



## Course guides

# 3200511 - TDMM1 - Theory and Design of Machines and Mechanisms I

Last modified: 29/05/2020

**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:** 2020    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

### LECTURER

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**Coordinating lecturer:** Rafel Sitjar

**Others:**

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**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

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- Face-to-face lectures and problem solving sessions.
- Independent learning and exercises.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding.

Students will be expected to study in their own time so that they are familiar with concepts are able to solve the exercises set.

The transversal piece of work on the course will concentrate on the study of an object, machine or real mechanism. It will be completed outside of class time in groups.

### LEARNING OBJECTIVES OF THE SUBJECT

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In the subject, students will become familiar with and apply the concepts covered in Mechanical Systems, Elasticity and Strength of Materials.

### STUDY LOAD

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

**Total learning time:** 150 h



## CONTENTS

### TOPIC 1: INTRODUCTION

**Description:**

- Introduction to the study of mechanisms.
- Nomenclature used in the field.
- Definition of basic mechanical elements.
- Combination of mechanical elements.

**Full-or-part-time:** 5h

Theory classes: 2h

Self study : 3h

### TOPIC 2: Degrees of freedom

**Description:**

- Definition of degree of freedom.
- Application to basic mechanical elements.
- Calculation criteria for planar mechanisms.
- Application.

**Full-or-part-time:** 5h

Theory classes: 2h

Self study : 3h

### TOPIC 3: KINEMATIC INVERSION

**Description:**

- Nature of thermal radiation.
- Black-body radiation. Fundamental Laws.
- Radiation properties of real physical bodies.
- Radiation exchange between surfaces. View factor. Methods in calculus.

**Full-or-part-time:** 10h

Theory classes: 4h

Self study : 6h

### TOPIC 4: DESCRIPTION OF MECHANISMS

**Description:**

- Classification.
- Composition.
- Geometric limitations.
- Paths.
- Dead points.
- Equations of motion.

**Full-or-part-time:** 20h

Theory classes: 8h

Self study : 12h



#### TOPIC 5: SPEED AND ACCELERATION

**Description:**

- Reference systems.
- Graphical analysis.
- VECTOR CALCULUS.
- Sliding and non-sliding mechanisms.

**Full-or-part-time:** 40h

Theory classes: 16h

Self study : 24h

#### TOPIC 6: FORCES AND TORQUES IN MACHINES

**Description:**

- External forces.
- External moments.
- Internal forces.
- Moments of inertia.
- Reduced mass.

**Full-or-part-time:** 20h

Theory classes: 8h

Self study : 12h

#### TOPIC 7: BALANCING OF MECHANISMS

**Description:**

- Balancing of masses in a common radial plane.
- Balancing of masses in a common axial plane.
- General case.
- Balancing of masses in alternating motion.
- Balancing of multiple alternating masses.

**Full-or-part-time:** 30h

Theory classes: 12h

Self study : 18h

#### TOPIC 8: REGULATION OF MECHANISMS

**Description:**

- Degree of irregularity of machines.
- Flywheel calculation.
- Equivalent inertia of mechanisms.
- Flywheel placement.
- Starting torque.

**Full-or-part-time:** 30h

Theory classes: 12h

Self study : 18h

## GRADING SYSTEM

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The acquisition of knowledge, competencies and skills will be assessed based on:

- Assessment examination: 50%
- Final examination: 50%

For those students that have failed the first test, there will be a recovery question coinciding with the final exam. The maximum recovery mark will be 5 and it will only substitute the previous mark if it is higher.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

## EXAMINATION RULES.

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Students will be expected to have taken and preferably passed the following subjects: Mechanical Systems, Elasticity and Strength of Materials.

## BIBLIOGRAPHY

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### Basic:

- Shigley, Joseph Edward. Diseño en ingeniería mecánica. 6a ed. México: McGraw-Hill, 2002. ISBN 9701036468.
- Shigley, Joseph Edward. Teoría de máquinas y mecanismos. México: McGraw-Hill, 1982. ISBN 968451297X.
- Decker, Karl-Heinz. Elementos de máquinas. Bilbao: Urmo, 1980. ISBN 8431403403.
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- Mabie, Hamilton H. Mecanismos y dinámica de maquinaria. 2a ed. México: Limusa, 1998. ISBN 9681849264.
- Norton, Robert L. Diseño de maquinaria: síntesis y análisis de máquinas y mecanismos [on line]. 4a ed. México: McGraw-Hill, 2008 [ Consultation : 09/11/2020 ]. Available on : [https://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=5701](https://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=5701). ISBN 9789701068847.
- Norton, Robert L. Diseño de máquinas. México: Prentice-Hall Hispanoamericana, 1999. ISBN 9701702573.