COURSE DATA

Data Subject	
Code	34205
Name	Organic chemistry III
Cycle	Grade
ECTS Credits	6.0
Academic year	2012 - 2013

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	3	First term

Subject-matter

Degree	Subject-matter	Character
1108 - Degree in Chemistry	9 - Organic chemistry	Obligatory

Coordination

Name	Department
ASENSIO AGUILAR, GREGORIO	325 - Organic Chemistry
FUSTERO LARDIES, SANTOS	325 - Organic Chemistry
PEDRO LLINARES, JOSE RAMON	325 - Organic Chemistry

SUMMARY

The subject of Organic Chemistry III that is taught in third year of the degree in Chemistry assumes a continuation and deepening of the knowledge acquired in the subjects Organic Chemistry I and II that are taught in second year of the degree.

Organic Chemistry is the branch of Chemistry that studies the structure, reactivity and synthesis of the compounds of carbon. The study covers the behavior of many millions of chemical compounds with different properties, which constitutes one of the great challenges in the teaching of this discipline: To show the Organic Chemistry as a logical and consistent body of interrelated ideas and not as a mere collection of facts without any connection between them.

Of the relevance of Organic Chemistry is illustrated by the fact that this discipline goes beyond the purely academic limits and is an important part of life itself. The lipids, carbohydrates, proteins and nucleic acids, all of them compounds essential for life, are organic compounds. There are also many substances that we facilitate the everyday life, such as textile fibers, drugs, antioxidants, etc.

The knowledge of the structure of the organic compounds has been driving us to the understanding of their reactivity and, in consequence, the understanding of the biological processes that are involved many organic compounds. In addition, the knowledge of the reactivity enable us to have the design of new synthesis methods leading to the preparation of organic compounds with useful properties and without unwanted side effects. Such synthesis must be carried out in a sustainable manner, i.e. with a minimum of waste generation.

The study of the subject Organic Chemistry III is based on the knowledge acquired in the previous courses in Organic Chemistry I and II and, of course, in the subjects of General Chemistry I and II. Based on this knowledge, will be carried out the systematic study of some functional groups that complete the already seen, as well as the various bifunctional organic compounds, including natural product groups more representative. This study will be completed by a side with an introduction to spectroscopic methods as a tool for the structural determination of organic compounds and, on the other, with an introduction to the design of synthesis.

The objectives to be achieved in this subject can be summarized in the following points:

§ Identify the different functional groups present in the organic molecules functional teamwork, their relative positions and understand the interactions between these functional groups.
§ Studying the reactivity and methods of obtaining organic compounds that contain phosphorus, sulfur and silicon.
§ Studying the reactivity and methods of obtaining monocyclic aromatic compounds and biciclicos simple hex with heterocyclic ring.
§ Studying the reactivity and methods of obtaining monocyclic aromatic compounds and simple biciclicos pentagonal with heterocyclic ring.
§ Identify the major groups of natural products of the primary and secondary metabolism, as well as learn about its importance.
§ Design simple synthesis of organic compounds from the products of heading indicated and involving synthetic sequences of up to 5 stages.
§ Introduce the basic concepts of spectroscopic methods for the determination of structures of organic compounds.

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 of Organic Chemistry III is based on the knowledge acquired in the subjects of Organic Chemistry I and II, where the structure and reactivity of the functional groups already seen it is important to understand the more complex systems to be studied here. It is essential that always strengthens the knowledge representation and nomenclature of organic compounds, also including their configurations and conformations.

OUTCOMES

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Solve problems effectively.
- Toma de decisiones.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.
- Comunicación oral y escrita en las lenguas nativas.
- Trabajo en un equipo de carácter interdisciplinar y/o en un contexto internacional.
- Razonamiento crítico.
- Capacidad de gestión de la información.
- 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.
- Creatividad.
- Liderazgo.
- Motivación por la calidad.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.
- Interpret the variation of the characteristic properties of chemical elements according to the periodic table.
- Demonstrate knowledge of the main types of chemical reaction and their main characteristics.
- Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry.
- Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
- Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.

- Solve qualitative and quantitative problems following previously developed models.
- Recognise and analyse new problems and plan strategies to solve them.
- Evaluate, interpret and synthesise chemical data and information.
- Handle chemicals safely.
- Handle the instrumentation used in the different areas of chemistry.
- Recognise and evaluate chemical processes in daily life.
- Develop sustainable and environmentally friendly methods.
- Relate chemistry with other disciplines.

