Course guide
320140 - DM - Mechanism Design

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

Degree:	BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Compulsory subject).

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

LECTURER

Coordinating lecturer:	Albert Català.
Others:	Rafael Sitjar. Catalan Artigas, Albert

PRIOR SKILLS

Students should be complete courses in mechanics systems and Elastic and Strength of materials, even desirable that the student had passed them.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CED05-DIDP. Ability to perform and analyze experimental tests on mechanisms and resistant elements. (Common module for the industrial branch).
CED07-DIDP. Ability to simulate and design mechanisms as a solution to a specific mechanical problem. (Common module for the industrial branch).
CED08-DIDP. Ability to size and select machine elements and structures. (Common module for the industrial branch).
CED09-DIDP. Ability to analyze and solve problems in the design of machines and mechanisms. (Common module for the industrial branch).

Transversal:
CT04 N2. Teamwork - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favour communication, task assignment and cohesion.

TEACHING METHODOLOGY

Students should be complete courses in Mechanics Systems and Elastic and Strength of materials, even desirable that the student had passed them.

LEARNING OBJECTIVES OF THE SUBJECT

To know and to understand all the concepts learnt in Mechanics Systems and Elastic and Strength of materials.
To solve kinematic and dynamic problems

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

TOPIC 1: Introduction and degrees of freedom

Description:
· Introduction to the study of the mechanisms
· Nomenclature used.
· Definition of basic mechanical elements.
· A combination of mechanical elements.
· Degrees of freedom definition
· Application of mechanical principles.
· Calculation criteria mechanisms plan.
· Application.

Related activities:
· Terminology normally used
· Conventions used
· Schematic representation
· Determine mobility mechanisms

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

TOPIC 2: Inverse Kinematics

Description:
· Concept.

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

TOPIC 3: Mechanisms Description

Description:
· Classification
· Composition
· Geometric limitations
· Trajectories
· Deadlocks
· Equations of motion

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

TOPIC 4: Velocities and accelerations

Description:
· Reference systems
· Graphic Analysis
· Vector calculus
· Mechanisms with and without sliding

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

TOPIC 5: Forces and couples in machines

Description:
· External forces
· External moments
· Internal forces
· Moments of Inertia
· Reduced mass

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

TOPIC 6: Balance of Mechanisms

Description:
· Mass balance in a common radial plane
· Mass balance in a common axial plane
· General situation
· Alternative masses balance

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

TOPIC 7: Regulation of mechanisms

Description:
· Grades of irregularity
· Calculating the flywheel
· Equivalent inertia of mechanisms
· Location of the flywheel
· Starting torque

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

TOPIC 8: Stress state

Description:
· Definition
· Simple stress state
· Distribution of stresses in the interior parts
· Representation of the stress state
· Principal stresses
· Mohr Circle

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

TOPIC 9: Breaking theories

Description:
· Definition and limitations
· Safety factor
· Theory of the maximum normal stress
· Theory of the maximum tangential stress
· Theory of the maximum energy of distortion
· Applications

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

TOPIC 10: Fatigue of materials I

Description:
· Wöhler tests Machine
· Finite life and infinite life
· Soderberg and Goodman diagrams

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

TOPIC 11: Fatigue of materials II

Description:
· Coefficients that modify the fatigue strength
· Soderberg and Goodman diagrams
· Determination of the equations

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

TOPIC 12: Machines elements

Description:
· Calculation of axis
· Calculation of bolted joints

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

TOPIC 13: Activities done in a company

Description:
· Practical case about the analysis of a mechanical project
· The mechanical analysis tools

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

TOPIC 14: Activities done in a company

Description:
· Practical case about designing a mechanical project

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

TOPIC 15: Activities done in a company

Description:
· Practical case about the analysis of a mechanical project
· The mechanical analysis tools

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

GRADING SYSTEM

- Exam 1: 25%
- Exam 2: 25%
- Exam 3: 25%
- Exam 4: 25%

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.

BIBLIOGRAPHY

Basic:

- Mabie, Hamilton H.; Reinholtz, Charles F. Mecanismos y dinámica de maquinaria. 2ª ed. México: Limusa, 1998. ISBN 9681845676.
- Shigley, Joseph Edward; Mischke, Charles R. Diseño en ingenieria mecánica. 6ª ed. México [etc.]: McGraw-Hill, cop. 2002. ISBN 9701036468.
- Shigley, Joseph Edward; Uicker, John Joseph. Teoría de máquinas y mecanismos. México [etc.]: McGraw-Hill, 1982. ISBN 968451297X.
- Decker, Karl-Heinz. Elementos de máquinas. Bilbao: Urmo, DL 1980. ISBN 8431403403.
- Norton, Robert L; Sánchez García, Gabriel. Diseño de máquinas. México [etc.]: Prentice-Hall Hispanoamericana, 1999. ISBN 9701702573.
- Norton, Robert L. Diseño de maquinaria: síntesis y análisis de máquinas y mecanismos. 6a ed. Aravaca: McGraw-Hill, 2020. ISBN 9788448620998.