

Academic Year/course: 2024/25

## 60801 - Design and testing of machines and Integrated manufacturing systems

### Syllabus Information

**Academic year:** 2024/25

**Subject:** 60801 - Design and testing of machines and Integrated manufacturing systems

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

**Degree:** 532 - Master's in Industrial Engineering

**ECTS:** 6.0

**Year:** 1

**Semester:** First semester o Second semester

**Subject type:** Compulsory

**Module:**

### 1. General information

The objective of the subject is to learn aspects related to machines and integrated manufacturing systems involved in the production of mechanical components. That is, the design and development of mechanical systems according to design specifications and within the requirements of quality, costs and delivery times, as well as the equipment (systems) to carry out manufacturing processes according to different levels of automation. and flexibility.

The subject is mandatory and addresses the basic principles of design and testing of machines and integrated manufacturing systems. On the other hand, the degree presents several Optional Training modules that provide continuity to this subject. It has no prerequisites in the master's degree. Only for students who must take the following as homogenization subjects, these should be passed beforehand: "Manufacturing technologies" and "Machine design criteria".

### 2. Learning results

Acquire skills for machine design.

Know how to calculate the different elements of machines.

Acquire practical skills for the application of experimental machine testing systems.

Learn about the different types of machine tools and flexible manufacturing systems.

Acquire practical skills for verifying production systems.

Assimilate scientific, technological and economic criteria to develop integrated manufacturing systems.

### 3. Syllabus

Theoretical-practical agenda

1) Introduction to Machine Design

Materials.

Technical specifications.

Loads notebook.

Specifications.

2) Design of Joints

Mechanical joints: strapping, crimps, screws and rivets/bolts.

Non-mechanical joints: Welding and gluing.

3) Design of transmission elements.

Design of shafts, keys and couplings.

Design of bearings, belts and chains.

Design of gear transmissions.

4) Flexible manufacturing systems: machine tools, materials handling, monitoring and control systems.

Principles for designing machine tools from components.

Drives and motion transmission. Structures, interfaces and assembly.

Diagnosis and control of manufacturing systems. Dynamics and vibrations.

5) Geometric and functional verification of production systems.

Standardization. Modeling of productive systems.

Direct verification.

Indirect verification.

6) Development of manufacturing cells.

Lean Manufacturing.

Clustering methods for cell formation.

Plant layout design for cellular manufacturing.

Practical classes:

Deformation analysis through simulation and extensometry.

Analysis of stresses and deformations in mechanical joints through simulation.

Analysis of axles and transmission elements.

Experimental techniques for verification of manufacturing systems.

Modelling and verification of machine tools.

Lean Manufacturing: VSM and formation of manufacturing cells.

#### **4. Academic activities**

The proposed methodology tries to encourage the student's continued work and focuses on the most practical aspects of machine design and testing.

In the sessions with the entire group, the most theoretical aspects are covered in the form of a master class and are completed with the development of problems and the study of technical cases.

The practical sessions are held in smaller groups to work with specialized computer applications and mechanical and manufacturing engineering workshop equipment and metrology laboratory. The aim is to promote practical learning, so attendance at the practical sessions is recommended, where you have direct experience with machines and manufacturing systems. At the end of each practical session, the immediate completion of a small control or script is required. In some cases, the practical session makes it possible to collect data to carry out more elaborate work that allows for better assimilation of the knowledge related to the subject. These controls and work are mandatory if you opt for the gradual evaluation.

*This subject is English Language Friendly (ELF) in at least one group. The study and class material is available in English and the teachers will attend office hours and prepare and evaluate students in English if they don't speak Spanish.*

#### **5. Assessment system**

Students can opt for a gradual evaluation. Thus, during the course of the subject, you must demonstrate that you have achieved the theoretical-practical learning results. If you do not pass any test of the gradual evaluation, you may take the global evaluation to which you are entitled, in either of the two calls.

Gradual evaluation: the gradual evaluation is divided into two blocks:

Evaluation of practical sessions: It represents 30% of the final grade.

- After completing each practice, the student must submit a complete report of results and conclusions, meeting the indicated requirements.

Resolution of theoretical-practical issues, problems and technical cases related to the subject taught: it represents 70% of the final grade and a grade higher than 4.0 must be obtained to average with the other evaluation block (practical sessions). In turn, this block of theoretical-practical questions, problems and technical cases is divided into two sub-blocks: one related to the Mechanics part, which will include an evaluation test with theoretical-practical questions (30% of the grade for this subblock; minimum grade to average 4.0) and a technical case (70% of the grade of this subblock) and will represent 50% of the final grade of this block, and another for the Manufacturing part that will also have 50% of weight on the final grade of this block. In each of them it is necessary to obtain a grade higher than 4.0 so that both sub-blocks can be averaged (in a weighted manner).

Global evaluation: the global evaluation will consist of taking a written test with the following parts:

- Resolution of theoretical-practical issues and problems related to the subject taught. It represents 70% of the final grade and a grade higher than 4.0 must be obtained to average with the other part (practical sessions). This part shows the same division, the same conditions and the same percentages as those indicated in its equivalent in the gradual evaluation.

- Evaluation of practices. It represents 30% of the final grade and a grade higher than 4.0 must be obtained to average with the other part.

On the other hand, the second call for evaluation will be carried out through a global test carried out in the period established for this purpose in the academic calendar.

## **6. Sustainable Development Goals**

9 - Industry, Innovation and Infrastructure  
12 - Responsible Production and Consumption