COURSE DATA

Data Subject	
Code	34290
Name	Optical materials
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Faculty of Physics	1	Second term

Subject-matter

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	6 - Chemistry	Basic Training

Coordination

Name	Department
MELLO CENTONZE, ROSSELLA CECILIA	325 - Organic Chemistry

SUMMARY

Optical Materials The course is a basic training course mandatory quarterly taught in the first degree course in Optometry. The curriculum consists of a total of 6 ECTS. This course is intended for students to delve into those skills acquired in Chemistry Baccalaureate courses and, in some respects, to complete. Such knowledge and skills essential to lay the foundation for the student to subsequently address the study of the various branches of the field of materials and especially the organic optical materials that are based on polymeric materials. Being integrated in the course of Optometry degree approach to study chemical concepts, should be geared specifically toward organic optical materials. The course has a theoretical character. The basic lines contained in the program of the course is organized around the fundamental concepts in organic chemistry. In particular it is intended that the student is familiar with the concepts of structure, bond, nomenclature and isomerism and intermolecular forces. Who knows the principles governing the kinetic and thermodynamic aspects of chemical transformation, to understand the effects that influence the stability of organic reactional intermediate draw energy profiles of these reactions, delving into those involved in polymerization processes. You know those aspects of the structure, link, basic properties and reactivity of organic molecules of particular relevance to the manufacture of organic optical materials with polymeric structures and their use as ophthalmic materials.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is assumed that students know and use, basic but clear manner, the concepts taught in the final year of high school chemistry, especially:
Chemical Nomenclature and Formulation of organic compounds.
Adjustment of chemical reactions.
Identification of acid-base character of organic compounds.
However, teaching materials will be provided to cover those deficiencies are detected.

OUTCOMES

1207 - Degree in Optics and Optometry

- Knowing how to apply the knowledge acquired to professional activity, knowing how to solve problems and develop and defend arguments.
- Being able to transmit information, ideas, problems and solutions to both a specialized and non-specialized audience.
- Development of learning skills necessary to undertake further studies with a high degree of autonomy.
- To know the structure of matter, the chemical processes of dissolution and the structure, properties and reactivity of organic compounds.
- To know the physical and chemical properties of the materials used in optics and optometry.

LEARNING OUTCOMES

Describe basic aspects associated with the formation of covalent (single or multiple) in molecular organic.
Draw Lewis structures of neutral and charged organic species, asking whether or not satisfy the octet rule, identifying possible structures resonance forms and saying, if there are several possible structures, which is the most stable through the application of the rules of prioritizing nonequivalent resonant structures.
Predict the molecular geometry.
Describe the basic elements of the model of localized covalent bond and the concept of hybrid orbital.
Identify the type of hybridization in organic molecules and the type of bond they have.
Justify and predict the polarity and the dipole moment of diatomic and polyatomic organic molecules.
Obtain basic stereochemistry and distinguish between constitutional and configurational isomers (geometric and optical isomerism)
Identify the different functional groups in organic molecules.
Derive some properties of organic molecules based on the structure of the functional group containing

structure within the relationship ----- properties.
Identify various existing intermolecular forces (Van der Waals forces and hydrogen bonding)
Explain, from them, properties or phenomena of interest (states of aggregation, melting and boiling points, solubilities, etc. ...
Saber Name and formulate organic compounds: hydrocarbons (alkanes, alkenes, alkynes and aromatic), halogenated, oxygenates (alcohols, ethers, aldehydes, ketones, acids and esters) nitrogen (amines, amides and nitriles)
Appoint polyfunctional organic molecules.
Distinguishing between types of organic reactions from the mechanistic standpoint.
Addition reactions distinguish substitution, deletion and rearrangement.
Predict an oxidation-reduction (redox)
Acquire basic knowledge of thermodynamics and kinetics of organic reactions, and the representation of the energy profile of an organic process of one step or two steps.
Knowing the stability of the reaction intermediates (carbocations, carbanions and free radicals) and the effects that influence its stability.
Predicting the acid-base behavior of the organic molecules.
Understanding the concepts nucleophile-electrophile and its application to the reactivity in organic chemistry.
Enter the basic concepts and classification of polymers and their properties.
Distinguishing polymer structures and the relationship between structure and properties of the polymers.
Define the crystallinity of the polymers. Differentiate between the melting point (Tm) and glass transition phenomenon (Tg).

Defining the thermoplastic and thermoset polymers.
Enter different polymerization processes and mechanisms. (Addition cationic, anionic, free radical, condensation etc. ....
Knowing the materials of spectacle lenses and contact lenses: made of inorganic glass and organic materials
Acquire knowledge about the lens manufacturing process in series and organic materials for rigid contact lenses, and soft silicone.
Acquire knowledge about the properties and characteristics of the polymeric materials used for the manufacture of plastic frames.
Identify the metal frames and surface treatments.
In short: To acquire basic knowledge about the nature of organic and polymeric materials with special focus on materials with optical properties that manage and use the student in his professional life, as well as familiarize with the main methods of fabrication and characterization of these materials .

DESCRIPTION OF CONTENTS

1. STRUCTURE AND BONDS IN ORGANIC MOLECULES

Introduction. The chemical bond: Ionic bond and covalent bond. Lewis structures. Polar covalent bonds. Resonant forms. Molecular orbital theory. Hybridization of the orbitals. Representation of organic compounds. Functional groups. Classification of organic compounds. Intermolecular forces.

2. HYDRACARBONS

Alkanes. Structural isomerism and stereoisomerism. Alkenes. Alkynes. Aromatic hydrocarbons. Nomenclature and structure-physical-chemical properties relationship.

