Course guide
240IMA21 - 240IMA21 - Design, Ecodesign and Recycling

Last modified: 07/02/2024

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN RESEARCH IN MECHANICAL ENGINEERING (Syllabus 2021). (Optional subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: NOEL LEÓN ALBITER

Others: MARIA LLUÏSA MASPOCH RULDUA
JESSICA CALVO MUÑOZ
ANA HERNÁNDEZ EXPÓSITO
LEANDRO ISIDRO MARTINEZ OROZCO

TEACHING METHODOLOGY

Presentation of master classes, directed activities and laboratory sessions in order to provide the necessary and sufficient knowledge to allow an adequate and efficient understanding of the subject.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, the student should be able to understand the basic aspects related to optimization, recycling, and alternatives in the use of plastic materials.

Specific objectives include:
- To know the design principles that make material optimization possible during the manufacture of a plastic part.
- To know the main characteristics of polymeric materials and biopolymers.
- To understand the main ways of recycling plastic materials.

STUDY LOAD

Type	Hours	Percentage
Self study	72,0	64.00
Hours large group	27,0	24.00
Hours small group	13,5	12.00

Total learning time: 112.5 h

CONTENTS

T1. Introduction

Description:
- Basic concepts about plastic materials
- Processing methods (injection molding)

Related activities:
Master class

Full-or-part-time: 10h 30m
Theory classes: 3h
Self study : 7h 30m

T2. Plastic design principles

Description:
- Introduction
- Thickness effect
- Stress concentrators
- Ribs and reinforcements
- Demolding

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 3h
Self study : 6h 30m

T3. CAD-CAE, plastic parts examples

Description:
- Background
- Advantages
- Most used programs
- Practical examples

Related activities:
Master class

Full-or-part-time: 9h 10m
Theory classes: 2h
Self study : 7h 10m

T4. Waste, alternatives to waste and ecodesign principles

Description:
- Demand and production of plastics
- Plastic waste: Industrial and post-consumer
- Alternatives to plastic waste: the 3Rs rule
- Ecodesign strategies

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 2h
Self study : 7h 30m

T5. Plastic recycling

Description:
- Mechanical recycling
- Polymer degradation
- Chemical recycling

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 2h
Self study : 7h 30m

T6. ACV - Activity: CES edupack

Description:
- Introduction
- Evolution
- Program operation
- Activity

Related activities:
Master class

Full-or-part-time: 12h 50m
Theory classes: 3h
Laboratory classes: 2h
Self study : 7h 50m

T7. Practical cases of recycling plastics + bioplastics

Description:
- Examples of revaluation of plastics
- Biodegradation
- Life cycle/carbon footprint
- Main biopolymers

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 3h
Self study : 6h 30m

T8. Rubber recycling

Description:
- Introduction
- Natural and synthetic rubbers
- Mechanical recycling
- Chemical recycling

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 3h
Self study : 6h 30m

T9. Laboratory sessions

Description:
- Fast identification techniques for plastics
- Injection of plastic materials

Related activities:
Team work

Full-or-part-time: 10h
Laboratory classes: 10h

T10. Metals recycling

Description:
- Relevance of recycling
- Recyclable metals
- Recycling processes

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 3h
Self study : 6h 30m

T11. Work presentations

Description:
- Selection of scientific papers of interest
- Presentation/exposition of the main results

Full-or-part-time: 13h
Theory classes: 3h
Self study : 10h

GRADING SYSTEM

The final score will correspond to:
0,47*Final exam + 0,17*Seminars + 0,16*Activity + 0,1*Works + 0,1*Laboratory sessions

BIBLIOGRAPHY

Basic:
- Gilbert, Marianne [ed.]. Brydson's plastic materials [on line]. 8th. Amstgerdam: Butterworth-Heinemann, 2017 [Consultation: 14/02/2022]. Available on: https://www.sciencedirect.com/book/9780323358248/brydsons-plastics-materials. ISBN 9780323358248.
- Malloy, R. A. Plastic part design for injection molding : an introduction [on line]. 2nd ed. Munich, Germany ; Cincinnati, Ohio: Hanser, 2010 [Consultation: 15/03/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6010495. ISBN 9783446433748.
- Asbhy, Michael F.. Materials and the environment : Eco-informed material choice. 2nd ed. Amsterda: Butterworth - Heinemann, 2013. ISBN 9780123859716.

RESOURCES

Other resources:
Teaching material available in Atenea