

Course Unit	Organic Chemistry II	Field of study	Chemistry
Bachelor in	Chemical Engineering	School	School of Technology and Management
Academic Year	2023/2024	Year of study	2
Type	Semestral	Semester	1
Level	1-2	ECTS credits	6.0
Code	9125-755-2104-00-23		
Workload (hours)	162	Contact hours	T - TP 24 PL 36 TC - S - E - OT - O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Maria Filomena Filipe Barreiro

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Classify aminoacids, recognize them as structural units of peptides and proteins, understand their acid-base behavior and know their typical reactions.
2. Understand the formation of peptides and proteins. Identify structural levels of proteins, characterize and determine the sequence of aminoacids in a protein.
3. Understand the role of enzymes as biochemical catalysts. Understand the enzymatic activity, regulation and inhibition.
4. Know the structure, function and classification of saccharides. Establish isomery and stereoisomery relationships between the main monosaccharides. Understand the chemistry of saccharides.
5. Understand the structural and functional variety of several classes of lipids. Know the reactions of lipids and its industrial importance.
6. Perform experiments of Organic Chemistry, analyse the results and present them (reports):

Prerequisites

Before the course unit the learner is expected to be able to:

1. Understand concepts of Organic Chemistry I.
2. Understand concepts of Biology (high school level).

Course contents

Study of the Major Molecular Components of Cells (Water, Carbohydrates, Proteins, Lipids, Nucleic Acids). Enzyme Kinetics. Laboratory Experiments.

Course contents (extended version)

1. Saccharides
 - Structure and function of saccharides.
 - Stereochemistry. Aldoses and ketoses. Cyclic structures of monosaccharides.
 - Reactions of monosaccharides. Glycosidic bond.
 - Monosaccharides, disaccharides, oligosaccharides and polisaccharides. Reducing sugars.
2. Lipids
 - Major groups and structural variety. Fatty acids. Triacylglycerides. Waxes.
 - Functions and classification.
3. Proteins
 - Aminoacids and their classification. Acid-base behavior. Isoelectric point.
 - Aminoacids reactions. Chemical properties. Separation and analysis. Peptidic bond.
 - Proteins. Characteristics and acid-base properties. Function and classification.
 - Three-dimensional structure of proteins (primary structure, secondary, tertiary, quaternary).
 - Methods to quantify and determine the sequence of amino acids in a protein.
4. Enzyme Kinetics
 - General characteristics of enzymes.
 - Function, classification and nomenclature. Enzymatic activity and kinetics.
 - Michaelis-Menten equation and linear representation of Lineweaver-Burk.
 - Catalytic power of enzymes. Knowledge of optimal conditions for catalytic activity.
 - Enzyme inhibition. Regulation of enzyme activity. Identification of cofactors and coenzymes.
5. Laboratorial experiments
 - TL1 - Methods for identification and determination of sugars.
 - TL2 - Synthesis of an aroma.
 - TL3 - Isolation and purification of caffeine from tea leaves.
 - TL4 - Potentiometric titration of amino acids and agarose gel electrophoresis of genomic DNA.

Recommended reading

1. A. Quintas, A. P. Freire, M. J. Halpern, Bioquímica - Organização Molecular da Vida, 1ª edição, 2008.
2. R. H. Garret, C. M. Grisham, Biochemistry, 4th edition, Saunders College Publishing, 2010.
3. C. F. Most Jr. , Experimental Organic Chemistry, 7th edition, John Wiley and Sons, 1998.
4. G. Solomons, C. Fryle, Organic Chemistry, 12th edition, John Wiley and Sons, 2015.
5. D. L. Nelson, M. M. Cox, Lehninger Principles of Biochemistry, 7th edition, W. H. Freeman and Company, 2017.

Teaching and learning methods

Theoretical-practical classes: Presentation of the theoretical principles and supervised resolution of exercises. Home study: Individual/group study, including reading of bibliography, solving of exercises further analysed in practical classes, preparation of laboratorial works and reports.

Assessment methods

- Universal Method - (Regular, Student Worker) (Final, Supplementary, Special)
- Practical Work - 20% (It includes a practical work per chapter in a total of four.)
- Final Written Exam - 80%

Language of instruction

English

Electronic validation

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13-10-2023	25-10-2023	25-10-2023	31-10-2023