3. Oxygen-containing functional groups AND SULFUR.

Alcohols, Phenols and Thiols, Ethers and Sulfides. Aldehydes and Ketones. Carboxylic acids and derivatives. Nomenclature and structure-physical-chemical properties relationship.

4. Nitrogen-containing functional groups

Amines and nitriles. Nomenclature and structure-physical-chemical properties relationship.

5. INTRODUCTION TO organic reactions

Classification of organic reactions. Reaction mechanisms. Thermodynamics and kinetics of reactions. Reaction intermediates: carbocations, free radicals and carbanions. Nucleophilic and electrophilic reagents

6. POLYMERIZATION REACTIONS

Types of polymerization reactions. Radical, anionic and cationic type chain growth polymerization. Copolymerization. Coordination polymerization. Vinyl and diene addition polymers of industrial interest. Staged growth polymerization. Condensation polymers of industrial interest.

7. PROPERTIES AND USES OF ORGANIC POLYMERS

Relationship between structure and properties of polymers. Factors influencing properties
of polymers. Size and molar mass. Crystallinity of polymers. Melting and glass transition.
Classification of polymers according to their technological applications conditioned by their structure.
Optical properties of polymeric materials. Polymer additives.

8. MATERIALS FOR OPHTHALMIC OPTICS

Materials for ophthalmic lenses. Physico-chemical and optical properties. Glass. Plastic organic materials. Superficial treatments of ophthalmic lenses. Manufacturing process for mineral and organic lenses. Plastic materials for rigid, soft and silicone hydrogel contact lenses. Physico-chemical and optical properties. Contact lens manufacturing process. Polymeric materials for plastic frames. Materials for metal frames.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	50,00	100
Tutorials	10,00	100
Development of group work	10,00	0
Study and independent work	20,00	0
Readings supplementary material	10,00	0
Preparing lectures	30,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Clasroom activities
Theoretical and practical classes: classes modality (can be blended or modalities also include non-contact) which impart the theoretical content of the material. It will reinforce the use of audiovisual methodology, which more clearly exemplify the theoretical and examples to develop. Exercises will develop practical application of theoretical content.

Small Group Theory sessions: sessions are devoted to student group work, with suggested exercises to be analyzed and studied by the group. Interactivity will be sought through group presentations and classroom examples and accounted for continuous assessment.

Student Work
- Study of theoretical
- Development of work and issues raised in class
- Individual tutorials

EVALUATION

The continuous evaluation of student will be based mainly on the results of the follow-up controls, on active participation during the development of the problem classes and on the result of the final theoretical exam.
The final grade will be obtained by adding:

1) 35% of the grade corresponding to the student's continuous evaluation as a result of follow-up controls carried out throughout the semester, participation and resolution of the problems raised in the tutoring classes;

2) 65% of the mark corresponding to the final written exam. A minimum of 5/10 must be obtained so that the percentage referred to in point 1 can be added.

Those students who do not pass the grade of five out of ten (5/10) in the written exam of the 1st call will have a 2nd call within the same academic year, in which the grade assigned to section 1 will be kept). Students who do not appear for the theoretical exam of the 1st call, but have completed the rest of the follow-up activities, will be classified as "Not Presented" in the Minutes of the 1st call and "Failed" in the 2nd.

REFERENCES

Basic

- Principios de Química, P. ATKINS; L. JONES, PANAMERICANA, 2012
- Química General, R. H. PETRUCCI , PEARSON, 2013.
- Química Orgánica Básica y Aplicada (Tomos 1 y 2). Eduardo Primo Yúfera, REVERTÉ, 1994-5
- Química Orgánica, F.A. CAREY, MCGRAW HILL, 2006
- Química Orgánica, J. MCMURRY, CENGAGE LEARNING, 2008.
- Polímeros, J. AREIZAGA, SINTESIS, 2002.
- Introducción a la Química de los Polímeros, R.B. SEYMOUR, C.E. CARRAHER, JR. , REVERTÉ, 1995.

Additional

- Materiales Ópticos Orgánicos. Monturas y Lentes, A. NAVARRO SENTANYES, BARCELONA, 2007.
- Materiales Ópticos Inorgánicos. Propiedades de vidrios y metales para óptica, A. NAVARRO SENTANYES, TERRASSA, 2006.
- El vidrio : constitución, fabricación, propiedades, J.M. Fernández Navarro, Madrid: C.S.I.C : Fundación Centro Nacional del Vidrio, Real Fábrica de Cristales de la Granja, 1991.
- Fundamentos de la Ciencia e Ingeniería de los Materiales. W. F.SMITH, J. HASHEMI, MCGRAW HILL, 2006.
- Superficie ocular y Biomateriales: Lentes de Contacto, A. LÓPEZ ALEMANY, ULLEYE, XÁTIVA, 2010.
- Tecnología Óptica, J. S. ARQUÉS, M. FRANSOY BEL, EDICIONS UPC, 2001.
- ChemBioOffice Ultra, PerkinElmer (CambridgeSoft). Amplia selección de aplicaciones y funcionalidades que permite estudiar, dibujar, formular, modelar y editar estructuras moleculares químicas y biológicas.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

TEACHING METHODOLOGY

During the month of February 2021, the teaching of theories and seminars-supervised work, become a synchronous videoconference taught in the schedule set by the subject and the group.

From 1 March, the teaching modality indicated in the Teaching Guide and the teaching modalities approved in the Academic Commissions of Title of the months of July 2020 and November 2020, respectively, will be followed, unless the health authorities and Rectorate indicate a new reduction in attendance, in which case it would return to synchronous video conferencing.