



Course guide

320010 - SM - Mechanical Systems

Last modified: 28/07/2026

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Pàmies Gómez, Teresa

Others: Clot Razquin, Arnau
Quintero Perez, Guillermo

En algun grup o en alguna part de l'assignatura la docència pot ser en castellà. Consultar idioma d'impartició als horaris.
En algún grupo o parte de la asignatura la docencia puede ser en castellano. Consultar idioma de impartición en horarios.
For some groups or parts of the course, instruction may be in Spanish. Please check the timetables for the language of instruction.

PRIOR SKILLS

Students should be familiar with those concepts on statics and dynamics presented in Physics.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CE13-INDUS. Knowledge of the principles of machine theory and mechanisms. (Common module in the industrial branch)

CE14-INDUS. Knowledge and use of principles of material resistance. (Common module in the industrial branch)

Generical:

CG05-INDUS. Knowledge for carrying out measurements, calculations, valuations, appraisals, expert opinions, studies, reports, work plans, and other similar tasks.

TEACHING METHODOLOGY

- Theoretical lectures and problem solving sessions.
- Autonomous work on the course theoretical concepts and proposed exercises.
- Preparation and completion of group activities subject to assessment.

The theoretical lectures will introduce the basic fundamentals of the subject, concepts, methods and results, which will be illustrated with relevant examples to facilitate their understanding.

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

Tools found on the ATENEA platform will be used to foster collaborative learning.

The group project of the course will be focused on the study of a realistic mechanical system.

LEARNING OBJECTIVES OF THE SUBJECT

- Provide students with the knowledge that will enable them to determine the characteristic parameters of a mechanical system.
- Examine the characteristic elements of the systems of forces, with the aim of applying them in statics and dynamics.
- To model applied forces and interaction forces to draw free body diagrams.
- Understand the kinematics and dynamics of simple mechanisms and the basic concepts behind them.
- Apply the acquired concepts to the study of mechanical systems.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

INTRODUCTION

Description:

Overview of basic concepts of mechanics:

- Newton's laws.
- Vector study.
- Statics of particles.

Specific objectives:

- Introduction to the subject, learning objectives, syllabus, assessment system and reading list.
- Introduction of the basic concepts of mechanics.
- Overview of all the vector concepts required to follow the subject.

Full-or-part-time: 6h

Theory classes: 2h

Self study : 4h

BEAMS

Description:

Study of the static equilibrium of a beam under the action of point and distributed loads.

Specific objectives:

- Study of the internal forces that support beams.
- Sketch of bending moment and shear stress diagrams.

Related activities:

ACTIVITY 1

Related competencies :

CE13-INDUS. Knowledge of the principles of machine theory and mechanisms. (Common module in the industrial branch)

CE14-INDUS. Knowledge and use of principles of material resistance. (Common module in the industrial branch)

Full-or-part-time: 32h

Theory classes: 6h

Practical classes: 6h

Self study : 20h

STATICS OF RIGID BODIES

Description:

Study of the static equilibrium of a system composed of rigid bodies.

Specific objectives:

- Study of the conditions of equilibrium of a system of rigid bodies.
- Type of forces applied.
- Determination of bonding actions.
- Sketch of free body diagrams.
- Study of the internal forces inside a rigid body.
- Application to practical cases.

Related activities:

ACTIVITY 2

Related competencies :

CE13-INDUS. Knowledge of the principles of machine theory and mechanisms. (Common module in the industrial branch)

Full-or-part-time: 46h

Theory classes: 10h

Practical classes: 12h

Self study : 24h

KINEMATICS AND DYNAMICS OF RIGID BODIES

Description:

Introduction to plane kinematics and dynamics. Application of the presented concepts to the study of different types of mechanical systems.

Specific objectives:

- Methodology for calculating velocity and acceleration.
- Determination of the dynamic forces that arise in mechanical systems with motion.

Related activities:

ACTIVITY 4

ACTIVITY 3

Related competencies :

CE13-INDUS. Knowledge of the principles of machine theory and mechanisms. (Common module in the industrial branch)

Full-or-part-time: 66h

Theory classes: 12h

Practical classes: 12h

Self study : 42h

ACTIVITIES

ACTIVITY 1

Description:

Development of the first exam of the subject.