LEARNING OUTCOMES

In this subject there will be approached the following results of learning contained in the document of Degree inside the CHEMICAL ORGANIC matter: 1.-To demonstrate knowledge of the principal aspects of terminology and organic nomenclature. (CE1) 2.-To understand the structural properties and the reactivity of the compounds and of the functional organic groups applying them to the solution of synthetic and structural problems. (C16, C21, CE2, CE4, CE6, CE7, CE23, CE26) 3.-To elucidate the structure of the organic simple compounds, using spectroscopic technologies. (CE8, CE19) 4.-To explain in an understandable way phenomena and processes related to the Organic Chemistry. (C1, C2, C12, CE13)

5.-To acquire and to use bibliographical information and technology referred to the organic compounds.(C13, CE16)

6.-To write and to expose in the native language with correction (C8) 7.-To fulfil effectively the tasks assigned as member of an equipment with perspective of kind (C7, C9, C18, C19) 8.-To demonstrate knowledge of sustainable methodologies in organic chemistry. (CE25) 9.-To demonstrate skill to manipulate chemical reagents and organic compounds safely. (CE17) 10 .-To demonstrate aptitude to plan and carry out experimentally simple syntheses of organic compounds safely and using the suitable technologies. (C3, CE18, CE21) 11.-To demonstrate aptitude to elaborate a memory of a laborator practice with rigor. (C8, CE16) 13.-To take decisions with rigor. (C6, C15, C17) 14.-To demonstrate critical reasoning. (C12) 15.-To demonstrate autonomous learning. (C16)

16.-To solve problems with rigor. (C5, C20, CE14, CE15)

These results have to allow that at the end of the subject the student should be capable of:

To identify the functional organic groups, incorporating new types of groups to previously seen.

To identify the possible interactions between two or multifunctional groups in organic multifunctional molecules, as well as the new properties that could arise from the above mentioned interactions.

To understand the basic heterocyclice reactivity of the aromatic compounds with pentagonal and hexagonal ring, as well as some useful methods of preparation of the same ones.

To identify the principal types of natural products of the primary and secondary metabolism, as well as his chemical and biological properties. To learn to design synthesis up to 5 steps.

To identify the most important spectroscopic characteristics of an organic molecule (IR, RMN, etc.) and to associate them with the essential structural aspects of the same one (functional groups, type of skeleton carbonado, etc.).

To reason, to argue and to memorize basic aspects.

To work in group.

To solve problems by means of the integrated application of the acquired knowledge.

To express orally of a precise and clear form.

To express in writing of an organized form.

DESCRIPTION OF CONTENTS

1. Carbonyl compounds alpha,beta-unsaturated.

Unsaturated aldehydes and ketones. Additional Stability of carbonyl compounds alpha,beta-unsaturated: isomerization of carbonyl compounds alpha,beta-unsaturated compounds to alpha,beta-unsaturated. Reactions of carbonyl compounds alpha,beta-unsaturated. Additions 1.2 and 1.4 (conjugate addition or adding Michael): mechanistic aspects. Conjugate additions of nucleofilos carbonated. Addition of HCN. Addition of organo-metallic compounds: (a) derivatives of Li and Mg. (B) organocupratos. Addition of anions enolato. Reaction of anelacion of Robinson. Conjugate additions of nucleofilos oxygenated: retroaldolica reaction. Conjugate nucleofilos additions of nitrogen. Conjugate nucleofilos additions of sulfur. Methods of

2. beta-dicarbonilic compuounds

Enolizaction beta-dicarbonyl compounds: stability and reactivity of enolate anions. Decarboxylation of beta-Keto acids. Reactions of the beta-dicarbonyl compound: acetilacetic synthesis and malonic synthesis. Preparation of beta-dicarbonyl compound: Claisen and Dieckmann condensation. Mixed Claisen condensations

3. Compounds of sulfur, phosphorus and silicon.

Properties, preparation and reactivity of organic main functions with phosphorus: Phosphine and phosphonium salts, phosphates and phosphonates, phosphorus iluros. Wittig olefination reaction. Properties, preparation and reactivity of organic sulphur main functions: tioalcoholes and Thioethers, sulfoxides and sulfones, iluros sulfur, and sulfonic acids. Properties, preparation and reactivity of organic main functions with Silicon: silane. Peterson olefination reaction. Synthetic applications.

4. Aromatic heterocycles of six links.

Classification of the aromatic heterocycles: heterocycles pi-deficient and pi-surplus. Aromatic heterocycles of six links: pyridine. Reactions of the pyridine. Methods for the preparation of the pyridine ring. Diazinas. Quinoline and isoquinolina.

5. Aromatic heterocycles of five links

Aromatic heterocycles of five links: furan and pyrrole, thiophene. Reactions of the pentagonal heterocycles. Methods of preparation of heterocycles pentagonal. Azoles. Indoles.

6. Natural organic products.

Carbohydrates. Classification. Monosaccharides. Cyclical forms of the monosaccharides. Structure of the glucose. Anomeric Carbon and glicosidica union. Disaccharides and polysaccharides. Glycosides.
Nucleic acids. Nucleosides and nucleotides. Genetic Code.
Proteins. Amino acids. Peptide Connections. Polypeptides. Three dimensional structure of proteins.
Secondary metabolites. Polyketide. Shikimic acid. Terpenes. Alkaloids.

