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320140 - DM - Mechanism Design

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering

Teaching unit: 712 - EM - Department of Mechanical Engineering

Academic year: 2019

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

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: 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

Transversal:

1. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
3. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.
4. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor 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

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Study load

Total learning time: 150h	Hours large group:	30h	20.00%
	Hours medium group:	0h	0.00%
	Hours small group:	30h	20.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

TOPIC 1: Introduction and degrees of freedom

Learning time: 4h
Theory classes: 2h
Practical classes: 2h

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

TOPIC 2: Inverse Kinematics

Learning time: 4h
Theory classes: 2h
Practical classes: 2h

Description:
· Concept.

TOPIC 3: Mechanisms Description

Learning time: 4h
Theory classes: 2h
Practical classes: 2h

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

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TOPIC 4: Velocities and accelerations	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

TOPIC 5: Forces and couples in machines	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

TOPIC 6: Balance of Mechanisms	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

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TOPIC 7: Regulation of mechanisms	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

TOPIC 8: Stress state	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

TOPIC 9: Breaking theories	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

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TOPIC 10: Fatigue of materials I	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

TOPIC 11: Fatigue of materials II	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

TOPIC 12: Machines elements	Learning time: 4h Theory classes: 2h Practical classes: 2h

Description:
· Calculation of axis
· Calculation of bolted joints

TOPIC 13: Activities done in a company	Learning time: 4h Theory classes: 2h Practical classes: 2h

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

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TOPIC 14: Activities done in a company	Learning time: 4h Theory classes: 2h Practical classes: 2h
Description: · Practical case about designing a mechanical project	

TOPIC 15: Activities done in a company	Learning time: 4h Theory classes: 2h Practical classes: 2h
Description: · Practical case about the analysis of a mechanical project · The mechanical analysis tools	

Qualification 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.

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Bibliography

Basic:

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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; Rios Sánchez, Miguel A. Diseño de maquinaria : síntesis y análisis de máquinas y mecanismos. 4a ed. México [etc.]: McGraw-Hill, cop. 2008. ISBN 9789701068847.