# Advanced Polymeric Materials

**Academic Year: ( 2023 / 2024 )** **Review date: 17/05/2023 13:07:32**

**Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department**

**Coordinating teacher: SERRANO PRIETO, MARIA BERNARDA**

**Type: Compulsory ECTS Credits : 6.0**

**Year : 1 Semester : 1**

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Not applicable

## OBJECTIVES

A student that has met the objectives will be able to
Being able to understand the differences between small molecules and polymers.
Describing polymer properties and knowing experimental techniques for their determination.
Predicting the phase stability of polymer solutions.
Describing the structure and dynamics of polymers.
Describing the solid state (amorphous and crystalline) of a polymer
Describing the most advanced and current techniques of polymer synthesis to obtain functional polymeric materials with advanced properties.
Provide knowledge and understanding of the relationship between polymer chemical structure, physical properties, processing methods, and ultimate applications.
Provide knowledge to predict polymer phase behavior in a Polymer Blend
Being able to identify materials for specific applications

## DESCRIPTION OF CONTENTS: PROGRAMME

Advanced polymer materials specific topics:
- Introduction. Polymer technology.
- Macromolecular conformations. Molecular weights
- Polymer Synthesis. Polymerization Techniques
- Solid State of Polymers. Relaxations in amorphous polymers, melting and crystallization.
- Viscoelasticity.
- Elasticity of rubber.
- Polymer Blends and multicomponent systems.
- Advanced techniques of synthesis and functionalization, polymers for advanced applications.
- Hydrogels
- Polymers for biomedical applications
- Dielectric and conductive properties of polymers and their applications
- Simulation with molecular dynamics of Polymers

## LEARNING ACTIVITIES AND METHODOLOGY

TRAINING ACTIVITIES
AF1Theoretical-practical classes
AF2 Laboratory
AF3 Tutorials
AF4 Group work
AF5 Student individual work
AF6 Visits to companies in the sector or research centers

TEACHING METHODOLOGIES

MD1, Presentations in a class by the teacher with the support of computer and audiovisual media, in which the main concepts of the subject are developed and examples exercises or practical cases are given.
MD3, Resolution by the student (individually or in a group) of practical cases, exercises proposed by the teacher
MD4, Presentation, and discussion in class, under the teacher's moderation, of topics related to the content of the subject
MD5, Obtaining experimental results in the laboratory. Managing research equipment and techniques under the guidance of the professor
MD6, Preparation of work and reports individually or in groups

## ASSESSMENT SYSTEM

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|---|---|
| **% end-of-term-examination/test:** | 70 |
| **% of continuous assessment (assigments, laboratory, practicals…):** | 30 |

Participation in theoretical classes and laboratories and demonstrated critical analysis capacity on the issues raised (SE1) 5%
Completion and / or presentation of works, exercises or reports carried out individually or collectively throughout the course (SE2) 0-10%
Carrying out laboratory practices, preparation, presentation and discussion of detailed reports or questionnaires on the techniques used and the experimental results obtained. (SE3) 15- 25%
Final evaluation exam of the subject carried out individually, in writing or orally (SE4) 70%

## BASIC BIBLIOGRAPHY


- Dietrich Braun, Harald Cherdron, Matthias Rehahn, Helmut Ritter, Brigitte Voit Polymer Synthesis: Theory and Practice, Springer Berlin Heidelberg, 2013

- M. Rubinstein, Ralph H. Colby Polymer Physics , OXFORD UNIVERSITY PRESS, 2003

- D.R. Paul, C.B. Bucknall, Polymer Blends, Vol. I: formulation y Vol. II: performance; Ed. Willey-Interscience, N.Y., 2000..

- E.A. Turi Polymer Blends and Block Copolymers¿ en ¿Thermal Characterization of Polymeric Materials, Vol 1, and Vol 2 Academic Press, USA, 1997..

- L.H. Sperling Physical Polymer Science, Wiley-Interscience third edition, USA, 2001.

- Montgomery T. Shaw, William J. MacKnight Hardcover $117.25 Introduction to Polymer Viscoelasticity, 3rd edition, Willey-Interscience, USA, 2005