

## ORGANIC CHEMISTRY

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
I - Fundamentals	Chemistry	1	1	6	BASIC
<b>LECTURER(S)</b>			<b>Postal address, telephone nº, e-mail address</b>		
Prof. Mónica Díaz Gavilán (MDG) Prof. Francisco Franco Montalbán (FFM)			Dpto. Química Farmacéutica y Orgánica, 3ª planta, Facultad de Farmacia. Campus de cartuja, s/n, 18071 e-mail: MDG (monicadg@ugr.es) FFM (ffranco@ugr.es)		
			<b>TUTORSHIPS</b> MDG: Tuesday, Wednesday, Thursday: 9:30 to 11:30 h. FFM: Tuesday, Wednesday, Thursday: 9:30 to 11:30 h.		
<b>DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT</b>					
Food Science and Technology					
<b>PREREQUISITES and/or RECOMMENDATIONS (if necessary)</b>					
Suitable knowledge of Chemistry, high-school level.					
<b>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)</b>					
STRUCTURE OF ORGANIC COMPOUNDS. STEREOCHEMISTRY. REACTIVITY. FUNCTIONAL GROUPS. CHEMISTRY OF CARBOHYDRATES, PEPTIDES AND LIPIDS. VITAMINES. BASIC ORGANIC CHEMISTRY LAB.					
<b>GENERAL AND PARTICULAR ABILITIES</b>					
<b>GENERAL AND BASIC ABILITIES:</b> CG.08 – Critical thinking. CG.10 – Ability to plan and organize. CG.11 – Ability to manage information. CG.13 – Sensitivity toward environmental issues. CG.01 – Communication skills, both oral and written, in the native language. CG.02 – Generation of ideas. CG.03 – Teamwork. CG.04 – Ability to apply theoretical knowledge to practice.					

- CB1 – Student must have a sufficient knowledge, obtained in Secondary Education, in the area of study. This knowledge must comprise vanguard information of the subject.
- CB2 – Student must be able to apply his knowledge to his work in a professional way, having acquired the necessary abilities that qualify him to elaborate sustainable arguments and provide judicious solutions to the problems encountered.
- CB3 – Student must have the capability to gather and interpret relevant data (normally within his area of study) to express reasonable judgements on social, scientific or ethical subjects.
- CB4 – Student must be able to communicate information, ideas, problems, and solutions both to a specialized and non-specialized audience.
- CB5 - Student must develop those learning abilities necessary to understand, with a high degree of autonomy, more complex studies in his area of study.

**SPECIFIC:**

- CE.1 Recognize and apply the fundamentals physical, chemical, biochemical, biological, physiological, mathematical and statistical necessary for understanding and development of science and food technology.
- CE.2 Know the models of food production, composition and physical properties, physicochemical and chemical to determine its nutritional value and functionality

**OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)**

**GENERAL:**

- Learn the chemical bases necessary to undertake further study with a high degree of autonomy.
- Initiate students in the study of the chemical elements and their compounds.
- Understand the structure and properties of organic chemical components of food.
- Know the basic operations typical of a chemistry lab.
- Knowing the scientific method, and skills for synthesis, isolation and characterization and determination of the physicochemical properties of chemical compounds.
- To encourage in students the ability to perform experimental designs based on the scientific method and the interpretation of scientific papers.
- Train the student in intellectual work techniques and team work.
- To prepare students for long term learning.

**SPECIFIC:**

- Give an overview of modern organic chemistry from a theoretical and practical, directing it towards the field of science and food technology.
- Understand the structure and the bond in organic molecules.
- Applying the concept of orbital hybridization and its application to the reactivity of the organic molecules.
- Know and understand the nature and behavior of functional groups in organic molecules.
- Integration of the chemical basis of biological and technological processes (nomenclature and formulation, constitution, transformations and properties of organic compounds).
- Understanding of issues related to the chemical transformations of the components of food within the food itself and inside the human body.
- Knowledge of chemical nomenclature of natural and synthetic components of food.
- Know the basic operations typical of an Organic Chemistry Laboratory, such as those involved in the



synthesis and isolation of simple organic substances.

## DETAILED SUBJECT SYLLABUS

### LECTURES:

**UNIT 1. CONCEPT AND EVOLUTION OF ORGANIC CHEMISTRY.** Concept of Organic Chemistry. Its evolution. Basic Concept of isomerism. Kekule's structural theory. Current Situation of Organic Chemistry.

**UNIT 2. MOLECULAR CONSTITUTION.** Main features of the bonds in the compounds of carbon. Electrical effects. Systems with multiple double bonds: conjugation and aromaticity.

**UNIT 3. MOLECULAR CONFORMATION.** Acyclic and cyclic carbon skeletons. Conformational analysis.

**UNIT 4. MOLECULAR CONFIGURATION.** Geometric isomerism. Stereoisomerism: concept and classification. Chirality. Optical activity. Relative and absolute configuration. Cahn, Ingold and Prelog. Molecules with more than one chiral center. Resolution of a racemic mixture .

**UNIT 5. HIDROCARBONS.** Classification of hydrocarbons. Nomenclature and physical properties of hydrocarbons. Reactivity.

