General Information	BACELOR DEGREE IN BIOTECHNOLOGIES
Title of the subject	Organic Chemistry with laboratory
Degree Course (class)	Industrial and agro-food biotechnologies (L – 2) Medical and pharmaceutical biotechnologies (L – 2)
ECTS credits	8
Compulsory attendance	Yes
Language	Italian
Academic year	2020-2021

Subject Teacher	
Name and Surname	Maria Annunziata M. Capozzi
email address	maria.capozzi@uniba.it
Place and time of reception	Every day at room 214 dep. of Chemistry or Teams after contacting email

ECTS credits details	Discipline sector (SSD)	Area
	CHIM/06	---

Study plan schedule	Year of study plan	Semester
	I	II

Time management	Lessons	Laboratory	Exercises	Total
CFU	**7**		**1**	**8**
Total hours	**175**		**25**	**200**
In-class study hours	**56**		**12**	**68**
Out-of-class study hours	**119**		**13**	**132**

Syllabus

Prerequisites / Requirements	

Fundamental concepts of General and Inorganic Chemistry

Expected learning outcomes (according to Dublin descriptors)

Knowledge and understanding	The course aims to make the student familiar with the study of the chemistry of organic compounds, through the knowledge of the fundamentals of nomenclature, structure and reactivity of the main functional groups with particular reference to the biologically important ones.
Applying knowledge	The course provides the fundamental tools for the recognition of functional groups of the chemical-physical properties that they confer on organic molecules and their reactivity. The acquisition of a formally correct language is taken care of, the ability to express the

	contents in a clear and linear way is stimulated, connections between the different parts of the course are underlined.
Making informed judgments and choices	The student will be able to identify the central aspects of the proposed problems and bring them back to the fundamental concepts acquired by proposing coherent solutions. The acquisition of independent judgment will be verified by evaluating the topics covered by the teaching.
Communicating knowledge	Thanks to the adequate skills and tools of written and oral communication, the student will be able to analyze, propose and critically discuss the fundamentals of organic chemistry.
Capacities to continue learning	The student will have acquired sufficient ability to learn and deepen the main issues of organic chemistry by consulting bibliographic material in paper form. The learning ability is verified by analyzing the knowledge of the topics covered by the teaching through the grade of the questions in the oral exam.
Study Program	
Content	Introduction. Notes on the history of organic chemistry. Review of the theories of the chemical bond. Molecular Orbital. Polarity of bonds and molecules. Intermolecular interactions. Polar and apolar, protic and aprotic solvents. Hybridization of orbitals. Alkanes, structure, nomenclature and chemical-physical properties. Structural isomerism. Cycloalkanes, cis-trans stereoisomerism. Main reactions. Sources of alkanes: composition of crude oil and natural gas. Stereoisomerism. Configurational and conformational stereoisomers. Chirality. Enantiomers and diastereomers. Absolute configurations. Optical activity. Chiral discrimination. Alkenes and alkynes. Structure, nomenclature and chemical-physical properties. Geometric isomerism in alkenes and dienes. The terpenes. Reactions of alkenes and alkynes: additions, oxidations and reductions. Electrophilic additions to double bonds. Addition of halogenhydric acids, hydration. Regioselectivity, Markovnikov's rule. Addition of halogens, bis-hydroxylation and their stereochemical course. Alkyl halides. Nomenclature and chemical-physical properties. Aliphatic nucleophilic substitution and elimiation reactions. SN1 and SN2, E1 and E2 mechanisms. Nucleophiles and leaving groups. Effect of the solvent. Aromatic hydrocarbons. Benzene and derivatives. Aromaticity and chemical-physical properties of aromatic compounds. Nomenclature. Polynuclear aromatic hydrocarbons. Aromatic heterocyclic compounds. Aromatic electrophilic substitution reactions. Reactions of halogenation, sulfonation, nitration, alkylation and acylation reactions. Activating / deactivating and orienting effects of substituents. Alcohols, ethers and thiols. Nomenclature and chemical-physical properties. Acidity of alcohols and thiols. Reactions of alcohols: conversion into alkyl halides, dehydration, oxidation. Polyols. Synthesis of ethers and epoxides; opening reactions of epoxides. Oxidation of thiols. Phenols. Nomenclature, chemical-physical properties and reactivity. Amines. Structure, nomenclature, chemical-physical properties and reactivity. Basicity. Aldehydes and ketones. Structure, nomenclature and chemical-physical properties. Reactivity of the carbonyl group and oxidation and reduction reactions. Nucleophilic addition reactions to the carbonyl. Acid and basic catalysis. Carbon, nitrogen and oxygen

	nucleophiles. Reactions with cyanide, amines, and alcohols. Acidity of hydrogens in alpha to carbonyl. Enols. Aldol condensation. Carboxylic acids and derivatives. Nomenclature, chemical-physical properties and reactivity. Derivatives of carboxylic acids: acyl chlorides, anhydrides, esters, amides: Nomenclature and chemical-physical properties. Nucleophilic acyl substitution reactions. Classification of reactions. Acid and basic catalysis. Nucleophiles and leaving groups. Claisen condensation. Acids and bases in organic chemistry. Structural effects on the acidity and basicity of organic compounds. Surfactants. Chemical-physical structures and properties. Lipids. Classification and main reactions: triglycerides, phosphoglycerides, terpenes, steroids, fat-soluble vitamins, prostaglandins. Carbohydrates. General structures. Monosaccharides: aldoses and ketoses. The mutarotation. Glycosides. Reactions of monosaccharides: oxidation and reduction. Disaccharides: sucrose, galactose, maltose and cellobiose. Polysaccharides: starch and cellulose. Amino acids. Structures of natural amino acids and chemical-physical characteristics. Peptide bond.Protein. Nucleic acids. Structures of nitrogenous bases, nucleosides, nucleotides. Phosphodiester bond. Nomenclature of multifunctional compounds. Prediction of the reactivity of organic compounds. Structural and conformational analysis of organic molecules. Laboratory: Thin layer chromatography of a mixture of colored substances. Techniques of extraction of organic compounds. Extraction of photosynthetic pigments from spinach leaves with a solvent and their qualitative analysis by thin-layer chromatography. Use of molecular models.
Bibliography and textbooks	W.H. Brown-T Poon. Introduzione alla Chimica Organica V Ed. (EdiSES, Napoli) **or** J.G. Smith Fondamenti di Chimica Organica Ed. Mc Graw Hill
Notes to textbooks	
Teaching methods	Lectures on theory, examples on solving problems, laboratory experiment.
Assessment methods (oral, written, ongoing assessment)	Oral Exame
Evaluation criteria (describe criteria for each of the above expected outcomes)	The oral exam may include the request for theoretical explanations based on reactions described in class or the solution of one or more exercises of a type similar to those addressed in the classroom. The oral exam aims to evaluate the ability to analyze and interpret critically the topics of the teaching.
Further information	