UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Organic Chemistry

2122-1-E3002Q027-E3002Q031M

Aims

The Chemistry course (E3002Q027, 12 ECTs) is splitted in two modules: INORGANIC CHEMISTRY (E3002Q030M, 6 ECTS, first semesters) and ORGANIC CHEMISTRY (E3002Q031M, 6 ECTS, second semester). The course aims at providing a wide basic knowledge on both main areas of chemistry. This is relevant both to the general scientific culture and to the comprehension of the structure/properties relationship in all the main classes of materials for Optics: glasses and solutions for contact lenses (illustrated in the Inorganic chemistry module) and plastic materials for contact lenses (organic chemistry module).

There will be a separated exam for each module, in written form for Inorganic Chemistry and oral form for Organic Chemistry. The final mark is recorded as an average of the written and oral essays, once both exams have been passed.

Incoming Erasmus students have also the possibility to include only one module in their plan.

Organic Chemistry Module

The Organic Chemistry Module is divided in two topics. In the first, the basic concepts of organic chemistry together with basic concepts on the nature and reactivity of the mean functional groups will be provided to the student. In the second, the organic materials for optical devises (glasses and contact lenses) together with their properties and synthetic strategies will be analysed.

O1 – knowledge and understanding

To the student, it is requested to show an adequate comprehension and skills of organic chemistry:

1) To recognize the nature of bonds in organic molecules and the organic functional groups.

2) To recognize the possible interactions between molecules based on the nature of functional groups (physical state and solubility in water).

3) To apply nomenclature rules to simple organic molecules and related to the type of functional groups present in the organic molecules

4) To individuate the potential electrophilic or nucleophilic reactive sites in an organic molecule and to analyze the reactivity of a functional group.

5) The knowledge of the principal organic materials with application in the ophthalmic field and the understanding of principal protocols for their preparation.

O2 – Applying knowledge and understanding

The student, during the assessment method, has to demonstrate an adequate capability of applying the knowledge and understanding of the provided concepts:

1) To recognize the structural and electronic parameters at the base of non-linear properties in general and specifically in organic push-pull systems.

2) To individuate the principal functional groups, to recognize their principal reactivity and show a sufficient skills with the rules of nomenclature of organic molecules

3) To recognize the nature of organic materials used in ophthalmic and contact lenses.

4) To recognize the processes used in the preparation of polymeric materials their classification and use in the ophthalmic field..

O3 – Making judgements

To be able in individuating the principal functional groups, to define their reactivity. To recognize the principal polymeric materials used in the ophthalmic field.

O4 –Communication skills

To be able in illustrating and identifying the peculiar reactivity characteristic of functional groups and those of principal plastic materials used in the ophthalmic field.

O5 –Learning skills

To be able in applying the acquired knowledge to the comprehension of behaviour of simple organic molecules and to be able in understanding the evolution of the materials used in the ophthalmic field.

Contents

The basic concepts of organic chemistry will be provided to the student together with basic concepts on the nature and reactivity of the mean functional groups. Basic aspects on the materials used in the preparation of optical and ophthalmic devices. These latter aspects are of primary importance to understanding to properties of ophthalmic devices and, hence, from professional point of view.

Detailed program

General aspects and introduction to Organic Chemistry.

Nature and type of the chemical bond: hybridization, molecular orbitals, electronic delocalisation and aromaticity concept, structure and molecular formula, molecule representations. Isomery: structural, configurational, conformational and stereoisomery, concept of stereogenic element. Chirality: optical purity and activity, diastereo and enanthiomorphism; Cahn-Ingold-Prelog rules, descriptors used for discriminating stereoisomers. Functional groups: concept and type of reactivity (electrophile, nucleophile and radical concept); classification of the organic compounds. Nomenclature, physic, chemical, and reactivity properties of principal organic compounds and their preparation:

aliphatic, unsaturated and aromatic hydrocarbons; halogen derivatives, alcohols and polyols (sugars), ethers, amines, aldehydes, ketons, carboxylic acids and their derivatives (esters, amides nitriles). Mention on cyclic amino acids, proteins and chemistry of the vision processes. Mention on chemistry of the vision.

Introduction to polymerisation. Synthesis and characteristics of common hard resins: CR39, polycarbonate, PMMA, polyurethanes, hydrogels. Contact lens (CL) production. Classification, nomenclature, and composition of materials used in contact lens industry. Chemical and physical properties of contact lenses: transparency, refractive index, stability, glass transition, hydration, wettability, oxygen permeability.

Prerequisites

To attend the inorganic chemistry module is required for an adequate comprehension of the concept proposed in the course.

Teaching form

Lectures with the use of slides and adding examples and explanation at the blackboard

Textbook and teaching resource

The lecturer suggest the students to have a reference textbook on organic chemistry. A textbook suggested is “Introduzione alla Chimica Organica”, Brown, Edises.

Notes provided by the lecturer

Semester

The organic chemistry module is provided during the second semester.

Assessment method

Oral assessment is used to verify the level of mastery reached by the student. This will be done by asking questions to the students inherently the topics taught during lectures. First questions will ask on the second part of the course and a sufficient mastery of this part is compulsory to conclude the assessment with question on the first part. The exam is passed with a minimum mark of 18/30. On request, the assessment can be hold in English.

Office hours

Prof. Papagni receives students Friday from 14.30 to 16.30. Students must fix an appointment in advance