Specific objectives:

Apply the concepts acquired in the theoretical and practical lessons, showing the level of understanding acquired. Be able to solve the exam paper in the established time.

Material:

Exam paper.

Delivery:

This activity is the first written test in the global mark of the subject.

Related competencies :

CE13-INDUS. Knowledge of the principles of machine theory and mechanisms. (Common module in the industrial branch)

CE14-INDUS. Knowledge and use of principles of material resistance. (Common module in the industrial branch)

Full-or-part-time: 2h

Theory classes: 2h

ACTIVITY 2

Description:

Development of the second exam of the subject.

Specific objectives:

Apply the concepts acquired in the theoretical and practical lessons, showing the level of understanding acquired. Be able to solve the exam paper in the established time.

Material:

Exam paper.

Delivery:

This activity is the second written test in the global mark of the subject.

Related competencies :

CE13-INDUS. Knowledge of the principles of machine theory and mechanisms. (Common module in the industrial branch)

Full-or-part-time: 2h

Theory classes: 2h

ACTIVITY 3

Description:

Development of the third exam of the subject.

Specific objectives:

Apply the concepts acquired in the theoretical and practical lessons, showing the level of understanding acquired. Be able to solve the exam paper in the established time.

Material:

Exam paper.

Delivery:

This activity is the third written test in the global mark of the subject.

Full-or-part-time: 2h

Theory classes: 2h

ACTIVITY 4

Description:

Prepare a technical report and do an oral exposition of the analysis of a mechanical system proposed by the course lecturers.

Specific objectives:

That the student learns to use strategies for preparing and giving oral presentations, writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors. Participate on working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Material:

Bibliographical resources of the subject, class notes, rubric of the efficient oral and written communication.

Delivery:

Technical report that follows the requirements specified by the lecturers. The technical report and the oral presentation are evaluated together.

Related competencies :

CE13-INDUS. Knowledge of the principles of machine theory and mechanisms. (Common module in the industrial branch)

Full-or-part-time: 28h

Practical classes: 2h

Self study: 26h

THEORETICAL LECTURES

Description:

Lectures to establish the theoretical principles of the subject.

Specific objectives:

To learn the theoretical principles of the subject.

Material:

Lecture notes on Atenea platform.

Full-or-part-time: 48h

Theory classes: 24h

Self study: 24h

PROBLEM SOLVING LECTURES

Description:

Problem-solving lectures.

Specific objectives:

Practice the resolution of problems proposed by the lecturers.

Material:

Lists of proposed problems on Atenea platform.

Full-or-part-time: 68h

Practical classes: 28h

Self study: 40h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the [Action Framework for Academic Integrity in Assessment at the UPC](#).

- Written tests 80%: First exam (Activity 1) 20%, Second exam (Activity 2) 20%, Third exam (Activity 3) 40%.
- Course project (Activity 4): 20%.
- Cross-competence (effective oral and written communication) embedded in the course project activity (Activity 4).

For those students who meet the requirements and take the reevaluation exam, the grade of this exam will replace the grades of the Activities 1, 2 and 3, keeping the grade of Activity 4.

If the final grade after reevaluation is lower than 5.0, it will replace the initial grade 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 5.0 (Pass).

EXAMINATION RULES.

- The course exams are taken without class notes.
- The first exam of the subject will be held during class time along the course.
- The second exam of the subject will be held during the period of partial exams.
- The third exam of the subject will be held during the period of final exams.

BIBLIOGRAPHY

Basic:

- Hibbeler, R. C. Mecánica vectorial para ingenieros: estática. 10a ed. México: Pearson Educación, 2004. ISBN 9702605016.
- Meriam, J. L. Mecánica para ingenieros. Vol. 1, Estática [on line]. 3a ed. Barcelona: Reverté, 2004 [Consultation: 11/05/2022]. Available on : <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5635461>. ISBN 8429142576.
- Meriam, J. L. Mecánica para ingenieros. Vol. 2, Dinámica [on line]. 3a ed. Barcelona: Reverté, 1998 [Consultation: 24/11/2021]. Available on : <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5635460>. ISBN 8429142592.
- Beer, Ferdinand P.; Johnston, E. Russell. Mecánica vectorial para ingenieros. 13ª ed. México: McGraw-Hill, 2026. ISBN 9786071529435.

RESOURCES

Other resources:

Theory slides and problems collections available on ATENEA.