DIPARTIMENTO DI SCIENZE

COURSE: **Organic Chemistry**			
ACADEMIC YEAR: **2019-2020**			
TYPE OF EDUCATIONAL ACTIVITY: **Characterizing**			
TEACHER: **Prof. Daniele CASARINI**			
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Language: **ITALIAN**			
ECTS: **10** (**8** of lessons and **2** of tutorials)	n. of hours: **88** (**64** lessons and **24** tutorials)	Campus: **Potenza** Dept./School: **Department of Science**	Semester: 1° from 02/10/2019 to 15-31/01/2020

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course represents the first teaching of Organic Chemistry and aims to provide students with the necessary basics of Organic and Bioorganic Chemistry in order to follow other related teachings of the same CDL, i.e. Biochemistry.

Knowledge and understanding : the student must know :

– the language of organic chemistry through symbols, structural formulas and equations
– the correct way to write structures of molecules according to the IUPAC and common nomenclature
– the basic concepts of isomerism, conformational analysis and stereoisomerism
– the structure and reactivity of the most important functional groups present in organic molecules
– understanding the mechanism and the stereochemical features involved in the substitution, addition and elimination reactions in aliphatic and aromatic substrates. For this purpose common reactions in bioorganic chemistry are often shown during the lessons.

Ability to apply knowledge and understanding: the student must be able to understand and apply:

– the name assignment to organic molecules, which may meet in other chemical or related disciplines, by the traditional or IUPAC nomenclature
– how represent the 3D structure of a molecule, recognize the possible stereoisomers and assign the R/S configuration and E/Z geometry
– how to analyze simple multistep synthesis of molecules with assigned structure, or the most common transformations that occur in bioorganic or biochemical processes

Making judgments: the student must be able to:

– analyze and design simple syntheses of functionalized organic compounds
– use the acquired bases to understand or deepen organic and bioorganic chemistry topics encountered in similar or application fields.

Communication skills: the student must be able to communicate and produce short written reports with a correct and appropriate scientific language

Learning skills: the acquired bases allow the student to be able to follow courses or seminars on more specific topics of organic chemistry or bio-organic, and to be able to update or deepen using bibliographic resources of moderately advanced or intermediate level.

PRE-REQUIREMENTS

It is required to have clear and know how to apply some basic knowledge of the General and Inorganic Chemistry course, such as:

– the electronic configuration of the atoms of the first line of the periodic system
– the concepts of electronegativity and ionization potential
– the concept of chemical bond formation, molecular orbital and the octet rule
– the concept of the equilibrium constant, acidity constant (pKa) and pH
– the concept of acid-base pair according to Lowry and Bröensted and according to Lewis

SYLLABUS

References to the theory of atomic and molecular orbitals. Hybridizations of carbon and other elements of the first line. Electronegativity, interactions between molecules. Structure and reactivity of the main functional groups. Thermodynamic and kinetic fetures in organic reactions. Transition state, reaction intermediate and activation energy, Hammond postulate and Curtin-Hammett principle (**total 6 hours**).
Alkanes, nomenclature, properties, isomers of structure and conformational analysis of linear, branched and cyclic alkanes. Halogenalkanes and mechanism of radical halogenation: bromination and chlorination in linear and branched substrates. (**total hours 6**)
Nucleophilic substitutions S_N1 and S_N2, enantiomers, diastereoisomers and Chirality assignment with the CIP rules. Projections of Fischer and Haworth. Stereochemistry of molecules with two or more chiral centers, meso forms. Mechanisms and regio and stereochemical requisites of the reactions E1, E2 and E1cb. Alkenes, properties, structure, geometric isomerism, nomenclature E, Z. (**total hours 8**)
Electrophile addition to the π bond in alkenes, dienes and alkynes; mechanisms, stability of carbocations and Markovnikov 's rule. Preparation and most common reactions of alkenes and alkynes. (**total hours 4**)
Nomenclature, properties, structure and main synthesis of alcohols, ethers, sulfides, epoxides and aliphatic amines. Amino acids and acid-base characteristics, pKa and isoelectric point (**total hours 5**).
Structure and reactivity of carbonyl, nomenclature and properties of aldehydes and ketones. Nucleophilic addition to carbonyl, formation of imines and enamines. (**total hours 5**)
Mechanism of nucleophilic acyl substitution. Carboxylic acids, inductive and conjugative effect on pKa. Preparation and reactions of acyl halides, anhydrides, acids, esters (Fischer) and amides. (**total hours 8**)
Enols and enolates of acyl derivatives, α-halogenation, haloform reaction (**total hours 4**)
Aldolic reaction of aldehydes and ketones and their auto or cross condensation and their use in synthesis. Addition of α,β-unsaturated carbonyl enolates. Malonic and acetacetic synthesis (**total 6 hours**)
Aromatics requirements, nomenclature and properties of aromatic compounds. Electrophilic and nucleophilic substitution reactions and most common synthesis. Effect of substituents on reactivity and their orientation in the poly-substitution. (**total hours 8**)
Aromatic amines, formation of diazonium salts and Sandmayer reaction. Synthesis strategy of multi-functional derivatives. Nitrogenous aromatic heterocycles with five and six characteristic terms and signs of their reactivity. Introduction to keto-enol tautomerism in purine bases and their importance in natural compounds and in the biochemistry (**total hours 4**)
The tutorial part (2CFU) is spread along the course and is completely dedicated to the resolution of exercises in the classroom with the purpose of pushing the students to apply the theoretical concepts seen in the lessons to simple modifications of organic molecules. (**total 24 hours**)

