Course guide
295453 - 295TM021 - Integrated Machine Design and Manufacture Projects

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Unit in charge: Barcelona East School of Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering.

Degree: MASTER'S DEGREE IN MECHANICAL TECHNOLOGIES (Syllabus 2024). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JOSE ANTONIO TRAVIESO RODRIGUEZ

Others: Primer quadrimestre:
RAMON JEREZ MESA - Grup: T1
EVA MARTÍNEZ GONZÁLEZ - Grup: T1
JOSE ANTONIO TRAVIESO RODRIGUEZ - Grup: T1

PRIOR SKILLS

Those acquired in the subjects of Machine Design, Manufacturing and Expansion of Graphic Expression

LEARNING RESULTS

Knowledges:
K.06. Identify the most appropriate techniques, components and materials for the development of advanced applications in mechanical engineering.
K.04. Correctly interpret technical documentation related to the design of facilities, processes and products in the context of research and development projects in the mechanical engineering field.
K.03. Recognise the process and product design principles and methods that apply to smart manufacturing systems.

Skills:
S.02. Correctly apply the analytical, computational and/or experimental techniques best suited to the analysis of a case or project in the mechanical field.
S.08. Integrate knowledge from different areas of the mechanical field in the design and development of projects, systems and engineering solutions.
S.05. Critically examine the results of the analysis of a process or product, taking into account the limitations of the techniques used.
S.07. Design flexible production/operation systems to improve the performance of industrial processes.
S.01. Comprehensively apply experimental techniques, calculations, evaluations, appraisals, expert reports, studies, work plans and related tasks in the development of mechanical engineering projects, applying compulsory specifications, regulations and standards at each stage of the process.

Competences:
C.03. Manage the acquisition, structuring, analysis and visualisation of data and information in the mechanical field and critically evaluate the results of this process.
C.01. Recognise the complexity of the economic and social phenomena typical of a welfare society in order to relate welfare to globalisation and sustainability, and use techniques, technology and principles of economics and sustainability in a balanced and compatible way.
C.04. Ensure, within the limits of one's professional competence, compliance with ethical standards, professional guidelines and current legislation regarding fundamental rights, taking into account the goal of reducing inequalities, the gender perspective, and the principles of accessibility, inclusion and non-discrimination in the design of technical solutions and in the management of projects and teams.

TEACHING METHODOLOGY

The subject is based on an eminently practical approach and applied to engineering design and manufacturing projects. For this reason, it will be deployed with practical methodologies and experiences that allow students to be the protagonists of their learning. Specifically, the application of the following methodologies is envisaged:
Project-based learning. The central axis of the subject is based on the work to develop a project related to the design and manufacture of a machine.
Consultation of audiovisual material and highly specialized technical documentation in the field of machine design and manufacturing.
Seminars on specific topics to help the development of the project.

LEARNING OBJECTIVES OF THE SUBJECT

Develop the design and manufacturing process of machine parts.
Implement quality control operations of manufactured elements.
Propose predictive maintenance actions through vibration monitoring.

STUDY LOAD

Type	Hours	Percentage
Self study	96,0	64.00
Hours large group	40,5	27.00
Hours small group	13,5	9.00

Total learning time: 150 h

CONTENTS

Machine Component Design

Description:
Calculation of machine components.
Determination of initial materials for the manufacture of components.
Selection of standardized components such as bearings, screws, friction bearings, springs, gears, etc.
Critical axle speeds.
Lubrication.
Knowledge of European machinery regulations.

Specific objectives:
RA1. Properly select the materials to manufacture the components of a machine.
RA2. Design and calculate the elements that make up a machine.
RA3. Properly select the different standardized elements that make up a machine.
RA4. Correctly apply machine regulations to the design of the different components of a particular machine.

Related activities:
Seminars and group work sessions

Full-or-part-time: 54h 30m
Theory classes: 18h
Laboratory classes: 4h 30m
Self study : 32h

Manufacture of the machine components

Description:
Representation in manufacturing drawings and other technical documentation.
Calculation of ISO normalized fits between parts.
Selection of the manufacturing processes of the different components of the machine.
Planning manufacturing routines and machining route sheets.
Design and calculation of manufacturing processes.
Manufacturing of prototypes.

Specific objectives:
RA5. Correctly develop manufacturing plans and additional technical documentation to be able to communicate technically, for the proper development of a desired manufacturing process.
RA6. Apply to a product technical concepts such as the need to design and manufacture with tolerances, the correct definition of adjustments between pieces and the correct definition of the different parameters that define the surface state of a piece, in terms of roughness and texture.
RA7. Decide the process(es) necessary to manufacture a part, based on different technological requirements.
RA8. Calculate the technical parameters necessary to carry out a manufacturing process of a mechanical component.
RA9. Calculate the economic parameters associated with the manufacturing process of a mechanical component.
RA10. Select the machinery necessary to carry out the different manufacturing processes of a part.

Related activities:
Seminars and group work sessions

Full-or-part-time: 54h 30m
Theory classes: 18h
Laboratory classes: 4h 30m
Self study : 32h

Quality control and maintenance

Description:
Advanced metrology and quality control.
Vibrations for predictive maintenance.

Specific objectives:
RA11. Implement the activities necessary to carry out quality control of the manufactured parts.
RA12. Propose predictive maintenance actions to detect failures in machine elements during operation through vibration monitoring.

Related activities:
Seminars and group work sessions

Full-or-part-time: 54h 30m
Theory classes: 18h
Laboratory classes: 4h 30m
Self study : 32h

GRADING SYSTEM

The final grade is the result of the weighted average of different evaluation elements:
Integrative project of the learning outcomes defined for the subject: 60%
Grade for practical work and proposed activities in class: 40%
The final grade cannot be modified by an ulterior additional evaluation test.

BIBLIOGRAPHY

Basic:
- Groover, Mikell P. Fundamentos de manufactura moderna : materiales, procesos y sistemas [on line]. 3a ed. Mèxic D. F: McGraw-Hill, cop. 2007 [Consultation: 18/09/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/reader.action?docID=4585363. ISBN 9781456215439.
- Gibson, Ian; Rosen, David W; Stucker, Brent. Additive Manufacturing Technologies : Rapid Prototyping to Direct Digital Manufacturing [on line]. 1st ed. 2010. New York, NY: Springer US, 2010 [Consultation: 18/09/2024]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-1-4419-1120-9. ISBN 9786612836695.

RESOURCES

Other resources:
1. Blackboard.
2. Reading articles, technical notes and standards.
3. PowerPoint presentation or similar used in seminars.
4. Videos.
5. Teaching intranet: Digital campus.