted in the laboratory, the laboratory notebook, the results obtained, and the reports and/or papers presented. The instructor will inform his or her students of the specific assessments of each item in paragraph (a) before they begin their practices.

B) PRESENTATION OF RESULTS (40 %): Students will present a report setting out all the work they have completed and an analysis and discussion of their results. They will present a summary of their report in a 15-minute oral presentation, after which the instructor may ask questions. Students must obtain at least 4 points out of 10 on this section to be able to add the other percentages. To pass the course students must obtain a score of at least 5.0.

SECOND CALL

The second call will comprise a theoretical examination, a practical examination, and a paper on the practice completed during the practical examination.

NOTE: This course is excluded from the regulations on advance calls for completing graduate studies (Degree Committee agreement of 26/03/2015).

REFERENCES

Basic

- MARTÍNEZ GRAU, M.A. CSAKY, A.G. Técnicas experimentales en Química Orgánica. Ed. Síntesis, 1998. ISBN: 84-7738-605-6
- DURST, H.D. GOKEL, G.W. Química Orgánica Experimental. Ed. Reverté, 1985
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- HARWOOD, L.M. MOODY, C.J. Experimental Organic Chemistry, Ed. Blackwell Sci. Publ., 1989
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- SHOEMAKER,D.P. GARLAND, C.W. NIBLER, J.W. Experiments in Physical Chemistry. 6ª ed, New York, McGraw-Hill, 1996
- RUIZ SÁNCHEZ, J.J. RODRÍGUEZ MELLADO,J.M. MUÑOZ GUTIÉRREZ,E. SEVILLA SUÁREZ DE URBINA, J.M. Curso experimental en Química Física. Ed. Síntesis, 2003

Additional

- Características de los compuestos (datos físicos, químicos, seguridad etc.):
  a) Inst. Nacional de Seguridad e Higiene en el Trabajo (Ministerio de Trabajo e Inmigración)
  b) Catálogo SIGMA-ALDRICH (Casa Comercial)
  c) CHEMnetBASE reúne una serie de Bases de datos como:
  1. Combined Chemical Dictionary (CCD)
  2. The Handbook of Chemistry & Physics
  d) Index Merck (libro que se puede encontrar en la biblioteca)
- MILLER,J.N. MILLER,J.C. Estadística y Quimiometría para Química Aanalítica. 4ª Ed., Madrid, Prentice Hall, 2002
- SKOOG,D.A. WEST,D.M. HOLLER, F.J. CROUCH, S.R. Fundamentos de Química Analítica. 8ª Ed., Madrid, Paraninfo, 2005
- SPIRIDONOV, V.P. LOPATKIN, A.A. Tratamiento Matemático de Datos Fisicoquímicos. Moscú. Mir, 1983

- GIAMBERARDINO, V. Teoría de los Errores. Reverté Venezolana S.A.
- LEVINE, I.N. Físico Química. 4ª Ed., Madrid, McGraw-Hill, 1996