UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Advanced Organic Chemistry

2122-1-F5401Q019

Aims

The course aims to provide advanced knowledge on the structure and reactivity of organic molecules. The main reaction mechanisms of organic molecules will be explored with particular attention to the stereochemical outcome.

Contents

Advanced course on structure and reactivity of organic molecules, with particular attention to the reaction mechanisms and the stereochemistry.

The lab module is addressed to provide the student with the safety and behavior aspects for conducting correctly an organic chemistry experiment. The experiments carried out in the laboratory are intended to exploit the basic technical operations in organic chemistry to synthesise some organic compounds using multi-step synthetic protocols

Detailed program

- Review of the electronic structure of molecules

- Valence bond theory
- Hybridization
- Electronegativity
- Hard and Soft theory
- Polarizability
- Resonance and Conjugation, references
- Hyperconjugation
- Molecular orbitals theory, HOMO and LUMO
- Perturbation of molecular orbitals
- Stereochemistry, references of stereogenic centers and axes
- Optical rotary power
- Circular dichroism
- Determination of the absolute configuration
- Syn, Anti. Threo, Eritro
- Prochirality
- Dynamic stereochemistry
- Resolution of enantiomers
- Enantioselection and diastereoselection
- Conformations and their energies
- Stereospecific reactions: SN2, syn and anti
- Stereoselective reactions. Catalytic hydrogenation. Chiral catalysts
- Stereoselective reactions.
- Nucleophilic additions, Chan and Felkin-Ahn model
- Enantioselective hydroborations
- Enantioselective epoxidations and di-hydroxylations, Sharpless
- Double stereodifferentiation
- Resolution and dissymmetrization by use of enzymes
- Lipase and Esterase
- Protease
- Epoxide hydrolase
- Anomeric effect
- Effect of polar substituents in the reduction of cyclic carbonyl compounds
- Structural effects on stability and reactivity
- Nucleophilic substitution, mechanisms
- Structural and solvation effects
- Participation of neighborhood groups
- Carbocation, structure and reactions
- Additions to alkenes
- Addition of halogenic acids
- Halogen addition
- Selenazione
- Epoxidation
- Epoxy reactions
- Additions to alkenes involving transition metal salts
- Mercuriazione
- Argentazione
- hydroboration
- Borane reactions
- Additions to alkynes and trains
- Elimination reactions
- Carboanions and other carbon nucleophiles
- Carbonyl group reactivity, additions, substitutions
- Condensation reactions
- Concerted pericyclic reactions. Diels Alder, 1,3-dipolar Cycloadditions, Cicloadditions [2 + 2], sigmatropic rearrangements.

- Radical reactions

In the laboratory will be presented the safety rules and behavior to be followed in an organic chemistry laboratory, the main techniques of analysis and purification of organic substances (crystallization, distillation, chromatographic techniques, selective extraction with solvents) and how to handle organic chemistry reactions for the synthesis of molecules obtained as a result of multistep synthesis.

Prerequisites

Knowledge of basic Organic Chemistry

Teaching form

face-to-face lessons and laboratory

Textbook and teaching resource

Carey, Advanced Organic Chemistry, Vol. A

Semester

October 4, 2021 - January 28, 2022

Assessment method

Oral examination.

For the laboratory part, the activity carried out will be evaluated as well as the compilation of the laboratory notebook. Furthermore, two tests relating to the skills acquired to be done during the course on the e-learning platform will complete the evaluation of the laboratory course.

Office hours

Thursday 12.30