COURSE DATA

DATA SUBJECT

Code: 34290
Name: Optical materials
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Facultat de Física	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	Chemistry	BASIC

COORDINATION

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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 / LEARNING OUTCOMES

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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.

Knowing how to apply the knowledge acquired to professional activity, knowing how to solve problems and develop and defend arguments.

To know the physical and chemical properties of the materials used in optics and optometry.

To know the structure of matter, the chemical processes of dissolution and the structure, properties and reactivity of organic compounds.

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

PRESENCIAL ACTIVITIES

Activity	Hours

Tutorials	10,00
Theory	50,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	30,00
Preparation of lessons	50,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**90,00**

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:

(1) Written exam (80%)

(2) 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 5.0 (out of 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 part (2) will be kept.

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 5.0 (out of 10).

REFERENCES

- Principios de Química, P. ATKINS; L. JONES, PANAMERICANA, 2012
- 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.
- 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.
- 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)
- Bruice, Paula Y. Química Orgánica. 3ª edición Pearson Educación. Madrid. 2008. (ebook en UV)
- Mc.Murry, J. Química Orgánica Cengage Learning (7ª Edicion (2008) y posteriores).