DIPARTIMENTO DI SCIENZE

COURSE: **Organic Chemistry**			
ACADEMIC YEAR: **2018-2019**			
TYPE OF EDUCATIONAL ACTIVITY: **Characterizing**			
TEACHER: **Prof. Daniele CASARINI**			
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Language: **ITALIAN**			
ECTS: **10** (lessons and tutorials/practice)	n. of hours: **88** (64 lessons and 24 tutorials/practice)	Campus: **Potenza** Dept./School: **Department of Science**	Semester: 1° from 02/10/2017 to 15-31/01/2018)

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. For this purpose, together with the common organic reactions, examples of reactions of bioorganic chemistry are often shown.

Knowledge and understanding: the student must be able to:

– know the language of organic chemistry through symbols, structural formulas and equations
– know the correct way to write structures of molecules according to the IUPAC and common nomenclature
– know the basic concepts of isomerism, conformational analysis and stereoisomerism
– know adequately 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

Ability to apply knowledge and understanding: the student must be able to apply the basic knowledge acquired for:

– assign the name to organic molecules using the IUPAC or traditional nomenclature, which may meet in other chemical or related disciplines
– represent the 3D structure of a molecule, recognize the possible stereoisomers and assign the R/S configuration and E/Z geometry
– know 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 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 acid-base pair according to Lowry and Bröensted and according to Lewis
– the concept of the equilibrium constant, acidity constant and pH

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**)
In the exercises and laboratory part (2CFU = 24 hours), 8 hours are dedicated to the performance of exercises in the classroom and 4 hours to safety, behavior in the laboratory and the explanation of the experiences to be carried out. 12 hours are dedicated to the laboratory practice where students make simple synthesis followed by the related work-up operations with the purpose of applying the theoretical concepts seen in the frontal lessons. (**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 supported by 8 hours of summary exercises (material distributed by the teacher) that students are invited to play at home and then they are corrected in the classroom. The correction aims to bring out the doubts and difficulties encountered in the resolution of the exercises

EVALUATION METHODS

the learning control for 2nd year students consists of two mid-term (optional) written tests and a further task at the end of the course. For those who do not attend the two mid-term tests there is a final written task followed by an interview in which is evaluated also the ability to link topics of organic chemistry.
–the written tasks consist of 12 exercises with multiple choice or gap-filling answers to be completed in 2 hours, while the interview consists in a critical discussion (15-20 minutes) of the task exercises. The written test is passed if the student acquires at least 50% of the total score available. Evaluations of the written, oral, and laboratory part contribute to the final mark.

– for students in trial debt or who prefer a single trial on the whole program, the written test consists of a task, max. 15 exercises, with multiple choice answers or gap-filling to be completed in 2 hours. The task is sufficient if at least 60% of the available score is acquired. The exam is completed by an interview of 15-20 minutes concerning a critical discussion of 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 a virtual campus with lots of additional material with free access for the students after registration in the site.

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, prefer to receive an appointment by appointment or e-mail communication that is very efficient as it can take place freely every day at any time in a simple and rapid manner.
Telephone contact almost never happens.

EXAMINATION SESSIONS (FORECAST)[1]

They are set to approximately 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 2018-19 academic year there are no exams during the periods: 15 October-15 December and 15 March-25 May, 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.