

COURSE INFORMATION

POLYMER TECHNOLOGY

Code number: 606210301

Degree: Industrial Chemical Engineering

Department: Chemical Engineering, Physical Chemistry and Materials Science

Academic Year: 2017-2018.

Course type: Elective course. 4th year

Teaching hours: First semester: 1.5 hours per session, 2 sessions per week. And 15 hours of other activities (seminars, lab, etc.).

Credit value: 6 ECTS

Link to Spanish counterpart: <http://www.uhu.es/etsi/guia-de-asignatura/?codigo=606210301>

TEACHING STAFF

Prof.: Inmaculada Martínez García

Office: P3-N6-05 Faculty of Experimental Sciences

Tel: +34 959 219997

E-mail: imgarcia@uhu.es

Office hours:

First Semester:

Monday from 10:00 to 12:00h; Wednesday from 12:00 to 14:00h and Tuesday from 16:00 to 18:00 h

PROGRAMME

1. DESCRIPTION

The main objective of the course is to provide students with basic knowledge of polymer science and technology, covering physico-chemical properties, characterization techniques and processing.

The course is divided into four sections:

SECTION I: MACROMOLECULAR STRUCTURE AND POLYMER

This section includes a brief discussion of the historical development of polymers, basic definitions and concepts, and an overview of the basis for the various classifications of polymers. It also examines the requirements for polymer formation from monomers and discusses polymer structure and the section continues with a discussion of polymer solutions.

SECTION II: POLYMER SYNTHESIS

The second section deals with how polymers are prepared from monomers. It starts with a discussion of the various polymer preparation methods with emphasis on reaction mechanisms and kinetics. This section continues with a discussion of polymer reaction engineering. Emphasis is on the selection of the appropriate polymerization process and reactor to obtain optimal polymer properties

SECTION III: POLYMER CHARACTERIZATION

The third section deals with the properties and applications of polymers. It provides an overview of polymer characterization test methods. The effects how processing conditions affect the ultimate properties of the finished polymer product are examined too.

BLOQUE IV: POLYMER TYPES AND POLYMER PROCESSING.

This section deals with the main conventional polymer types and their applications. The section presents a discussion of unit operations in polymer processing

2. PREREQUISITES

Basic knowledge in Organic Chemistry, Physical Chemistry, Thermodynamic and Chemical Kinetic.

3. LEARNING OUTCOMES

By the end of this course, the students acquire basic knowledge of classification, synthesis, physico-chemical properties, processing and characterization of polymer.

4. COMPETENCES

G04
G05
G11
G12
G16
T01
T02

5. TEACHING METHODOLOGY

Lectures
Laboratory
Seminars and tutorials
Group work
Problem-based learning
Examinations and assessments

6. CONTENTS

SECTION I: MACROMOLECULAR STRUCTURE AND POLYMER

UNIT 1. INTRODUCTION

- 1.1. Basic Concepts
- 1.2. Classification of Polymers
- 1.3. Nomenclature
- 1.4. History of Polymers and Plastics
- 1.5. Molecular Weight

UNIT 2. MACROMOLECULAR STRUCTURE

- 2.1. Introduction
- 2.2. Polymer Structure
- 2.3. The Amorphous and Crystalline State

- 2.4. Thermal Transitions
- 2.5. Structure- Property relationship

UNIT 3. POLYMER SOLUTIONS

- 3.1. Introduction
- 3.2. Polymer solubility
- 3.3. Thermodynamics of polymer solutions
- 3.4. Polymer- polymer blends

SECTION II: POLYMER SYNTHESIS

UNIT 4. POLYMERIZATION

- 4.1. Introduction
- 4.2. Chain Growth Polymerization
- 4.3. Step Growth Polymerization

UNIT 5. INDUSTRIAL POLYMERIZATION PROCESSES

- 5.1. Introduction
- 5.2. Bulk polymerization
- 5.3. Solution polymerization
- 5.4. Suspension polymerization
- 5.5. Emulsion polymerization

SECTION III: POLYMER CHARACTERIZATION

UNIT 6. POLYMER RHEOLOGY

- 6.1. Why Rheology ?
- 6.2. Fundamental Rheology Concepts and Parameters
- 6.3. Viscosity and Steady Shear Testing
- 6.4. Viscoelasticity and Time Dependence
- 6.5. Fundamental Rheometry Concepts

UNIT 7. POLYMER TESTING

- 7.1. Introduction
- 7.2. Mechanical properties
- 7.3. Physical properties
- 7.4. Thermal properties
- 7.5. Environmental properties

SECTION IV: POLYMER TYPES AND POLYMER PROCESSING

UNIT 8. PLASTICS

UNIT 9. RUBBERS

UNIT 10. FIBERS

UNIT 11. POLYMER RECYCLING

7. BIBLIOGRAPHY

-PLASTIC TECHNOLOGY HANDBOOK

Chanda, M. y Roy, S.K.

Marcel Dekker, New York, 1998

-AN INTRODUCTION TO POLYMER SCIENCE

Hans-Georg, E.

VCH, New York, 1997

-PRINCIPLES OF POLYMERISATION

Odian, G.
Ed. Willey, 1991
-THE ELEMENTS OF POLYMER SCIENCE AND ENGINEERING
Rudin, A.
Ed. Academic Press, 1998
-POLYMER RECYCLING: SCIENCE, TECHNOLOGY AND APPLICATIONS
Schiers, J.
John Wiley & Sons, Cichester, 1998
-POLYMER CHEMISTRY AND INTRODUCTION
Stevens, M P.
Ed. Oxford University Press, 1999
-PROPERTIES OF POLYMERS.
Van Krevelent, D.W. Ed. Cartoné- 2009.
-POLYMER SCIENCE AND TECHNOLOGY
Robert O. Ebewele
CRC Press LLC, 2000

8. ASSESSMENT

Exams

Presentations, group projects, reports, essays, problem-solving.
Active classroom participation.

The student may choose among the two different methods of assessment proposed below:

A. Continuous assessment

- 1) Exam: Individual assignment with public presentation (40%).
- 2) Multiple choice test and report about the work done in lab (20%).
- 3) Active participation (papers, presentation, attendance, etc.) (40%).

B. Final assessment:

- 1) Written Exam (100%).

An overall total mark of 50% for continuous assessment or final assessment would be required to pass the course.

Final results will be given in terms of a numerical scale between 0 and 10 (including tenths), with the corresponding qualitative ratings below:

- ≤ 4.9 : Fail (D)
- 5.0 - 6.9: Pass (C)
- 7.0 - 8.9: Pass with Merit (B)
- 9.0 - 10: Distinction (A)

The total number of distinctions cannot exceed 5% of the students enrolled in the subject in the academic year (unless the number of students enrolled is lower to 20, in which case one distinction can be awarded)

The grading system is subject to the Bachelor's Degree Exam Regulations of the University of Huelva (Normativa de Evaluación para las Titulaciones de Grado de la Universidad de Huelva). Please refer to:

<http://www.uhu.es/sec.general/Normativa/Texto_Normativa/Normativa_de_Evaluacion_grados.pdf>.
In particular, please note that make-up exams and other special circumstances will be subject to article 19 of these regulations.'