



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
BACHELOR'S DEGREE (BSC)	CHEMICAL AND BIOCHEMICAL ENGINEERING
SUBJECT	ORGANIC CHEMISTRY
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	10657-Attività formative affini o integrative
CODE	01933
SCIENTIFIC SECTOR(S)	CHIM/06
HEAD PROFESSOR(S)	BRUNO MAURIZIO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	BRUNO MAURIZIO Tuesday 12:00 14:00 Edificio 17 Thursday 12:00 14:00 Edificio 17

DOCENTE: Prof. MAURIZIO BRUNO

PREREQUISITES	-Knowledge of General Chemistry : (Chemical bonding , hybrid orbitals, electronegativity , acids and bases, chemical kinetics , basics of thermodynamics) . -Knowledge of Physics : Electromagnetic waves, quantization of energy
LEARNING OUTCOMES	Knowledge and understanding Acquisition of knowledge of the structure of various organic substances by physical, chemical and spectroscopic methods. Applying knowledge and understanding Ability to determine the relationship between chemical structure and reactivity, to design synthetic processes and separative processes. Making judgments Evaluate the best synthetic procedures for the preparation of organic compounds from both a synthetic and economic point of view. Communication skills Ability to expose the reasons of the use of certain synthetic techniques and instrumental investigation methods for the determination of organic compounds, stressing the implications between their scientific nomenclature and the industrial one. Learning ability Update capability by consultation of its scientific publications. Ability to attend, using the knowledge acquired in the course, teachings concerning both the chemical analysis and the processes for the obtaining of organic compounds .
ASSESSMENT METHODS	The evaluation of student learning requires the possession of the skills and knowledge of the subject matter of the course as well as the ability to apply them to problems related to typical topics of Chemical Engineering. In addition, it verifies the possession of property of scientific language and of exposure capacity. The final examination consists of a written test. The written test, of the duration of about 3 hours, consists of several different types of open response exercises: 1) Synthesis of organic compounds from commercial chemical (four exercises up to 4 points each); 2) Synthesis of polymeric materials (one exercise up to 3 points); 3) Chemical-physical properties of organic compounds (one exercise up to 3 points) 4) Spectroscopy exercises (one exercise, up to 4 points) 5) Biomolecules (one exercise up to 4 points) in order to ensure the learning of the required knowledge. The method of carrying out and evaluating all types of exercises is discussed during the course exercises. The written test is passed when the sum of the individual exercises is higher than 18/30 and at least one synthesis exercise has been carried out exhaustively. The evaluation of the spectroscopy exercises will be modulated according to the completeness of the response (identification of the compound, identification of functional groups, determination of mass fragments)
EDUCATIONAL OBJECTIVES	Adequate knowledge of the methodological aspects of the topics of the course and the ability to use that knowledge to interpret and describe engineering problems.
TEACHING METHODS	Teaching takes place in the first half of the 2nd year and consists of lectures and of numerical exercises. Classroom exercises are performed to simulate the final examination.
SUGGESTED BIBLIOGRAPHY	R. T. Morrison, R. N. Boyd: "Chimica Organica", Casa Editrice Ambrosiana. W. H. Brown: " Chimica Organica", Edises, 2015

SYLLABUS

Hrs	Frontal teaching
2	Introduction - Ionic and covalent bonds. Atomic orbitals. Hybridization. Electronegativity and polarity. Oxidation number. Bond dissociation energies. Resonance. Electrophilic and nucleophilic reagents. Acids and bases. Resonance. Isomerism.
2	Alkanes - Nomenclature. Physical properties. Newman projection. Conformational analysis. Reactions. Radicalic halogenation. H. Activation energy. Rates of reaction. Radical stability. Alicyclic compounds: nomenclature, structure and stability.
2	Stereochemistry – Optical isomerism. Specific rotation. Symmetry elements. Chiral molecules. Fisher projection. Enantiomers and racemic forms. Relative and absolute configuration. Diastereomers. Meso structures. Resolutions of racemic forms. Synthesis and optical activity.
4	Alkyl halides - Nomenclature. Physical properties. Nucleophilic displacement. Nucleophilic reagents and bases. Leaving group. Carbocation ions and rearrangements. Synthesis of RX. Grignard reagents.
3	Alkenes – Geometric isomers. Nomenclature. Physical properties. Preparation of alkenes: dehydrohalogenation, dehydration. Heats of hydrogenation. Catalysis. Electrophilic polar addition reactions. Free-radical additions. Polymerizations. Oxidations.
2	Alkadienes – Conjugated and isolated. Electrophilic polar addition reactions (1,2 and 1,4). Free-radical additions. Polymerizations

SYLLABUS

Hrs	Frontal teaching
2	Alkynes - Nomenclature. Physical properties. Acidity and salts. Methods of preparation. Addition reactions. Keto-enol tautomerism. Reduction. Oxidation.
2	Alcohols - Nomenclature. Physical properties. Preparations: hydration of alkenes, carbonyl compounds and Grignard reagents, reductions. Acidity. Oxidation.
2	Ethers Nomenclature. Physical properties. Williamson synthesis. Epoxides.
3	Aromatic compounds - Benzene: structure, nomenclature and properties, resonance energy. Aromaticity and antiaromaticity. Polynuclear aromatic hydrocarbons. Eteroaromaticity. Aromatic substitutions. Arenes.
2	Carbonyl group. Nucleophilic addition and acyl nucleophilic substitution. Acidity of H's.
2	Aldehydes and ketones. - Nomenclature. Physical properties. Methods of preparation. Addition reactions of nucleophiles. Reductions: H ₂ and catalyst, metal hydrides, Wolff-Kishner, Clemmensen. Reazioni di ossidazione. Enols. Haloform reaction. Aldol condensation. Cannizzaro reaction.
6	Carboxylic acids and their derivatives. - Nomenclature. Physical properties. Acidity. Salts. Methods of preparation. Nitriles. Acyl halides, anhydrides, amides, esters. Methods of preparation. Beckman rearrangement. Lactams and lactones. Lipids. Classifications. Saturated and unsaturated fatty acids. Essential fatty acids. Glycerides. Phospholipids and Glycolipids. Waxes.
2	Phenols - Nomenclature. Physical properties. Acidity. Salts. Methods of preparation (Dow process, cumene hydroperoxide).
2	Amines. - Nomenclature. Physical properties. Basicity. Salts. Methods of preparation.: reduction of N-containing compounds, alkylation. Reactions of aryl diazonium salts: displacement reactions, coupling.
4	Polymers. – Introduction to polymerization. Monomers and polymers. Linear and branched polymers . Types of polymerization: addition, condensation.
5	Carbohydrates. – Monosaccharides. Cyclic structure of monosaccharides. Disaccharides and oligosaccharides. Polysaccharides. Starch. Cellulose. Synthetic cellulose derivatives.
4	Proteins. - Amino acids. acidic and -basic properties of amino acids. Polypeptides and proteins. Animal fibers.
4	Techniques for separation and chromatography.
6	Spectrometry and spectroscopy. - Introduction to spectrometry. Mass spectrometry. Spectroscopy of nuclear magnetic resonance. Infrared and Raman spectroscopy. Ultraviolet spectroscopy..
Hrs	Practice
18	Classroom exercises
2	Classroom exercises of spectroscopy