

Academic Year/course: 2022/23

## 29698 - Designing with plastics and composite materials

### Syllabus Information

**Academic Year:** 2022/23

**Subject:** 29698 - Designing with plastics and composite materials

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 558 - Bachelor's Degree in Industrial Design and Product Development Engineering

**ECTS:** 6.0

**Year:** 4

**Semester:** Second semester

**Subject Type:** Optional

**Module:**

## 1. General information

### 1.1. Aims of the course

Brief presentation of the course

The development of products designed with plastic and composite materials is a transversal activity that concerns almost all industrial sectors: automotive, appliances, household items, furniture, footwear, etc.

To achieve success in the design, development and manufacture of a plastic and composite materials product is necessary to know how to integrate from the start the chosen material, part design, the type of process and conditions, as well as machine and tools to use.

Therefore, this course focuses on the concepts, methodologies and skills that allow a future engineer to understand this complex system in which there are many interrelated factors.

The contents of the course are designed to make this future engineer able to locate and analyze the great amount of problems that arise in the design, development and manufacture of a plastic product, regardless of the department to which it belongs (design and development, production or quality), proposing a work plan that integrates all the above factors.

### 1.2. Context and importance of this course in the degree

The usual engineer who chooses subjects related to 'Product Design' or 'Product Development' has to work during his professional life in the field of design and development of plastic and composite materials components. Thanks to the flexibility and versatility of this material today it has opened a large field of creativity and exploration. Moreover, design and plastic are absolutely linked in the current industrial context.

### 1.3. Recommendations to take this course

To follow this subject properly it is advisable that students have studied the courses related to 'Product Design' and/or 'Product Development'.

## 2. Learning goals

### 2.1. Competences

After to pass the course, students will be more competent to ...

#### GENERAL COMPETENCES

CG01 - Acquire basic knowledge of the professional activity of industrial design, to combine general and specialized knowledge with which to generate innovative and competitive proposals.

CG03 - Ability to conceive and develop design projects, in the aspects related to the nature of products and services, their relationship with the market, the environments of use and the user, and attending to their manufacture, selection of materials and processes more suitable in each case considering relevant facets such as quality and product improvement.

CG05 - Ability to obtain, manage, analyze and synthesize information from various sources for the development of design and product development projects. Use this documentation to obtain conclusions oriented to solve problems and make decisions with initiative, creativity and critical reasoning, generating new product concepts, new ideas and solutions.

CG06 - Ability to generate the necessary documentation for the proper transmission of ideas through graphic representations, reports and technical documents, models and prototypes, verbal or other presentations in Spanish and other languages.

CG08 - Ability to learn continuously and develop autonomous learning strategies, and to work in multidisciplinary groups, with motivation and responsibility for work to achieve goals.

CG09 - Know the industries, organizations, regulations and procedures and other elements to take into account in industrial design projects.

CG10 - Ability to plan, budget, organize, direct and control tasks, people and resources.

CB3 - That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant issues of a social, scientific or ethical nature

CB4 - That students can transmit information, ideas, problems and solutions to a specialized and non-specialized public

## SPECIFIC COMPETENCES

CE08 - Knowledge and application of the principles of the resistance of materials

CE14 - Ability to define design specifications by developing relatively complex products to a satisfactory technical degree.

CE23 - Knowledge of production and manufacturing systems.

CE25 - Ability to carry out a design project according to the requirements of a client company, according to the regulations and legislation, planning the deadlines, costs and resources and generating all the necessary documentation to carry it out.

Importance of learning outcomes obtained in the course:

The most important aspect of this subject is to reach the integration of the technical knowledge with the industrial reality. Knowing how to relate the knowledge with the skill is the key to progress personally. Knowing how to use both scopes is the profile requested by any industrial company. That means the engineer knows how to identify a problem, what are the available resources, and then, design and present a plan work for solve it.

