Course guide
3200511 - TDMM1 - Theory and Design of Machines and Mechanisms I

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 Mechanical Systems.

REQUIREMENTS

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 performance of a machine, both in steady state and transient state; irregularities.
Interpret machine/mechanism diagrams.
Analyze mechanisms, both kinematically and dynamically, and understand their mechanical characteristics.
Understand the concept of unbalance mechanism/machine and the systems used to regulate it.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Hours medium group	30,0	20.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

Introduction

Description:
System of study
Forces, energy and power.
Vector and energy theorems.

Full-or-part-time: 8h
Theory classes: 2h
Practical classes: 2h
Self study : 4h

Machine

Description:
Concept of machine.
Motor, transmission, and receiver.
Performance and behavior; irregularity.

Full-or-part-time: 25h
Theory classes: 4h
Practical classes: 4h
Self study : 17h

Mechanisms description

Description:
Bodies and links.
Degrees of freedom and redundancies.
Kinematic inversions.

Full-or-part-time: 18h
Theory classes: 4h
Practical classes: 4h
Self study : 10h

Analysis of mechanisms, positions

Description:
Generalized coordinates.
Link equations, dead points, and bifurcations.
Holonomic and non-holonomic systems.

Full-or-part-time: 25h
Theory classes: 4h
Practical classes: 4h
Self study : 17h

Velocities and accelerations

Description:
Kinematic analysis.
Velocities and accelerations of points and solids.
Graphical methods; IcR.

Full-or-part-time: 27h
Theory classes: 6h
Practical classes: 6h
Self study : 15h

Forces and torques

Description:
Dynamic analysis; internal, external, and constraint forces.
Physical properties of solids.
Friction and rolling conditions.

Full-or-part-time: 29h
Theory classes: 6h
Practical classes: 6h
Self study : 17h

Balance of mechanisms

Description:
Imbalance of a mechanism.
Static and dynamic balancing.

Full-or-part-time: 18h
Theory classes: 4h
Practical classes: 4h
Self study : 10h

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:
- Shigley, Joseph Edward. Teoria de máquinas y mecanismos. México: McGraw-Hill, 1982. ISBN 968451297X.
- Cardona i Foix, Salvador; Clos Costa, Daniel. Teoria de máquinas [on line]. 2a ed. Barcelona: Edicions UPC, 2008 [Consultation: 23/04/2024]. Available on: http://hdl.handle.net/2099.3/36645. ISBN 9788483019627.
- Norton, Robert L. Diseño de maquinaria: síntesis y análisis de máquinas y mecanismos. 6ª ed. Aravaca: McGraw Hill/Interamerica de España, [2020]. ISBN 9788448620998.

RESOURCES

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