COURSE OF STUDY: Science for the valorization of the gastronomic heritage
ACADEMIC YEAR: 2023/2024
ACADEMIC SUBJECT: Organic Chemistry

General information	
Year of the course	*1°year*
Academic calendar (starting and ending date)	*1° semester – 9th October 2023 – 26th January 2024*
Credits (CFU/ETCS):	*6 CFU*
SSD	*CHIM/06*
Language	*Italian*
Mode of attendance	*Compulsory*

Professor/ Lecturer	
Name and Surname	*Pietro Cotugno*
E-mail	*pietro.cotugno@uniba.it*
Telephone	
Department and address	*Chemistry Department – 2nd floor – room 231*
Virtual room	*Teams*
Office Hours (and modalities: e.g., by appointment, on line, etc.)	*Tuesday. 3:00-4:00 pm*

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
150	*32*	*28 (working groups)*	*90*
CFU/ETCS			
6	*4*	*2*	

Learning Objectives	*Knowledge of functional groups, nomenclature, reactivity and preparation of organic molecules with biological interest, stereochemistry. The teaching aims to acquire knowledge on the general aspects of the structure/properties relation of the main organic compounds and biomolecules, especially of food interest, oriented towards understanding the transformations of the different ingredients during specific gastronomic preparations. The analysis of the scientific background and the development of autonomal study and basic and applied research constitute a goal. Use of congruent lexicon in scientific English. Ability to formulate hypotheses and define theories. Technical-practical objectives.*
Course prerequisites	*Fundamentals of general and inorganic chemistry; rudiments of mathematics and calculation.*

Teaching strategie	*Frontal lectures, use of multimedia inputs, brain storming, collective and individual exercises, use of molecular models, visual and written ideation.*
Expected learning outcomes in terms of	
Knowledge and understanding on:	○ *Knowledge of chemical notation, IUPAC nomenclature, conventions for graphic representation of reactions in chemistry*

	○ *Knowledge of organic syntheses applied to the biological world* ○ *Knowledge of functional groups and overview on reactivity, preparation, stereochemistry and properties* ○ *Applications and connection of organic chemistry to nature and industrially exploited processes*
Applying knowledge and understanding on:	○ *Ability to write chemical structures from names and vice versa* ○ *Prediction of the chemical behavior, aiming to plan a synthetic preparation* ○ *Ability to predict stereochemical behavior and applicability of specific compounds*
Soft skills	*Making informed judgments and choices* ○ *Ability to apply chemical theory to daily processes* ○ *Problem solving* ○ *Ability to independently study and research using scientific literature and databases* ○ *Development of practical sense of theoretical study and technological impact* *Communicating knowledge and understanding* ○ *Written and spoken forms of communication ability related to information, problems, solutions* ○ *Didactic, Scientific and informative discussion* *Capacities to continue learning* ○ *Updating of literature through self-study* ○ *Introduction of new case studies* ○ *Possibility of writing a case study*
Syllabus	
Content knowledge	*Chemical bond theory, intra- and intermolecular interactions, molecular orbital theory, polarity and molecular geometry. Carbon hybridization. Saturated and unsaturated hydrocarbons. Alkanes, alkenes, alkynes, cycloalkanes: nomenclature, structure, properties, reactivity. Stereoisomerism. Configurational and conformational stereoisomers. Chirality. Enantiomers and diastereoisomers and determination of the absolute configurations. Optical activity. Geometric isomerism in alkenes and dienes. Natural hydrocarbons: terpenes and terpenoids. Focus on double and triple bond reactivity: electrophilic additions of hydrogen halides to the double bond, hydration. Regioselectivity, Markovnikov rule. Addition of halogens. Alkyl halides. Nomenclature, reactivity, chemical-physical properties and aliphatic nucleophilic substitution and elimination reactions, related mechanisms SN1 and SN2, E1 and E2. Benzene and aromatic hydrocarbons. Aromaticity and chemical-physical properties of aromatic compounds. Nomenclature. Natural aromatic molecules: spice monomers, flavors and polyphenols. Focus on electrophilic aromatic substitution reactions. Halogenation, sulfonation, nitration reactions, alkylation reactions, acylation. Substituents of the benzene ring, activating/deactivating and orienting effects. Acidity of phenols. Alcohols, ethers, thiols, epoxides: nomenclature, properties, reactivity. Acidity of alcohols and thiols and comparison with phenols. Molecular rancidity in nature. Amines. Structure, nomenclature, chemical-physical properties and reactivity. Natural aliphatic and aromatic amines, case of histamine in conservation. Basicity of amines. 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 base catalysis. Carbon, nitrogen and oxygen nucleophiles. Acidity of hydrogens in alpha to carbonyl. Enols. Keto-enol tautomerism. 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. Natural aldehydes, ketones and carboxylic acids in ripening processes. Phytohormones. Structural effects on the acidity and basicity of organic compounds. Saponifiable and non-saponifiable lipids. Surfactants. Triglycerides, phosphoglycerides, steroids, fat-soluble vitamins. Carbohydrates. General structures. Monosaccharides: aldoses and ketoses. Reactivity, focus on mutarotation. Natural glycosides. Reactions of monosaccharides: oxidation and reduction. Disaccharides: sucrose, galactose, maltose and cellobiose. Polysaccharides: starch and cellulose. Amino acids. Molecular bases of the industrial baking process and fermentations. Molecular bases of sugar digestibility. Structures of natural amino acids and acid-base features. Peptide bond. Nucleic acids. Structures of nitrogenous bases, nucleosides, nucleotides. Phosphodiester bond. Nomenclature of polyfunctional compounds. Prediction of the reactivity of organic compounds. Structural and conformational analysis of organic molecules. Use of molecular models. Exercises.
Texts and readings	*William H. Brown, Brent L. Iverson, Eric V. Anslyn, Christopher S. Foote, Chimica Organica, V Edizione, , 2015 EdiSES S.r.l. Napoli; recent literature, power point or .pdf slides.*
Notes, additional materials	*The text serves as a support for didactics. The entire course is based on book, lectures and scientific literature ranged from 10 years and the student mainly uses notes for the personal preparation of the course.*
Repository	*Teachers and lecturers supply the study materials.*

Assessment	
Assessment methods	*Intermediate exam, final oral exam*

Assessment criteria	• *Knowledge and understanding*
	  ○ *Testing of the knowledge using the written intermediate exam and the final oral exam*
	• *Applying knowledge and understanding*
	  ○ *Testing of the theory to case study*
	• *Autonomy of judgment*
	  ○ *Independent problem solving ability*
	• *Communicating knowledge and understanding*
	  ○ *Adequate language*
	  ○ *Cultural and content correctness*
	  ○ *Use of the suitable chemical notification*
	• *Communication skills*
	  ○ *All the likely communication skills presented*
	• *Capacities to continue learning*
	  ○ *Problem solving during the course attending*

Final exam and grading criteria	*Application of prerequisites, verification of lack or presence of gaps, verification of theory knowledge, correctness of chemical graphics, problem solving.*
Further information	
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