

## ORGANIC CHEMISTRY

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
I - Fundamentals	Chemistry	1	1	6	BASIC
<b>LECTURER(S)</b>			<b>Postal address, telephone n°, e-mail address</b>		
Prof. Olga María Cruz López			Dpto. Química Farmacéutica y Orgánica, 3ª planta, Facultad de Farmacia. Correo electrónico: ( <a href="mailto:olgac@ugr.es">olgac@ugr.es</a> ; 958-240716)		
<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>					
<p><b>GENERAL AND BASIC ABILITIES:</b></p> <p>CG.08 – Critical thinking.</p> <p>CG.10 – Ability to plan and organize.</p> <p>CG.11 – Ability to manage information.</p> <p>CG.13 – Sensitivity toward environmental issues.</p> <p>CG.01 – Communication skills, both oral and written, in the native language.</p> <p>CG.02 – Generation of ideas.</p> <p>CG.03 – Teamwork.</p> <p>CG.04 – Ability to apply theoretical knowledge to practice.</p>					



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. Hydro-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.

**RECOMMENDED INTERNET LINKS**

