VNIVERSITAT DE VALÈNCIA

Course Guide
34290 Optical materials

COURSE DATA

Data Subject	
Code	34290
Name	Optical materials
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

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
CUÑAT ROMERO, ANA CARMEN	325 - Organic Chemistry
ESCORIHUELA FUENTES, JORGE	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.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

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 (RD 1393/2007) // NO CONTENT (RD 822/2021)

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. GENERAL CONCEPTS. LINK IN ORGANIC MOLECULES

Introduction to Organic Chemistry. The chemical bond: Ionic bond and covalent bond. Lewis structures. Resonance structures and delocalized bonds. Polar covalent bonds, polar molecules. Molecular geometry Valence bond theory. Orbital hybridization: single bonds and multiple bonds. Link angles and distances. Representation of organic compounds. Theory of molecular orbitals.

2. STRUCTURE AND PHYSICAL PROPERTIES OF ORGANIC MOLECULES

Alkanes, saturated hydrocarbons. Alkane nomenclature. Functional groups. Classification of organic compounds. Structural isomery and stereoisomery. Intermolecular forces.

3. INTRODUCTION TO ORGANIC REACTIONS

Reactivity of the alkanes. Classification of organic reactions. Thermodynamics and kinetics of organic reactions. Energy profiles of organic reactions. Reaction mechanisms. Reaction intermediates. Acidity and basicity in organic molecules. Organic compounds with acid character and organic compounds with basic character. Nucleophilic and electrophilic reagents.

4. UNSATURATED HYDROCARBONS

Alkenes. Alkynes. Dienes. Aromatic hydrocarbons. Nomenclature and physico-chemical properties.

5. HETEROATOMIC COMPOUNDS

Halogenated organic compounds. Alcohols, phenols. Ethers. Amines. Sulfur compounds. The carbonyl group, aldehydes and ketones. The Carboxyl group, carboxylic acids and derivatives.

6. POLYMERIZATION REACTIONS

Types of polymerization reactions. Polymerization by growth of chain of radical, anionic and cationic type. Copolymerization. Polymerization by coordination. 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. Influencing factors of the properties of polymers. Molar size and mass. Crystallinity of polymers. Fusion and vitreous transition. Classification of polymers according to their technological applications conditioned by their structure. Optical properties of polymeric materials.

8. MATERIALS FOR OPHTHALMIC OPTICS

Ophthalmic lenses: glass; organic polymeric materials. Physico-chemical and optical properties. Surface treatments of ophthalmic lenses. Materials for rigid, soft and silicone hydrogel contact lenses. Physico-chemical and optical properties. Materials for 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

Modality A

Final Grade: It will consist of two parts:

• Written exam (80%)

• Evaluation of group tutoring sessions and continuous evaluation of each student based on face-to-face activities, participation and degree of involvement in the teaching-learning process (20%). In particular, the following will be evaluated:

• Delivery of problems and exercises solved

• Assistance and reasoned and clear participation in the discussions that arise.

• Problem solving and questioning.

The minimum overall grade to pass the subject is 5.0 in each of the two parts. 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 maintained). Students who do not appear for the theoretical exam of the 1st call, but have carried out the rest of the follow-up activities, will have the qualification of "Not Presented" in the 1st call and "Suspense" in the 2nd

Modality B

The student will be able to benefit from being evaluated only with an exam (100%) on the contents of the subject treated in the theory classes and the tutorials, so that the teacher will be able to evaluate if the student has acquired the competences and knowledge related to the subject. The minimum grade of the written exam to pass the subject is five out of ten (5/10).

REFERENCES

Basic

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- Química Orgánica Básica y Aplicada (Tomos 1 y 2). Eduardo Primo Yúfera, REVERTÉ, 1994-5
- Polímeros, J. AREIZAGA, SINTESIS, 2002.
- Introducción a la Química de los Polímeros, R.B. SEYMOUR, C.E. CARRAHER, JR. , REVERTÉ, 1995.
- P. Yurkanis-Bruice, Fundamentos de Química Orgánica (4ª Edición), Ed. Pearson, 2015.
- Bruice, Paula Y. Fundamentos de Química Orgánica. 3ª edición Pearson Educación. Madrid. 2015. (ebook en UV)
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- Mc.Murry, J. Química Orgánica Cengage Learning (7ª Edicion (2008) y posteriores).

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.