Course guide
220121 - OMFA - Mechanical Design and Manufacturing

Last modified: 11/04/2025

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2025 **ECTS Credits:** 3.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: José Antonio Ortiz Marzo

Others: José Antonio Ortiz Marzo
Comas Cespedes, Esteve

PRIOR SKILLS

Students must have achieved the objectives of graphic expression methods, materials technology and theory of machines and mechanisms

TEACHING METHODOLOGY

The teaching methodology is divided into two parts:
- On-site sessions to introduce the contents, in an expositive way with multimedia material and practical examples, short videos representative of the explained process, visits to the workshops and mechanical laboratories (depending on availability, visits to external companies), and resolution of basic problems, specially in module 2, where real cases of application are developed with the discussion of resolution alternatives.
- Autonomous work of study and performance of exercises, activities and group work.

LEARNING OBJECTIVES OF THE SUBJECT

The basic objective is the knowledge of the different manufacturing processes of the most common components and their application according to the type of components depending on the surface finish and dimensional tolerances required.
The student should also know and make use of the information available from the different suppliers or manufacturers of the technologies and processes involved. For this, references are given to specific websites or catalogs. There is an important part of this information that is in English, therefore, the student will have to make an effort to know technical English, as you will find when you start working professionally.
The student will have learned how to balance the engines and wheels of cars. You will also know the usefulness of flywheels.
The student, at the end of the course, will be able to identify and select the processes involved in the manufacture of components of the automotive sector. In this way, the available resources can be optimized, reducing production time and costs, increasing their quality and indirectly reducing energy consumption and waste volume.

STUDY LOAD

Type	Hours	Percentage
Self study	45,0	60.00
Hours large group	30,0	40.00

Total learning time: 75 h

CONTENTS

Module 1: Welding processes

Description:
Topic 1. Introduction to Welding process. Basic concepts. Classification. Design. Quality and Safety Regulations.
Topic 2. Welding Processes. Welding with electrodes, MIG / MAG, TIG:
Features and applications. Resistance welding. Automation of processes.

Specific objectives:
At the end of module 1, the student should be able to name the different welding processes and select a particular process, depending on the type of part and material to be welded. The student will know the necessary safety elements.

Related activities:
Activity 1
Activity 2
Activity 4

Full-or-part-time: 13h
Theory classes: 5h
Self study : 8h

Module 2: Machining processes with rotary machines

Description:
Topic 4. General concepts. General scheme. Type of machine tools. Material based tools. surface coatings.
Topic 5. Lathe. Type and geometry of cutting tools. Basic operations. Calculation of working conditions. Examples

Specific objectives:
At the end of module 2, the student should be able to name different machining processes and select a machining process, depending on the part geometry and material work, select the type of machine tool and the sequence of operations required.

Related activities:
Activity 1
Activity 2
Activity 4
Activity 5

Full-or-part-time: 22h
Theory classes: 9h
Self study : 13h

Module 3. Mechanical optimization in the automobile.

Description:
Topic 6: Balanced wheels. Static and dynamic balancing. Balancing of rotating masses punctual. Balanced "in situ".
Topic 7: Balanced engines. Forces and moments of shaking. Balancing a single cylinder engine. Balancing multi-cylinder engines online. Application to a 4 cylinder 4 stroke engine.
Topic 8: Flywheels of inertia. Reduction of forces and moments. Approximate calculation of the steering wheel. Application to motors.

Specific objectives:
At the end of module 3, the student should be able to know and understand the most common applications of dynamics in the car: flyers and balanced calculation of axles and engines.

Related activities:
Activity 1
Activity 3
Activity 5

Full-or-part-time: 30h
Theory classes: 12h
Self study : 18h

Module 4. Other manufacturing processes

Description:
Topic 9. Hot and Cold forming. Basic classification. Characteristics of the processes. Applications.
Topic 10. Prototyping technologies of plastic material. Classification and main technologies. Applications.

Specific objectives:
At the end of module 4, the student should be able to name different manufacturing processes of components of the automotive sector.

Related activities:
Activity 1
Activity 2
Activity 5

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

ACTIVITIES

ACTIVITY 1: THEORETICAL CLASSES

Description:
Classes with the basic explanation of the corresponding manufacturing processes, including images and videos that complement the theoretical session.

Material:
Class notes, with links to various complementary material (articles, catalogs, internet links) of interest.

