Course guide
330124 - MTM - Mechanics and Mechanism Theory

Last modified: 03/09/2026

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

Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Optional subject).

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

LECTURER

Coordinating lecturer: JOSE IGNACIO ALCELAY LARRION

Others: José Ignacio Alcelay Larrión
Pau Català Calderón
Martinez Cano, Ferran

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Must be able to assess the degrees of freedom of a machine, and its quality.
2. Must be able to analytically calculate the speeds and accelerations of the most common mechanisms.

Transversal:
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
4. 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

LEARNING OBJECTIVES OF THE SUBJECT

To ensure that students acquire sufficient theoretical and practical knowledge of the topics covered in this course so that they can apply them as effectively as possible in their profession

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

(ENG) Títol del contingut 1: Geometria del moviment pla

Description:
Analysis and synthesis. Kinematic pairs. Kinematic chains. Machines, mechanisms, and structures. Degrees of freedom and mobility. Grübler's criterion. Assur groups. Grashof's law. Kinematic inversions, transmission angle, and mechanical advantage.

Specific objectives:
Understand the fundamentals of kinematic pairs and chains.
Analyze the mobility and degrees of freedom of mechanisms.
Apply kinematic analysis and synthesis criteria to simple mechanisms.
Evaluate mechanical behavior using Grashof's law and mechanical advantage.

Related activities:
A 1, A 7 y A 9.

Full-or-part-time: 23h
Theory classes: 2h
Practical classes: 4h
Laboratory classes: 2h
Self study : 15h

(ENG) Títol del contingut 2: Anàlisis de velocitats

Full-or-part-time: 30h
Theory classes: 2h
Practical classes: 6h
Laboratory classes: 2h
Self study : 20h

(ENG) Títol del contingut 3: Acceleracions

Full-or-part-time: 34h
Theory classes: 4h
Practical classes: 6h
Laboratory classes: 4h
Self study : 20h

(ENG) Títol del contingut 4: Moviment relatiu

Full-or-part-time: 34h
Theory classes: 2h
Practical classes: 8h
Laboratory classes: 4h
Self study : 20h

(ENG) Títol del contingut 5: Mecanismes en l'espai

Full-or-part-time: 29h
Theory classes: 5h
Practical classes: 6h
Laboratory classes: 3h
Self study : 15h

ACTIVITIES

ACTIVITY 1: PRACTICUM AND PROBLEM SOLVING

Description:
The activity consists of identifying the different kinematic pairs and the schematic representation of mechanisms.

Specific objectives:
By the end of this activity, students should be able to:
Identify and analyze the most commonly used types of kinematic pairs. Represent schematically the different mechanisms used in practice and determine their degrees of freedom and kinematic inversions.

Material:
Practice Guide (available on the Digital Campus). Lecturer's notes.

Delivery:
Students must prepare, in groups (1–5 people), a report on the practical session according to the given instructions and submit it to the lecturer within the deadline established for each practice.

The assessment of this activity, together with other activities, will form part of the evaluation process as specified in the corresponding section of the course guide.

Full-or-part-time: 5h
Laboratory classes: 2h
Self study: 3h

ACTIVITY 2: PRÀCTICA DE LABORATORI

Full-or-part-time: 6h
Laboratory classes: 3h
Self study: 3h

ACTIVITY 3: PRÁCTICUM AND EXERCICES

Full-or-part-time: 5h
Laboratory classes: 2h
Self study: 3h

ACTIVITY 4: PRÀCTICA DE LABORATORI

Full-or-part-time: 6h
Laboratory classes: 3h
Self study: 3h

ACTIVITY 5: PRÀCTICA DE LABORATORI

Full-or-part-time: 6h
Laboratory classes: 3h
Self study: 3h

(ENG) TÍTOL DE L'ACTIVITAT 7: PRIMERA PROVA INDIVIDUAL D'AVALUACIÓ CONTINUA

Full-or-part-time: 12h
Theory classes: 2h
Self study: 10h

(ENG) TÍTOL DE L'ACTIVITAT 8: SEGONA PROVA INDIVIDUAL D'AVALUACIÓ CONTINUA

Full-or-part-time: 13h
Theory classes: 3h
Self study: 10h

(ENG) TÍTOL DE L'ACTIVITAT 9: PROVA FINAL

Full-or-part-time: 18h
Theory classes: 3h
Self study: 15h

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**.

