Course guide
3200512 - TDMM2 - Theory and Design of Machines and Mechanisms II

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 MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

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

LECTURER

Coordinating lecturer: Miquel Sararols Figueras

Others: Miquel Sararols Figueras

PRIOR SKILLS

It is highly advisable to have taken Elasticity, Strength of Materials and mainly TDMM I. Some of the exercises proposed are a continuation of those solved in that last course.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. MEC: Skills for the calculation, design and testing of machines.

Transversal:
3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

Sessions in a large group will introduce the theoretical foundations of the subject, concepts, methods, and results, along with examples to facilitate their comprehension
Students are expected to study autonomously to assimilate the concepts, and in medium group sessions, they will solve the proposed exercises/questions with the guidance of the instructor.

LEARNING OBJECTIVES OF THE SUBJECT

Evaluate the evolution of stress experienced by machine components over time.
Understand the effect of fatigue on machine failure, and evaluate it in non-commercial components.
Identify the failure criteria in commercial machine elements.
Interpret catalogs of commercial machine elements.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Hours medium group	15,0	10.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

Fatigue failure

Description:
Fatigue testing, S-n curve.
Modifying factors, mean and alternating stress.
Goodman diagram, working cycles.

Full-or-part-time: 38h
Theory classes: 8h
Practical classes: 8h
Self study : 22h

Bearings and bearing seats

Description:
Types of bearings and bushings.
Loads during operation and assembly.
Fatigue in bearings and wear in bushings.

Full-or-part-time: 25h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

Gears, reducers

Description:
Transmission between gear wheels, involute profile.
Gears, dimensions and contact forces.
Types of gear reducers, features and performance.

Full-or-part-time: 30h
Theory classes: 6h
Practical classes: 6h
Self study : 18h

Belt drives and chain drives

Description:
Loaded and unloaded branches, forces and stresses.
Types of belts: flat, trapezoidal, and toothed; performance characteristics.
Elements comprising chain drives.

Full-or-part-time: 30h
Theory classes: 6h
Practical classes: 6h
Self study : 18h

Dismountobel joints, screws

Description:
Dimensions and graphical representation of threads.
Elements of detachable unions.
Forces on the elements; sizing.

Full-or-part-time: 27h
Theory classes: 5h
Practical classes: 5h
Self study : 17h

GRADING SYSTEM

The final grade, FG, will be obtained as follows:NF = 0,2 Theory + 0,8 Problems
Theory = max(0,5 TM + 0,5 TF, 0,25 TM + 0,75 TF) and Problems = max(0,5 PM + 0,5 PF, 0,25 PM + 0,75 PF)
TM and PM : Theory and Problems sections of the Midterm exam
TF and PF : Theory and Problems sections of the Final exam.

Students who meet the requirements and take the reevaluation exam will have their grade capped at a maximum of 5, and the grade obtained will replace NF if it is higher.

EXAMINATION RULES.

The exams will consist of a first section of theory (short questions) and a second section of problems. For the exams, in addition to basic writing tools, in the problem section, a calculator, an A4 formula sheet (it is recommended to be handwritten), and, if applicable, tables specified by the professor can also be used.

BIBLIOGRAPHY

Basic:
- Avilés, Rafael. Métodos de cálculo de fatiga para ingeniería. Madrid: Paraninfo, cop. 2015. ISBN 8428335184.
- Budynas, Richard G; Nisbett, J. Keith. Diseño en ingeniería mecánica de Shigley [on line]. Décima edición. Ciudad de México: McGraw-Hill, 2019 [Consultation: 24/04/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5485813. ISBN 9781456262112.
- Norton, Robert L. Diseño de maquinaria: síntesis y análisis de máquinas y mecanismos. 6a ed. Aravaca: McGraw Hill/Interamerica de España, S.L, [2020]. ISBN 9788448620998.

Complementary:
- Decker, Karl-Heinz; Miguel Uñon, Enrique de. Elementos de máquinas. Bilbao: Urmo, S.A. de Ediciones, 1980. ISBN 8431403403.
- Decker, Karl-Heinz. Elementos de unión. Bilbao: Urmo, 1980. ISBN 8431403438.

- Larburu Arrizabalaga, Nicolás. Máquinas: prontuario: técnicas, máquinas, herramientas. 4ª ed., corr. y ampl. Madrid: Paraninfo, 1992. ISBN 8428319685.
- Shigley, Joseph Edward; Uicker, John Joseph. Teoría de máquinas y mecanismos. México [etc.]: McGraw-Hill, 1982. ISBN 968451297X.

RESOURCES

Other resources:
Presentations provided by the instructor in the theoretical sessions, available at ATENEA.
List of questions and problems, available at ATENEA.