Chim/06 Organic Chemistry 2nd course

Academic year: 2016/2017
Faculty: Dipartimento di Chimica
Study courses: Chemistry (first level)
Study plans/Curricula:
Type:
Total Credits: 6
Didactic Methods: lessons
Didactic Period: second year, second semester
Exam type: oral
Professor in charge: Francesco Babudri

Training objectives
Knowledge of organic reactions for building-up carbon carbon bond. Basic knowledge on biomolecules chemistry and of industrial organic chemistry.
Prerequisites
Basic concepts of organic chemistry (nomenclature of organic compounds, stereochemistry) and knowledge on the reactivity of main functional groups.
Didactic Methods
lectures
Course programme

C-C bond formation:
Enols and enolates. Alpha-halogenation to carbonyl group. Enolate equivalents. Alkylation of enolate equivalents and beta-dicarbonyl compounds.
Aldol condensation and analogous reactions. Acylation of enolates. Additions of enolates to alpha-beta unsaturated carbonyls.

C=C bond formation
Carbonyl olefination: Wittig, Horner-Wittig and Horner-Wadsworth-Emmons reactions. Peterson elimination. Julia olefination. Mc Murry reaction. Olefin metathesis.

Cycloaddition reactions
Diels-Alder reaction and synthesis of cyclohexane derivatives. Stereo- and regiochemical aspects.

Elemento-organic compounds
Sulfur, Silicon and boron derivatives in organic synthesis.

Organometallic compounds:

Tin, zinc and copper organometallics in organic synthesis. Transition metal catalyzed cross-coupling reactions (Kumada, Negishi, Stille, Suzuki coupling reactions). Coupling of terminal alkynes (Sonogashira coupling).

Heterocyclic compounds

Saturated 5 and 6 terms heterocyclic compounds. Synthesis and reactivity of main 5 and 6 terms aromatic heterocyclic compounds.

Oxidation reactions:

Main oxidation methodologies in organic synthesis. Oxidation of aromatic compounds. Metal based oxidation reactions. Metal free selective oxidants (Swern oxidation, periodinanes, TEMPO)

Reduction reactions:

Heterogeneous and homogeneous hydrogenations. Reduction with metal hydrides

Carbohydrates

Monosaccharides

Structure of monosaccharides. Cyclic structures; anomers. Reactions of monosaccharides:

chain elongation and degradation; epimerization; reactions of hydroxy groups (formation of esters, ethers, acetals and ketals, selective protection and deprotection of hydroxyl groups). Glycosidation reactions (Fisher, Helferich, Koenigs-Knorr). Oxidation and reduction of monosaccharides.

Oligosaccharides and polysaccharides

Main oligosaccharides (sucrose, galactose, cellobiose and maltose). Outline of main polysaccharides (amylose, amilopectin, cellulose and its semisynthetic derivatives).

Aminoacids and oligopeptides

Structure of alpha-aminoacids; zwitterions and acid-base properties of aminoacids. Synthesis of aminoacids.

Oligopeptides: structure and analysis. Edman sequential analysis of oligopeptides. Peptide synthesis: selective protection-deprotection of amino and carboxylic groups. Activation of carboxylic group and peptide bond formation. Peptide synthesis on solid phase. Outline on proteins structure.

Other natural products

Outline on other principal natural products: nucleosides and nucleotides, terpenes, steroids, saturated and unsaturated fatty acids and fats, alkaloids.

Outline of industrial organic chemistry:

Fundamental processes of industrial organic chemistry and related products: polymers, dyes, pesticides

Reference Texts

Clayden, Greeves, Warren Organic Chemistry 2nd edition, Oxford.

Lesson notes and lesson slides (for some arguments)