**UNIT 6. FUNCTIONAL GROUPS AND REACTIVITY.** Classification of Organic Compounds. Formulation. FUNCTIONAL GROUP concept. Reactivity of functional groups. SN1 SN2 E1 E2.

**UNIT 7. ALCOHOLS, ETHERS AND THIOLS.** Alcohols: structure, classification, nomenclature and physical properties. Chemical reactivity. Ethers. Phenols. Analogues with sulfur: thiols and sulfides.

**UNIT 8. AMINES.** Structure and nomenclature. Physical Properties. Preparation. Chemical properties. Diazonium salts.

**UNIT 9. CARBONYL CHEMICAL GROUP: ALDEHYDES, KETONES, CARBOXYLIC ACIDS AND DERIVATIVES.** Structure, nomenclature and physical properties. Preparation. Addition reactions and addition-elimination to the carbonyl group. Reduction and oxidation reactions. Keto-enol tautomerism. Aldol condensation and related. Malonic and acetylacetic synthesis. Acid-base reactions. Transformations acid derivatives. Overall reactivity of the carboxylic acid derivatives. Claisen condensation. Reactions of amides on the nitrogen.

**UNIT 10. CARBOHYDRATES.** Classification. Nomenclature. Structure: acyclic and cyclic forms. Reactions of interest in monosaccharides. Disaccharides. The glycosidic bond.

**UNIT 11. LIPIDS.** Structure of fats and oils. Structure of phospholipids, cerebrosides and sphingolipids. Steroids.

**UNIT 12. AMINO ACIDS, PEPTIDES AND PROTEINS.** Natural amino acids: Stereochemistry and chemical properties. Preparation of amino acids. Peptide bond: the structure and formation. Structural aspects of

peptides and proteins.

**UNIT 13. VITAMINS.** Introduction. Hidro-soluble and fat-soluble vitamins. Biological action.

**UNIT 14. METABOLIC PROCESSES AND PRODUCTION OF ENERGY.** Energy Metabolism and ATP. Digesting food. Coenzymes interest and metabolic processes. Glycolysis: Glucose oxidation. Citric acid cycle. Electronic transport. Oxidative phosphorylation and ATP. Fatty acid oxidation. Amino acid degradation.

**UNIT 15. NUCLEIC ACIDS AND PROTEIN SYNTHESIS.** Components of nucleic acids. Primary structure of nucleic acids. The DNA double helix. Protein synthesis.

#### LABORATORY SESSIONS AND SEMINARS:

Seminars

Problems solving

Laboratory sessions

**Session 1.** Synthesis of Isoamyl acetate.

**Session 2.** Synthesis of dibenzalacetone.

**Session 3.** Hydrolysis of sucrose.

**Session 4.** Saponification. Soap making.

**Session 5.** Search online database for the synthesis and properties of organic compounds (Reaxys).

#### READING

##### BASIC READINGS:

- **Chemistry: An Introduction to General, Organic, & Biological Chemistry.** K.C. Timberlake, Ed. Prentice Hall, 2008.

- **Organic Chemistry. 8th Ed.** L.G. WADE 2012.

- **Food. The Chemistry of its Components.** T. Coultate 5<sup>th</sup> Ed. RSC publishing., 2009.

- **Organic Chemistry.** J. Clayden, N. Greeves, S. Warren, P. Wothers. Oxford University Press, 2001.

##### COMPLEMENTARY READINGS:

- **Organic Chemistry With Biological Applications.** J. McMURRY. Brooks Cole Ed. 2010.

- **The Organic Chemistry of Biological Pathways.** J. McMURRY, T. Begley. Roberts&Company Publ.Ed.2005

- **Food Chemistry,** D. WANG, Ed. Nova, 2012.

#### ASSESSMENT (INSTRUMENTS, CRITERIA AND FINAL QUALIFICATION PERCENTAGE, ETC.)

Assessment will be based on the exams and student's personal work, which will have to demonstrate the skills acquired.

In the evaluation process the student should show a uniform minimum knowledge of all objectives. Simply not fully aware of some contents and ignoring the rest. In exceptional cases, it may make additional oral exam to justify a student's knowledge.



It is mandatory to carry out the lab work to pass the course, being indispensable to attend all practice sessions, as well as performing a test that guarantees their knowledge.

Neither theory exams passed will be saved for the next academic year or for the special examination in September. Approved practices are not saved for the next academic year, neither for the special examination in September.

LINK OF THE RULE OF EVALUATION AND QUALIFICATION OF STUDENTS UGR:

<http://farmacia.ugr.es/noticias/docu/NormEVALUACINYCALIFICACIN.pdf>

LEARNING OUTCOMES	ASSESSMENT	% MARKING
Theory classes	SE.1, SE.2, SE.3 y SE.4	100-85
Laboratory classes, elaboration and exposition of homework	SE.7, SE.8, SE.9 y SE.10	0-10
Class attendance	SE.5, SE.11 y SE12	0-5

The values in % of the markings will be set at the beginning of the course by the instructor/instructors of the subject.