TEACHING METHODS

The course is organized as follows:
- classroom lectures (64 hours) carried out with the classic use of the blackboard and slides showing the educational material included in the textbooks available in the library.
- the lectures are corroborated by 24 hours of summary exercises that students are invited to play at home and then are solved in the classroom by the teacher. This aims to push the students to work independently and bring out doubts and difficulties encountered in the resolution of the exercises

EVALUATION METHODS

the learning assessment for 2nd year students consists of three partial written tests. For those who do not take all the tests, there is an oral exam on the subjects of the missing part. Alternatively it is possible to take a final written test plus a short oral exam on the whole program.
The partial tests consist of a series of 12 exercises with multiple choice or gap-filling answers to be carried out in 2 hours, while the oral part consists in a 15-20 minutes discussion on the exercises of the task. Each written test is considered passed if the student gets at least 40% of the total score. Both written and oral parts contribute to the final mark which is kept up to the following A.A.
For students in trial debt or who prefer a single trial on the whole program, the written test consists of 12 exercises with multiple choice or gap-filling answers to be carried out in 2 hours. The task is considered

sufficient if at least 50% of the available score is acquired. The exam is completed by an interview with questions on the exercises of the task.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

B. Botta, Chimica Organica, Ed. Edi-ermes

J. Mc Murray, Chimica Organica, Ed. Piccin

T. W. G. Solomons, *Chimica Organica*, Ed. Zanichelli

J. C.Smith, C*himica Organica*, Ed. Mc Graw Hill

C. Vollhardt, Chimica Organica, Ed. Zanichelli

P. J. Bruice "Chimica Organica, Ed. Edises

J. Clayden "Organic Chemistry, Ed. Oxford University Press

NB. the teacher considers useless to put on-line further additional material that is already present all the common reference textbooks available also in the library. Moreover, almost all the publishers put on-line with free access, after registration in the site, lots of additional material for the students.

INTERACTION WITH STUDENTS

At the beginning of the course, after having described the educational goals, the expected learning outcomes, the program and the verification methods; the teacher indicates to the students the textbooks available in the library. After that the teacher collects a list (name, surname and email) of the students who wish to attend the course and reminds them that the frequency, even if not mandatory, is strongly recommended.

The students, who are often commuters or non-residents in Potenza, at the weekly reception prefer an immediate contact with the teacher at the end of the lesson or a reception by appointment. Communication by e-mail is even very efficient as it can be done freely, quickly and easily every day at any time. Telephone contact with the teacher has been rare and had occurred for urgent reasons.

EXAMINATION SESSIONS (FORECAST)[1]

They are set approximately to the half of the following months: January (1), February (1), June (2), July (1), September (1), October (1), for a total of 7 calls per year.
In order to facilitate attendance of the students during the 1° and 2° semesters, in the 2019-20 academic year there are no exams during the periods: 15 October-15 December 2019 and 15 March-25 May 2020, with the exception of out-of-school students.

SEMINARS BY EXTERNAL EXPERTS YES X NO

FURTHER INFORMATION

[1]Subject to possible changes: check the web site of the Teacher or the Department/School for updates.