



Universitat de Lleida

DEGREE CURRICULUM
**MATERIALS FOR MECHANICAL
MANUFACTURING**

Coordination: CAMPILLO BETBESE, MANEL

Academic year 2023-24

Subject's general information

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|---|--|---------------|------------------------|------------------|
| Subject name | MATERIALS FOR MECHANICAL MANUFACTURING | | | |
| Code | 102308 | | | |
| Semester | 1st Q(SEMESTER) CONTINUED EVALUATION | | | |
| Typology | Degree | Course | Character | Modality |
| | Bachelor's Degree in Mechanical Engineering | 3 | COMPULSORY | Attendance-based |
| | Double bachelor's degree: Degree in Mechanical Engineering and Degree in Energy and Sustainability Engineering | 4 | COMPULSORY | Attendance-based |
| | Master's Degree in Industrial Engineering | 1 | COMPLEMENTARY TRAINING | Attendance-based |
| Course number of credits (ECTS) | 6 | | | |
| Type of activity, credits, and groups | Activity type | PRALAB | PRAULA | TEORIA |
| | Number of credits | 0.4 | 2.6 | 3 |
| | Number of groups | 4 | 2 | 1 |
| Coordination | CAMPILLO BETBESE, MANEL | | | |
| Department | INDUSTRIAL AND BUILDING ENGINEERING | | | |
| Teaching load distribution between lectures and independent student work | 40% lectures 60% independent student work | | | |
| Important information on data processing | Consult this link for more information. | | | |
| Language | Catalan Also some material could be in Spanish or English | | | |
| Distribution of credits | Miquel Nogués Aymamí 3 Juan Jose González Fabra 7.2 | | | |

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|---------------------------|---------------------------|---------------------------|------------------------------|
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| GONZALEZ FABRA, JUAN JOSE | juanjose.gonzalez@udl.cat | 6,8 | |

Subject's extra information

It is essential to have studied previously, and it is advisable to have passed the following subjects:

- MATERIALS SCIENCE.
- ELASTICITY AND STRENGTH OF MATERIALS I.

In relation to the safety rules established in laboratories, it is required to state

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Blue laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

<http://www.publicacions.udl.cat/>

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratory gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following information of the *Servei de Prevenció de Riscos Laborals de la UdL*:

- <http://www.prevencio.udl.cat/ca/integracio-a-la-docencia/>
- <http://www.sprl.udl.cat/ca/capsules-formatives/>

Learning objectives

Provide students with the basic knowledge and techniques, tools, skills and abilities to effectively develop professionals activities involved in material knowledge and selection criteria for a given application.

Competences

Cross-disciplinary competences

- **EPS1.** Capacity to solve problems and prepare and defence arguments inside the area of studies.
- **EPS6.** Capacity of analysis and synthesis.

Specific competences

- **GEM25.** Knowledge and capacity for the application of materials engineering.

Subject contents

Unit 0. Introduction
Unit 1. Metrology and material characterization
Unit 2. Crystallography
Unit 3. Phase diagrams
Unit 4. Heat Treatment and Surface Treatments
Unit 5. Classification and selection of materials
Unit 6. Suitable materials for foundry
Unit 7. Coatings and joining Materials: Welding and adhesives
Unit 8. Corrosion

Methodology

Lectures: theoretical contents and proposal and/or resolution of some practical examples. In the 2021-22 academic year, these sessions may be held online using the "Videoconference" tool of the virtual campus (SAKAI).

Problems: Presentation and discussion of problems that will eventually solve by the students in an individual way or in groups.

Group work: Development of a study in groups on a set of different parts to be manufactured.

Practices: 5 laboratory sessions: Material testing, crystallography analysis, heat treatment (Jominy's test), hard coatings and electrochemical corrosion.

Development plan

| Week | Methodology | Unit | Attendance hours | Autonomous work hours |
|-------|----------------------|---|------------------|-----------------------|
| 1 | Lectures | Unit 0: Theory Unit 0: Problems | 2 0 | 0 0 |
| 2 | Lectures Problems | Unit 1: Theory Unit 1: Problems | 2 2 | 3 3 |
| 3 | Lectures Practice | Unit2: Theory Practice 1: Material testing | 2 2 | 3 3 |
| 4 | Lectures Problems | Unit 2: Theory Unit 2: Problems | 2 2 | 3 3 |
| 5 | Lectures Practice | Unit 2: Theory Practice 2: Crystallography | 2 2 | 3 3 |
| 6 | Lectures Problems | Unit 3: Theory Unit 3: Problems | 2 2 | 3 3 |
| 7 | Lectures Problems | Unit 3: Theory Unit 3: Problems | 2 2 | 3 3 |
| 8 | Lectures Problems | Unit 4: Theory Unit 4: Problems | 2 2 | 3 3 |
| 9 | Evaluation | Exam 1 | 2 | 4 |
| 10 | Lectures Problems | Unit 5: Theory Practice 3: Heat treatment | 2 2 | 3 3 |
| 11 | Lectures Problems | Unit 6: Theory Unit 6: Problems | 2 2 | 3 3 |
| 12 | Lectures Problems | Unit 6: Theory Unit 6: Problems | 2 2 | 3 3 |
| 13 | Lectures Problems | Unit 6: Theory Unit 6: Problems | 2 2 | 3 3 |
| 14 | Lectures Problems | Unit 7: Theory Unit 7: Problems | 2 1 | 3 3 |
| 15 | Lectures Practice | Unit 7: Theory Practice 4: Hard coatings | 2 2 | 3 3 |
| 16-17 | Evaluation | Exam 2 | 2 | 4 |
| 18 | Tutoring | Tutoring | 1 | 2 |
| 19 | Evaluation | Recovery exam | 2 | 2 |

Evaluation

Several evaluation activities will be carried out:

- 1st Individual written exam focused on theory/practical work developed along of the midterm. The exam will be done on the date scheduled in the academic calendar (approx. week 9th).

- 2nd individual written exam will assess the part related with the problems carried out until the midterm. The exam will be done just after the 1st exam.
- Attendance at laboratory and experimental parts is mandatory. The student could only get in the laboratory if he/she is wearing the corresponding PPE indicated in the laboratory exercise guidance.
- Several works in groups will be proposed, which must be delivered in the period scheduled for evaluation.
- 3rd individual written exam which will be focused on the theory/practical work developed in the second quarter. The exam will be done on the scheduled date in the academic calendar (approx. week 17th or 18th).
- 4th individual written exam will assess the part related with the problems carried out in the second part of the term. The exam will be done just after the 3rd exam.

The weight established to each evaluation activity, out of a total of 100, is as follows:

| Activity | Weight |
|-----------------|--------|
| 1a written exam | 20 |
| 2a written exam | 20 |
| 3a written exam | 20 |
| 4a written exam | 20 |
| Work in groups | 15 |
| Lab practices | 5 |

Bibliography

"Materials Selection in Mechanical Design", Michael F. Asby, Ed. Elsevier

"Disseny de màquines IV. Selecció de materials", Carles Riba Romeva, Edicions UPC

"Materials. Degradation and its control by Surface Engineering", A. W. Batchelor et al., Imperial Collage Press

"La Ciencia e Ingeniería de Materiales", Donald R. Askeland, Grupo Editorial Iberoamericana

"Materiales para ingeniería 1. Introducción a las propiedades, las aplicaciones y el diseño", Michael f. Ashby i David R. H. Jones. Editorial Reverté

"Materiales para ingeniería 2. Introducción a las propiedades, las aplicaciones y el diseño", Michael f. Ashby i David R. H. Jones. Editorial Reverté