COURSE GUIDE: 2014-15

DETAILS OF THE COURSE

Course:	Organic Chemistry II		
Code:	50902209	Plan:	Chemistry Degree (Program 2009)
Academic period:	2014-15	Degree Level:	Undergraduate Level
Academic year	2nd	Type:	Mandatory
Period:	Second Semester		

DISTRIBUTION OF HOURS

Credits:	6	Number of In-class Hours:	45
		Number of Out-of-class Hours:	105
		Total Hours:	150
USE OF THE VIRTUAL PLATFORM:		Teaching Support	

PROFESSORS DETAILS

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PLAN OF ACTIVITIES

Learning activities and workload of the student (in hours)

I. ACTIVITIES OF THE STUDENT(In-class/ Online)	• Large Group	0.0

	• Teaching Group	26.0
	• Work Group/Small Group	19.0
	Total Hours (In-class/On line) ...	45.0
II. OUT-OF-CLASS ACTIVITIES OF THE STUDENT (Autonomous work)	• (Team work, Individual work)	105
	Total Hours (Out-of-class) ..	105
TOTAL WORKING HOURS OF THE STUDENT		150.0

COURSE DESCRIPTION

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 amines, carbonyl and carboxylic compounds as well as their derivatives. 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

- Organic Chemistry I
- Organic Synthesis
- Experimental Organic Chemistry
- Advanced Organic Chemistry

Previous knowledge

Knowledge of General Chemistry is a prerequisite. 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

Other Generic Competencies

- Application of knowledge

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.

AIMS/LEARNING 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.

SYLLABUS

Group of contents	INTRODUCTION
Contents/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

Teaching Method

Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		2.0
Work Group/Small Group	Problem solving		1.0

Description of the autonomous work of the student	
Review of concepts: resonance structures, acid, base, nucleophile, electrophile.	
Group of contents	AROMATIC COMPOUNDS
Contents/Topic	
	2. Arenes and aromaticity Structure and properties of the aromatic compounds • Structure and properties of benzene • Criteria for aromaticity. Hückel's rule • Aromaticity of ions, heterocycles and fused systems • Spectroscopy of aromatic compounds

Teaching Method			
Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		2.0
Work Group/Small Group	Problem solving		1.0

Description of the autonomous work of the student	
Nomenclature of aromatic compounds. Review of IR and NMR spectroscopy	
Contents/Topic	
	3. Reactivity of aromatic compounds I • Electrophilic aromatic substitution: General mechanism • Effects of substituents on the reactivity and regiochemistry • The Hammet equation. Halogenation of benzene • Some important electrophilic aromatic substitution reactions: Halogenation, Nitration, Sulfonation, the Friedel-Crafts alkylation and acylation, Chloromethylation, Formylation.

Teaching Method			
Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		3.0
Work Group/Small Group	Problem based learning		2.0

Description of the autonomous work of the student	
Review of concepts: nucleophile, electrophile, electronic effects of substituents, acidity-basicity	
Contents/Topic	
	4. Reactivity of aromatic compounds II

	• Nucleophilic aromatic substitution: Addition-elimination mechanism, Elimination-addition mechanism • Reactions at the benzylic position: Oxidation, Halogenation, Nucleophilic substitution

Teaching Method

Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		1.5
	Evaluation session		0.5
Work Group/Small Group	Problem based learning		1.0

Description of the autonomous work of the student

Review of the nucleophilic substitution at saturated carbon

Group of contents	NITROGEN COMPOUNDS

Contents/Topic

	5. Amines • Structure and properties of amines • Spectroscopy of amines • Synthesis of amines: Synthesis of amines from azides. Gabriel synthesis • Reaction of amines: the Hofmann elimination. The Cope elimination. Formation of arendiazonium salts. • Reactions of arendiazonium ions: Substitution reaction. Diazo coupling

Teaching Method

Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		2.0
Work Group/Small Group	Problem based learning		2.0

Description of the autonomous work of the student

Nomenclature of amines. Review of IR and NMR fundamentals. Nucleophilicity and basicity. Nucleophilic substitution at saturated carbon.

Group of contents	CARBONYL COMPOUNDS

Contents/Topic

	6. General aspects of carbonyl compounds • Structure and reactivity of the carbonyl group. • Relative reactivity of carbonyl compounds

	• Spectroscopy of carbonyl compounds

Teaching Method

Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		2.0
Work Group/Small Group	Problem based learning		2.0

Description of the autonomous work of the student

Nomenclature of amines. Review of IR and NMR fundamentals. Nucleophile and electrophile. Leaving Group. Electronic and steric effects of substituents.