## 2.2. Learning goals

It is considered that the students have passed the subject, if they prove the following results

1. Know the design constraints imposed by the different transformation processes with plastic and composite materials.
2. Know the formal design criteria of plastic parts, being able to design objects and sets of these materials.
3. Know the formal design criteria with composite materials, being able to design objects with these materials.

## 2.3. Importance of learning goals

The subject and its expected results correspond with following approaches and objectives

The design of plastic parts is a widespread activity that has significant differences with the design with conventional materials like metal parts and metallurgy. This subject aims to be a successful start to work in a sector composed of 6,000 technicians and technologists in Aragon and 100.000 technicians and technologists in Spain.

Its guidance to design cabinets, also involves students in the departments of Production Engineering and Quality Departments of companies in the sector.

This course has the distinction of being one of the few official teachings that exist in Spain on these technologies. It is coordinated by the Department of Mechanical Engineering / Mechanical Engineering Area, by a university group of R&D&I, with more experience of Spain and with a large number of contacts with companies in the sector. Business experiences with this sector have helped to design the course content.

### 3. Assessment (1st and 2nd call)

#### 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he has achieved the intended learning outcomes through the following evaluation activities

1. Active participation in the practical classes, with elaboration of scripts of the same ones. 15%
2. Active participation in the theoretical classes, with elaboration of scripts of the same ones. 65%
3. Develop a case, the course work on the subject with composite materials and expose it. 25%

Each one of the sections must be approved individually in order to pass the subject.

### 4. Methodology, learning tasks, syllabus and resources

#### 4.1. Methodological overview

The learning process that is designed for this subject is based on the following:

The learning process which is presented to the student, has the following methodological phases, not chronological, because some of them must be synchronized according to the topics.

Preliminary phase

Study of concepts based on attendance at the theoretical sessions and personal work.

Maturation phase

Phase to establish the knowledge acquired about on the work in:

- ? Seminars with teaching tools like simulators type and RPGs.
- ? Seminars about on lab work.

Experimental phase based on the work in:

- ? Workshop and laboratory
- ? Visits to a company
- ? Scripts development.

#### 4.2. Learning tasks

The course includes the following learning tasks:

- 1. Lectures.
- 3. Practical sessions.
- 4. Seminars with technologist guest.
- 5. Personal work of study.
- 6. Development of a final course dossier.
- 7. Presentation of the final course dossier.

#### 4.3. Syllabus

The course will address the following topics:

1. 34 hours of theoretical classes
2. 11 hours of problem-solving
3. 12 hours of practice
4. 3 hours of company visits
5. 37 hours of development of final course work
6. 50.5 hours of study
7. 2.5 hours of presentation of the work and tutorials

#### 4.4. Course planning and calendar

Calendar of face-to-face sessions and presentation of works

THEORIC PROGRAMME	Hours
Introduction to plastics and their use in industry	4
Special casuistry in the design of the pieces due to the contraction	3
Redesign of plastic parts	4
Failure criteria for dimensioning plastic parts	4
Design of plastic parts from the point of view of rigidity	4
Adjustment joints	3
Crimp connections	4
Calculation of joints with screws	3
Bonding technologies for plastic parts	4
Introduction to Composite Materials	3
Fibres and matrix	2
Composite Materials Manufacturing	4
Testing	2
Theory of Composite Materials	1
<b>TOTAL HOURS</b>	<b>45</b>

CONTENT PROGRAM PRACTICES	HORAS
Injection simulation I	3
Injection simulation II	3
Work with Plastic injection Molds	3
The composite Materials manufacturing workshop	3
<b>TOTAL HOURS</b>	<b>12</b>

The deliverables will contain at least the following sections:

? Analysis of part design: demoulding, undercuts, rounds...

? Injection moulding parameters calculation.

? Sizing of the part

? Materials selection.

? Tooling and machine selection.

? Brief study of costs including material, mold and processing

? Approximate estimation of environmental impact

Therefore, the key dates during the development of the course are:

Dates for the practical sessions

Dates for visits to the companies and/or seminars

#### **4.5. Bibliography and recommended resources**

<https://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=29698>