7. Synthetic methodology.

Retrosintetico Analysis. Concepts of disconnection retrosintetica ("transform") and retron. Fundamental strategies. Synthetic sequence of events. Strategies based on the selectivity: regioselectivity and estereoselectividad. Strategies based on the interconversion of functional groups. Construction of the skeleton: recognition of structural models. Formation of links C-C, and C-nitrogen hetero-atom. Formation of cyclic structures. Protective Groups: importance and selection.

8. Structural determination of organic compounds by spectroscopic methods.

Expand and strengthen knowledge of the most common spectroscopic techniques: IR, 1H and 13C-NMR, UV, EM. Elucidation of the structure of a simple composite from the study of their spectra.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Tutorials	15,00	100
Study and independent work	90,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The subject is raised so that the student is the protagonist of their own learning and is structured in the following way:

§ Teaching materials-from the beginning of the course students will have educational materials for the course.
§ Theoretical classes.-will be devoted to expose students to the most fundamental aspects of the matter. These classes are complemented by personal study time.
§ Practical classes-these classes carry out the specific application of the knowledge that students have acquired in theory classes. Students must have previously worked problems will be resolved. The resolution of these problems is carried out on some occasions by the teacher and in other cases by the students, or in group, either on an individual basis.
§ Tutorial-will be 15 sessions in total spread uniformly throughout the course, being the duration of each of these sessions of 1 hour. Therein, the teacher will evaluate the overall process of learning for students, which will be organized previously in sub-working groups. Tutoring sessions will include jobs that have been entrusted by the teacher to the above subgroups. Also, tutorials will serve to resolve all questions that have been able to arise during classes and guide students on the methods of work more useful to the resolution of problems that may arise.
§ Seminars.-carried out 9 seminars of 1 hour each in the half. These seminars will be devoted to items 8 and 9 of the agenda of the subject. Half of the time spent on the seminars will be reversed in the presentation of the contents of the above topics. The other half will be devoted to the oral presentation by the students of the exercises that have been entrusted to them by the teacher. For this purpose, students will be organised in sub-working groups of the same way as in the case of tutorials.

EVALUATION

The evaluation of learning is carried out on an ongoing basis by the course Professor. The different sections that will be evaluated are as follows:

1. Direct assessment of the Professor (10 points): this evaluation will take into account different aspects, which include:
Attendance and participation clear and reasoned in discussions raised.
Progress in the use of the language characteristic of organic chemistry.
Troubleshooting and questions approach.
Qualifications obtained by each student throughout the course in the personal questions asked by the teacher.

Critical spirit.

Seminars and tutorials (20 points): this type of activity assessment shall take into account the following aspects:
Assistance.
Content and presentation in writing exercises mandated by the teacher to each sub-working group. The score will be a global note for the subgroup and shall be calculated in the same way to each Member of the same.

Final exam (70 points): will take place on the date indicated by the Faculty and will be common to all groups of the subject. It will consist of theoretical and practical questions related to the matter explained during the teaching period of the same. The approved global in the course take necessarily involved have obtained a minimum score of 30 points on 70 total in the examination.

REFERENCES

Basic

- P. Y. Bruice Química Orgánica Pearson Prentice Hall (2008), 5ª edición (en castellano).
- L. G. Wade. Química Orgánica. Pearson Prentice Hall (2004), 5ª edición (en castellano).
- K. P. C. Vollhardt. "Química Orgánica Estructura y Función". Ediciones Omega,S.A. (2008), 5ª edición (en castellano)
- J. E. McMurry. Química Orgánica Cengage Learning Editores. S. A. (2008), 7ª edición (en castellano).
- S. Duckett, B. Gilbert Foundations of Spectroscopy Oxford Chemistry Primers nº 78, Oxford University Press (2000).

Additional

- Referencia c1: F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Vols. A y B, 4ª Ed., Plenum Press (2000)
  Referencia c2: F. A. Carroll, Perspectives on Structure and Mechanism in Organic Chemistry, Brooks/Cole Publishing Company (1998).
  Referencia c3: S. Warren y P. Wyatt, "Organic Synthesis. The Disconnection Approach", John Wiley and Sons, 2ª Ed. (2009).
  Referencia c4: M. B. Smith, "Organic Synthesis" 2ª Ed, Mc Graw Hill Higher Education (2002).
  Referencia c5: M. Carda, J. A. Marco, J. Murga y E. Falomir, "Análisis retrosintético y síntesis orgánica. Resolución de ejemplos prácticos", Publicacions de la Universitat Jaume I, Castellón (2010).
  Referencia c6: J. A. Joule, K. Mills, Heterocyclic Chemistry, 4ª Ed., Blackwell Publishing (2003).
  Referencia c7: J. A. Marco, "Química de los Productos Naturales, Editorial SÍNTESIS (2006).
  Referencia c8 L. M. Harwood, T. D. W. Claridge, Introduction to Organic Spectroscopy, Oxford Chemistry Primers nº 43, Oxford University Press (1996).