Contents/Topic

7. Aldehydes and Ketones

- 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

Teaching Method

Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		3.5
	Evaluation session		0.5
Work Group/Small Group	Problem based learning		3.0

Description of the autonomous work of the student

Review of synthesis of aldehydes and ketones

Contents/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 • Reaction of carboxylic acid derivatives with organometallic compounds • Reduction of carboxylic acids and derivatives

Teaching Method

Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		3.5
	Evaluation session		0.5
Work Group/Small Group	Problem based learning		3.0

Description of the autonomous work of the student

Review of carboxylic acid acidity; concept of leaving group.

Contents/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 Claisen condensation. The Dieckmann condensation • The Perkin condensation • The Knoevenagel condensation • The Michael reaction • The Robinson annulation • The Mannich reaction

Teaching Method

Organizational Mode	*Learning Activities*	*Comments*	*In-Class/On line Hours*
Teaching Group	Lectures/participative		4.5

	Evaluation session		0.5
Work Group/Small Group	Problem based learning		4.0

Description of the autonomous work of the student

Review: Acidity-Basicity. Kinetic and thermodynamic control

MODE OF EVALUATION OF COMPETENCIES

Marking Criteria

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 regulations. Such exams will be in written format and both the generic and specific competencies will be assessed.

METHOD B (Continuous evaluation): Students performance will be graded as follows:

1) Periodical tests done during class time will contribute to 30-10% to the final grade
2) Exercises and problem solving, as well as supervised papers will contribute 25% to the final grade
3) Participation, defense of arguments and presentations will contribute 15% to the final grade
4) Periodical tests done through the “aula virtual” during the out-of-class time will contribute to 10% to the final grade
5) A final test (scheduled by the Higher Polytechnic School and the Faculty of Experimental Sciences) which requires a minimum score of 4 out of 10, will contribute 20-40% to the final grade.

Percentage of Evaluation of the Activities developed by the students

	Activity	*(hours)*	*Percentage*
I. ACTIVITIES OF THE STUDENT (In-class/ Online)	• Large Group	(0)	0 %
	• Teaching Group	(26)	20 %
	• Work Group/Small Group	(19)	30 %
II. OUT-OF-CLASS ACTIVITIES OF THE STUDENT (Autonomous work)	• (Team work, Individual work)	(105)	50 %

Evaluation Tools

- Test/Initial diagnostic interview
- Progress reports
- Tests, exercises, problems.
- Observation of the process.
- Final tests (written or oral).

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

- Cuestiones y ejercicios de Química Orgánica. Una guía de autoevaluación *(E. Quiñoá, y R. Riguera,)* - Basic Bibliography
- Foundations of Organic Chemistry: Worked Examples *(Michael Hornby, Josphine Peach)* - Basic Bibliography
- Organic Chemistry *(Clayden, Greeves, Warren, Wother)* – Basic Bibliography
- Problemas resueltos de Química Orgánica *(F.García y J.A. Dobado)* - Basic Bibliography
- Química Orgánica *(Carey, Francis A.)* - Basic Bibliography
- Química orgánica v.1 *(L. G. Wade, Jr.)* - Basic Bibliography
- Química orgánica v.2 *(L. G. Wade, Jr.)* - Basic Bibliography
- Organic Chemistry (*L. G. Wade Jr.)* - Basic Bibliography

Complementary

- Mecanismos de Reacción en Química Orgánica (*William C. Groutas*) – Complementary Bibliography
- Mechanisms in organic chemistry (*Richard A. Jackson*) - Complementary Bibliography
- Métodos Espectroscópicos en Química Orgánica (*M. Hesse, H. Meier, B. Zeeh*) - Complementary Bibliography
- Organic Chemistry (*Clayden, Greeves, Warren, Wother*) - Complementary Bibliography
- Organic Chemistry (*T. W. Graham Solomons and Craig Fryhle*) - Complementary Bibliography
- Organic chemistry (Paula Yurkanis Bruice) - Complementary Bibliography
- Química Orgánica *(K.P.C. Volhardt and N.E. Schore,)* - Complementary Bibliography

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