

Course guide

240EM023 - 240EM023 - Plastics Technology

Last modified: 02/06/2022

Unit in charge:	Barcelona East School of Engineering	
Teaching unit:	702 - CEM - Department of Materials Science and Engineering.	
Degree:	ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject). MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Compulsory subject).	
Academic year: 2022	ECTS Credits: 4.5	Languages: Spanish

LECTURER

Coordinating lecturer:	MARIA LLUÏSA MASPOCH RULDUA
Others:	Santana Perez, Orlando Cailloux, Jonathan García Masabet, Violeta Del Valle

PRIOR SKILLS

Knowledge about structure and properties of polymeric materials, transport phenomena.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CEMCEM-02. (ENG) Dissenyar i desenvolupar productes, processos, sistemes i serveis, així com l'optimització d'altres ja desenvolupats, atenent a la selecció de materials per a aplicacions específiques

CEMCEM-03. (ENG) Aplicar mètodes innovadors en la resolució de problemes i aplicacions informàtiques adequades, pel disseny, simulació, optimització i control de processos de producció i transformació de materials

CEMCEM-07. (ENG) Dissenyar, calcular i modelar aspectes relacionats amb els materials per a components mecànics, estructures i equips

Transversal:

01 EIN N2. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.

02 SCS N2. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

06 URI N2. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

Subject in process of extinction. There is no teaching, the students that enroll it do so only with the right to an exam.



LEARNING OBJECTIVES OF THE SUBJECT

- To deepen in the rheological behavior of polymers and their relation with the molecular structure.
- To study the techniques of characterization of the rheological behavior of polymeric materials.
- Know the main families of thermoplastic materials and their relevant characteristics: processing and final properties.
- To Study the techniques of processing plastic materials by analyzing the production lines and the relationship between the process parameters and the quality of the piece obtained.

STUDY LOAD

Type	Hours	Percentage
Self study	72,0	64.00
Hours large group	31,5	28.00
Hours small group	9,0	8.00

Total learning time: 112.5 h

CONTENTS

1.- Description and additives of thermoplastics

Description:

Description of the main families of thermoplastic materials attending to properties, considerations for their processing and additivation:

- Polyolefins
- Styrene base polymers.
- Acrylic Polymers
- Thermoplastic polyesters: aliphatic and aromatic.
- Polyamides
- Halogenated polymers.
- Bioplastics.

Full-or-part-time: 12h

Theory classes: 4h 30m

Self study : 7h 30m

2.- Flow of polymeric systems

Description:

Rheological behavior of polymers.
Techniques of rheological characterization.
Factors that determine rheological behavior.
Elastic effects on the fluid

Full-or-part-time: 13h 30m

Theory classes: 4h 30m

Laboratory classes: 1h 30m

Self study : 7h 30m



3.-Technology of mixing and compounding

Description:

- Mixing considerations: a) Polymer + rigid charges and b) Polymer + polymer
- Rheological criteria for mixing polymer systems.
- Morphology induced by mixing.
- Discontinuous mixing techniques.
- Continuous mixing techniques (Double screw extrusion).

Full-or-part-time: 11h 30m

Theory classes: 4h 30m

Self study : 7h

4.-Extrusion and main lines of production

Description:

- The extrusion process
- Description of the machine
- Operation curves: parameters and effects
- Main production lines and typical defects:
 - Production of Multicapas: Coextrusion, lamination and coating.
 - Sheetl Production
 - Fiber production
 - Production of pipes
 - Film production (calendering and blowing)
 - Production of hollow bodies (blown extension)

Full-or-part-time: 20h

Theory classes: 6h

Laboratory classes: 1h 30m

Self study : 12h 30m

5.- Thermoforming

Description:

- Process description.
- Types of thermoforming.
- Material requirements.
- Typical defects and solutions.

Full-or-part-time: 4h

Theory classes: 1h 30m

Self study : 2h 30m

6.- Rotational Molding

Description:

- Descripción del Proceso.
- Requerimientos del material.
- Defectos típicos y soluciones.

Full-or-part-time: 4h

Practical classes: 1h 30m

Self study : 2h 30m



7.- Injection molding

Description:

- Machines and parameters of the process
- Description of the mold and functionalities
- Defects and solutions in injected parts

Full-or-part-time: 20h

Theory classes: 6h

Laboratory classes: 1h 30m

Self study : 12h 30m

8.-Advanced Processing Techniques

Description:

Over-injection

Co-Injection

Fluid Assisted Injection

Injection + Microfoam

Additive Manufacturing: FDM

Full-or-part-time: 12h

Theory classes: 3h

Laboratory classes: 1h 30m

Self study : 7h 30m

GRADING SYSTEM

Subject in process of extinction. There is only one final test that corresponds to 100% of the final grade of the subject.

BIBLIOGRAPHY

Basic:

- Osswald, T.A. ; Menges, G. Materials science of Polymers for Engineers. 2nd ed. Munich: Hanser Publishers, 2003. ISBN 1569903484.
- Dealy, J. M. ; Wissbrun, K. F. Melt rheology and its role in plastics processing : theory and applications. Dordrecht: Kluwer, 1999. ISBN 0792358864.
- McCrum, N.G. ; Buckley, C.P. ; Bucknall, C.B. Principles of polymer engineering. 2nd ed. Oxford: Oxford University Press, 1997. ISBN 0198565267.

RESOURCES

Audiovisual material:

- Nom recurs. Resource

Hyperlink:

- Videos. Selected videos from the documentary series: How its made. <http://science.discovery.com/tv/how-its-made/> Selected videos of youtube processes.