Full-or-part-time: 58h
Theory classes: 26h
Self study: 32h

ACTIVITY 2: MANUFACTURING WORK

Description:
The students will have to present a work of manufacture in English language, with relation Road Safety (components of Active or Passive Safety)

Specific objectives:
Practice some of the soft skills required in the sector: Teamwork. Strengthen skills in third language. Practical oral presentation of a work.

Material:
In Atenea a document will be shared with the appropriate instructions for carrying out the work. Depending on the selected work theme, specific initial documentation will be provided for its proper development.

Delivery:
Group work. They will be delivered in the corresponding task, through the digital campus Atenea. In the last lesson session of the course there will be an oral presentation of the work to the rest of the students.

Full-or-part-time: 6h
Self study: 6h

ACTIVITY 3: MECHANICAL OPTIMIZATION WORK

Description:
Students must present a mechanical optimization work, in ENGLISH language

Specific objectives:
Practice some of the soft skills required in the sector: Teamwork. Strengthen skills in third language. Practical oral presentation of a work.

Material:
In Atenea a document will be shared with the appropriate instructions for carrying out the work. Depending on the selected work theme, specific initial documentation will be provided for its proper development.

Delivery:
In groups. The works will be delivered through the digital campus ATENEA, before the respective evaluation test.

Full-or-part-time: 4h
Self study: 4h

ACTIVITY 4: MANUFACTURING FINAL TEST

Full-or-part-time: 4h
Theory classes: 2h
Self study: 2h

ACTIVITY 5: FINAL TEST OPTIMIZATION MECHANICAL

Full-or-part-time: 3h
Practical classes: 2h
Self study: 1h

GRADING SYSTEM

The final grade of the course depends on four evaluation acts:
- 1st activity (Assistance and making proposals activities), weight 10%
- 2nd activity (Works Manufacturing), weight 30%
- 3rd activity (Mechanical Optimization Works), weight: 20%
- 4th activity (Manufacturing test), weight: 20%
- 5th activity (Mechanical Optimization test), weight: 20%

Any student who wishes to improve his grade may try it at the exam planned at the end of the course. The best mark is preserved.

EXAMINATION RULES.

Activity 2, obligatory, it will be done in a group and you must present a work by group.
Activity 3, obligatory, it will be done in a group and you must present a work by group.
Activities 4 and 5 (exams), it will be conducted individually.

BIBLIOGRAPHY

Basic:
- Salueña, X.; Nápoles, A. Tecnología mecánica [on line]. 2a ed. Barcelona: Edicions UPC, 2001 [Consultation: 19/05/2020]. Available on: http://hdl.handle.net/2099.3/36437. ISBN 8483014491.
- Salueña, X; Casals, J.; Ortiz, J.A. El universo de la tecnología mecánica [Recurs electrònic]. Barcelona: Edicions UPC, 2003. ISBN 8483017253.
- Kalpakjian, S.; Schmid, S. R. Manufactura, ingeniería y tecnología [on line]. 7a ed. México [etc.]: Pearson Educación, 2014 [Consultation: 20/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=5323.
- Ham, C.W.; Crane, E.J.; Rogers, W. L. Mecánica de máquinas. México: McGraw-Hill, 1979.
- Norton, Robert L. Diseño de maquinaria: síntesis y análisis de máquinas y mecanismos. 6a ed. Aravaca: McGraw-Hill, 2020. ISBN 9788448620998.
- Lafita, F.; Mata, H. Vibraciones mecánicas en ingeniería. Madrid: INTA, 1964.

Complementary:
- Coromant, Sandvik. El mecanizado moderno: manual práctico. Sverige: Sandvik Coromant, 1994. ISBN 919722992X.
- Khamashta, M.; Álvarez, L.; Capdevila, R. Problemas de cinemática y dinámica de máquinas, Vol. 2, Problemas resueltos de dinámica de mecanismos planos. 2ª ed. Terrassa: Departament d'Enginyeria Mecànica, 1994. ISBN 8476530358.
- Paul, Burton. Kinematics and dynamics of planar machinery. Englewood Cliffs: Prentice Hall, 1979. ISBN 0135160626.
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- Shigley, J.E.; Uicker, J.J. Teoría de máquinas y mecanismos. México: McGraw-Hill, 1982. ISBN 968451297X.

RESOURCES

Other resources:
Throughout the course, Internet addresses are given for consultation and copies of articles to read that complement the explanations given in class. Also interesting links are provided to web seminars related to topics of the subject.