COURSE GUIDE: 2018-19

DETAILS OF THE COURSE

Course:	Organic Chemistry II		
Code:	50902209	Plan:	Chemistry Degree (Program 2009)
Academic period:	2017-18	Degree Level:	Undergraduate Level
Academic year	2nd	Type:	Mandatory
Period:	Second Semester		

DISTRIBUTION OF HOURS

Credits:	6	Total time (in hours):	150
USE OF THE VIRTUAL PLATFORM:		Teaching Support	

PROFESSORS DETAILS

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Nombre	**Navarro García, Yolanda**		
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ELEMENTS OF INTEREST FOR COURSE LEARNING

Contents

The course is a continuation of Organic Chemistry I. In this course, students complete the basic study of the organic compounds classified on the basis of functional groups. The course includes the properties, characteristic chemical reactivity and methods of preparation of aromatic compounds, amines and carbonyl compounds. It is expected that by the end of term, students will have acquired an overview of

Organic Chemistry.

Courses with which this course is related in the Undergraduate Program

- Chemistry
- Organic Chemistry I
- Organic Synthesis
- Experimentation in Organic Chemistry
- Organic Chemistry (Extension)

Previous knowledge

Knowledge of General Chemistry is a requisite. Knowledge acquired in the course Organic Chemistry I (OCI) will be the starting point for this course. Building on the concepts studied in OCI will be an essential activity to progress appropriately in Organic Chemistry II.

Requirements set in the Plan

Being enrolled or to have passed the course Organic Chemistry I

COMPETENCIES

General Competencies

Generic Competencies of the University of Almería

- Problem Solving
- Oral and written communication in the own language
- Teamwork

Basic Competencies

- UAL-1 Ability in analysis and synthesis

Specific Competencies

E-C2 (2) Main types of chemical reactions and their most important features.
E-C8 (8) The kinetics of the chemical change, including catalysis. Mechanistic interpretation of chemical reactions.
E-C11 (11) Properties of aliphatic, aromatic, heterocyclic and organometallic compounds.
E-C12 (12) The nature and behavior of the functional groups in organic molecules.
E-C13 (13) The main synthetic routes in organic chemistry, including the interconversion of functional groups and the formation of carbon-carbon and carbon-heteratom bonds.

LEARNING OBJECTIVES/ OUTCOMES

- Acquiring the capacity to apply the theoretical content of the course to the solution of problems related with the mechanisms of organic reactions, reactivity, properties and preparation of

aromatic systems, aldehydes, ketones, amines, carboxylic acids and derivatives, as well as reactions of enolates and bifunctional compounds.
- Knowing the most common organic chemical reactions.
- Having the capacity to relate the reactivity of the different types of organic molecules with their structural features.
- Being able to predict some fundamental properties and reactivity of aliphatic and aromatic compounds.
- Having the capacity to propose transformations of functional groups based on their reactivity.

PLAN

Content

Topic 1: General concepts of reactivity
- The organic reactions and the way their take place
- Hard and soft acids and bases (HSAB). HSAB Principle
- Ambident species
- Structural effects on reactivity

Topic 2: Infrared and nuclear magnetic resonance spectroscopy
- Fundamentals
- Spectroscopy of aromatic, amino and carbonyl compounds

Topic 3: Arenes and aromaticity
- Structure and properties of benzene
- Criteria for aromaticity. Hückel's rule
- Aromaticity of ions, heterocycles and fused systems

Topic 4: Reactivity of aromatic compounds I
- Electrophilic aromatic substitution: General mechanism
- Effects of substituents on the reactivity and regiochemistry
- Some important electrophilic aromatic substitution reactions: Halogenation, Nitration, Sulfonation, the Friedel-Crafts alkylation and acylation, Gatterman-Koch formylation.

Topic 5: Reactivity of aromatic compounds II
- Nucleophilic aromatic substitution: Addition-elimination mechanism, elimination-addition mechanism
- Reactions at the benzylic position: Oxidation, halogenation, nucleophilic substitution

Topic 6: Amines
- Structure and properties of amines
- Synthesis of amines: Synthesis of amines from azides. Gabriel synthesis
- The Hofmann elimination reaction. The Cope elimination. Formation of arendiazonium salts.
- Reactions of arendiazonium ions: Substitution reaction. Diazo coupling

Topic 7: Aldehydes and ketones
- Structure and reactivity of the carbonyl group.
- Relative reactivity of carbonyl compounds
- General mechanism of the reactions of aldehydes and ketones with nucleophiles: nucleophilic

addition reaction and nucleophilic addition-elimination reaction.
- Reaction of aldehydes and ketones with oxygen nucleophiles: Hydration; formation of acetals and hemiacetals.
- Reaction of aldehydes and ketones with sulfur nucleophiles: Formation of thioacetals. Synthetic applications of dithianes.
- Reaction of aldehydes and ketones with nitrogen nucleophiles: Formation of imines and enamines. Reaction with hydroxylamine, hydrazine and semicarbazide.
- The Wolf-Kishner reduction.
- Reaction of aldehydes and ketones with hydride-transfer reagents: Reduction to alcohols. Reductive amination.
- Reaction of aldehydes and ketones with carbon nucleophiles: Formation of cyanohydrins. Reaction with organometallic reagents. Olefination reactions (The Wittig and Horner-Wadsworth-Emmons reaction)
- Oxidation of aldehydes and ketones. The Baeyer-Villiger oxidation
- Introduction to Carbohydrate Chemistry

