UNIVERSITÀ DEGLI STUDI DI PALERMO

SCHOOL	POLYTECHNIC SCHOOL
ACADEMIC YEAR	2016/2017
FIRST CYCLE COURSE	BIOMEDICAL ENGINEERING
SUBJECT	CHEMISTRY OF BIOLOGICAL MOLECULES
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	10657-Attività formative affini o integrative
CODE	18396
SCIENTIFIC SECTOR(S)	CHIM/06
HEAD PROFESSOR(S)	GIACALONE FRANCESCO Ricercatore Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
YEAR	3
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**GIACALONE FRANCESCO** Wednesday 9:30 11:00 Studio Dr. Giacalone - Dip. STEBICEF, sez. Chimica

DOCENTE: Prof. FRANCESCO GIACALONE

TEACHING METHODS	Frontal lessons
ASSESSMENT METHODS	Written Exam. The written examination, which tends to verify the skills and the knowledge relating to the disciplinary scope of the course, will be composed of ten questions with open answers that meet constraints that make them comparable with the predetermined correction criteria. The total score of the written tests will be out of thirty and will result from the sum of the scores given to each question depending on its complete resolution, partial or not. The expected duration of the written examination is two hours.
LEARNING OUTCOMES	Knowledge and understanding - The student at the end of the course, will acquire the basic knowledge about the nomenclature and how to depict organic molecules as well as their most representative reactions and stereochemistry. Moreover, the student will learn about structure and properties of carbohydrates, aminoacids and proteins, lipids, nucleotides, nucleosides and nucleic acids, enzyme, coenzymes and vitamins. Finally, the student will acquire concepts of supramolecular chemistry and molecular recognition, as well as notions on smart materials and nanotechnology. Applying knowledge and understanding - Capacity in rationalizing properties and reactivity of several functional groups and to be able to recognize them in biological molecules. - Ability to comprehend the chemical recognition process and to apply it to biological molecules. Making judgements - The student will gain autonomy in the application of the basic concepts of Chemistry of biologic molecules and in the resolution of problems regarding simple structure-properties relationships of molecules and biomolecules. Communication skills - The student will be able to communicate with competence and properties of language about the fundamental concepts of the chemistry of biologic molecules and in the resolution of problems concerning simple structure-properties relationships of molecules and biomolecules. Learning skills - The student will be able to deal independently the study of problems concerning all aspects presented during the course
EDUCATIONAL OBJECTIVES	At the end of the course the student will be able to understand how the knowledge of some basic concepts of Chemistry of Biologic molecules is the basis of biochemical processes and technologies devoted to the formation of biopolymers and, subsequently, how they can be used in the development of their profession. An important example concerns the graduated in biomedical engineering for which the basic concepts of Chemistry of biologic molecules are fundamental for the study, development and manufacturing of biomaterials.
PREREQUISITES	Knowledge of Chemistry
SUGGESTED BIBLIOGRAPHY	- W. H. Brown, T. Poon, "Introduzione alla Chimica Organica" (V ed), Edises, 2015 - P. Yurkanis Bruice, "Elementi di Chimica Organica" (I ed), Edises, 2007 - W. H. Brown, B. L. Iverson, E. V. Anslyn, C. S. Foote, "Chimica Organica" (V ed), Edises, 2014 - J. W. Steed, J. L. Atwood, "Supramolecular Chemistry" (II ed), Wiley, 2009 - Appunti e dispense di lezione forniti dal docente

SYLLABUS

Hrs	Frontal teaching
4	Atomic and molecular structure, atomic orbitals, chemical bond and molecular orbitals, hybridization and resonance. Intermolecular forces. General theory of acids and bases. Kinetics and thermodynamics of chemical reactions. Concept of reaction mechanism.
4	Alkanes: Nomenclature, structural and conformational isomerism. Cycloalkanes and their stereoisomerism
4	Stereochemistry: enantiomerism and diastereoisomerism, chiral molecules and absolute configuration, optical activity, Racemes, molecules with more than one chiral center. Chiral resolution. Chirality in biochemistry
3	Alkenes and alkynes: geometric isomerism, E/Z nomenclature, General reactivity. Electrophilic addition, oxidation and reduction reactions. Polymerization. Acidity of alkynes
2	Alkyl halides: Nucleophilic subtitution and elimination reactions
3	Alcohols: physical properties, amphoterism and nucleophilic reactivity, inorganic esters, dehydration, oxidation. Diols and polyols. Ethers and epoxides.
2	Aliphatic amines: basicity and nucleophilic reactivity

SYLLABUS

Hrs	Frontal teaching
4	Aldehydes and ketones: Nucleophilic addition reactions, hemiacetals, acetals, imines, enamines. Oxidation and reduction, acidity of hydrogen atoms in alpha-position, keto-enol tautomerism
3	Carboxylic acids and their derivatives: acidity and factors affecting it, Fischer esterification, Nucleophilic acylic substitution, Acyl chlorides, anhydrides, esters, amides, esterification and hydrolysis
2	Lipids: generalities, saturated and insaturated fat acids, triglycerides and phospholipids. Structure of steroids
4	Carbohydrates. Monosaccharides: steric series, cyclic structures, reduction, oxidation, glycosides, mutarotation. Disaccharides: maltose, cellobiose, lactose, sucrose. Polysaccharides: amylose, amylopectine, cellulose, glycogen. Aminosugars and desoxysugars
4	Aminoacids: structure and configuration; acid-base equilibria and isoelectric point, peptide bond, synthesis and analysis of peptides. Primary structure of peptides and its determination. Secondary, tertiary and quaternary structure of proteins and factors stabilizing them
2	Nucleosides, nucleotides and nucleic acids
2	Enzymes, coenzymes and vitamines
6	Supramolecular chemistry concepts: definitions, classification of receptors, hosts, guests, coordination. Lock-key analogy. Supramolecular chemistry in biological systems: alkali cations in biochemistry, membrane transport. Self-assembly: concepts and classification, self-assembly in proteins and other biochemical systems
5	Nanomaterials: self-healing polymers, carbon nanoforms and their biomedical applications, metal nanoparticles and their biomedical applications