BIBLIOGRAPHY

Basic:

- Alcelay Larrión, José Ignacio; Al Omar, Anas; Peña Pitarch, E; Català, Pau. Cinemática y dinámica de máquinas y mecanismos : ejercicios resueltos [on line]. Primera edición. Barcelona: Iniciativa Digital Politècnica. Oficina de Publicacions Acadèmiques Digitals de la UPC, junio de 2023 [Consultation: 05/06/2024]. Available on: https://upcommons.upc.edu/handle/2117/388501. ISBN 9788419184788.
- Beer, Ferdinand P., i altres. Mecánica vectorial para ingenieros. Vol. 1, Estática [on line]. 11a ed. México: McGraw-Hill Education, 2017 [Consultation: 08/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8077. ISBN 9781456255275.
- Beer, Ferdinand P., i altres. Mecánica vectorial para ingenieros. Vol. 2, Dinámica [on line]. 11a ed. México: McGraw-Hill Education, 2017 [Consultation: 08/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8078. ISBN 9781456255268.
- Cardona, Salvador; Clos, Daniel. Teoria de màquines [on line]. 2a. Barcelona: Edicions UPC, 2008 [Consultation: 14/05/2025]. Available on: https://upcommons.upc.edu/handle/2099.3/36644. ISBN 9788498803792.
- Uicker, J. J.; Pennock, G. R.; Shigley, J.E. Theory of machines and mechanisms. 4th ed. New York: Oxford University Press, 2011. ISBN 9780199777815.
- Norton, Robert L. Machine design: an integrated approach [on line]. 4a ed. Boston: Pearson, 2011 [Consultation: 12/09/2025]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=12312. ISBN 9780131384385.
- Mabie, Hamilton H.; Reinholtz, Charles F. Mecanismos y dinámica de maquinaria. 2a ed. México: Limusa, 1998. ISBN 9681849264.
- Calero Pérez, R.; Carta González, J. A. Fundamentos de mecanismos y máquinas para ingenieros. Madrid: McGraw-Hill, 1999. ISBN 844812099X.

Complementary:

- Khamashta, M.; Álvarez, L.; Capdevila, R. Problemas de cinemática y dinámica de máquinas. Vol. 1, Problemas resueltos de cinemática de mecanismos planos. 2a ed. Terrassa: Departament d'Enginyeria Mecànica, 1993. ISBN 847653003X.
- Khamashta, M.; Alvarez, L.; Capdevila, R. Problemas de cinemática y dinámica de máquinas. Vol 2, Problemas resueltos de dinámica de mecanismos planos. 2a ed. Terrassa: Departament d'Enginyeria Mecànica, 1993. ISBN 847653003X.
- Bertran Bertran, Juan M. Cinemática y dinámica de máquinas: teoría y problemas resueltos. Manresa: Universitat Politècnica de Barcelona, Escola Universitària Politècnica, 1983.
- Suñer Martínez, Josep-Lluís, i altres. Problemas resueltos de teoría de máquinas y mecanismos. Valencia: Universidad Politécnica de Valencia, 2001. ISBN 8497050142.
- García Prada, J. C., i altres. Problemas resueltos de teoría de máquinas y mecanismos. 2a ed. Madrid: Thomson, 2014. ISBN 9788428334426.
- Hernández, Alfonso. Cinemática de mecanismos: análisis y diseño. Madrid: Síntesi, 2004. ISBN 8497562240.