Topic 8: Carboxylic acids and derivatives
- Synthesis of carboxylic acids by carboxylation of Grignard reagents
- Synthesis of carboxylic acids from nitriles
- Reaction of carboxylic acids with thionyl chloride and oxalyl chloride. Synthesis of acid chlorides
- Nucleophilic acyl substitution: A general mechanism
- Interconversion of carboxylic acids and derivatives by nucleophilic acyl substitution
- Esterification reaction: Fischer esterification and esterification using diazomethane
- Phenol acylation: O- and C-acylation. Fries rearrangement. The Kolbe-Schmitt reaction
- Hydrolysis of carboxylic acid derivatives
- Reduction of carboxylic acids and derivatives
- Reaction of carboxylic acid derivatives with organometallic compounds

Topic 9: Reactions of enols and enolates
- Stabilized carbanions by functional groups
- Enols and enolate ions: kinetic and thermodynamic control.
- Halogenation reactions: The haloform reaction. The Hell-Volhard-Zelinsky reaction
- Alkylation reactions. Alkylation of ketones and aldehydes. The acetoacetic ester synthesis. The malonic ester synthesis.
- The aldol addition/condensation. The Henry-Neft reaction
- Condensation of esters: The Claisen condensation; the Dieckmann condensation
- The Perkin condensation
- The Knoevenagel condensation
- The Mannich reaction
- The Michael reaction
- The Robinson annulation

Methodology and Learning Activities

Participative Lectures
Problem solving
Supervised academic activities and seminars
Teamwork
Evaluation session

Activities of Teaching Innovation

MODE OF EVALUATION OF COMPETENCIES

Marking Criteria and Tools

METHOD A (Final exam) Any student enrolled in the course Organic Chemistry II may attend the final exams of the course (official call), according to the University of Almeria regulations. Such exams will be in written format and both the generic (UAL-1) and specific (E-C2, E-C8, E-C11, E-C12 y E-C13) competencies will be assessed.

METHOD B (Continuous evaluation): The student will have to carry out the activities programmed by the professor, actively participating in them. Students performance will be graded as follows:

1) Class participation and attendance to tutoring sessions 15%
2) Periodical tests 25%. Evaluation of specific (E-C2, E-C8, E-C11, E-C12 y E-C13) and generic (UAL-6: problem solving) competencies
3) Questions and problem solving, as well as supervised papers will contribute: 20%. Evaluation of specific competencies (E-C2, E-C8, E-C11, E-C12 y E-C13), and ability in analysis and synthesis (UAL-1), problem solving (UAL-6) written communication (UAL-3), and teamwork (UAL-8).
4) Participation, defense of arguments and presentations: 20%. Evaluation of specific competencies ((E-C2, E-C8, E-C11, E-C12 y E-C13) , and generic competencies such as ability in analysis and synthesis (UAL-1), problem solving (UAL-6), and oral communication (UAL-3).
5) A final test: 20%. Evaluation of specific competencies (E-C2, E-C8, E-C11, E-C12 y E-C13), and generic competencies such as ability in analysis and synthesis (UAL-1), problem solving (UAL-6) and written communication (UAL-3). The test will be scheduled by the Faculty of Experimental Sciences, which requires for the June call a minimum score of 4 out of 10.

Monitoring mechanisms

- Attendance of tutorials
- Attendance and participation in seminars
- Access to “Aula Virtual”
- Participation in communication tools (debate forums, emails)
- Submission of assigned work in class
- Submission of assigned work in “Aula Virtual”

BIBLIOGRAPHY

Recommended Bibliography

Basic

- Carey, Francis A. Organic Chemistry, McGraw-Hill ; 10 edition, 2016
- Quiñoá, E. and Riguera, R.; Cuestiones y ejercicios de Química Orgánica. Una guía de autoevaluación, McGraw Hill. 2004.
- Hornby, M.; Peach, J., Foundations of Organic Chemistry: Worked Examples,Oxford University Press,
- García, F.; Dobado, J. A.; Problemas resueltos de Química Orgánica, Thomson-Paraninfo. 2007
- Klein, D. R.; Organic Chemistry, Wiley; 2nd edition, 2013
- Wade, L. G.; Simek, J. W.; Organic Chemistry, Pearson; 9 edition, 2016

Complementary

- Volhardt, K.P.C. and Schore, N. E.; Organic Chemsitry, W. H. Freeman; 6th edition, 2010
- Hesse, M.; Meier, H.; Zeeh, B.; Spectroscopic Methods in Organic Chemistry, Thieme; 2 edition, 2014
- Jackson, R. A.; Mechanisms in organic chemistry, Royal Society of Chemistry, 2004
- Bruice, P. Y.; Organic Chemistry, Pearson; 8 edition. 2016
- Solomons, T. W. G.; Fryhle, C.; Snyder, S. A.; Organic Chemistry, Wiley; 11 edition, 2013

Bibliography at the Information System of the UAL Library

Please click the link below to find the recommended bibliography located within the Information System of the UAL Library:

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WEBSITES

http://www.ual.es/~ralvarez/scorm/
Bank of organic reactions