Course guide
340636 - FOME-R1P12 - Mechanical Fundamentals

Last modified: 17/05/2023

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering.

Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: Maurici Sivatte

Others: Maurici Sivatte

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. CC09 - Identify the symbols of mechanical systems and obtain the knowledge to determine the number of drives that will allow the desired movement of the system.

Transversal:
1. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

TEACHING METHODOLOGY

Classes of theory and problems
Lab.

LEARNING OBJECTIVES OF THE SUBJECT

Mechanical systems are the material basis of automation, per therefore an Automàtica i ingieniero in industrial electronics, must understand their movimento, transmission and causes that generate it. The objective of this course is to convey to students these skills.
This includes:
Know the symbology of the mechanical systems and obtain the knowledge to be able to determine the number of drives that will make possible the desired movement of the system.
Know the main elements of machines and know how to analyze their operation.
Acquire the ability to generate and solve the equations of motion for multi-body mechanical systems.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	33.33
Hours large group	30,0	66.67

Total learning time: 45 h

CONTENTS

Characterization of Mechanisms

Description:
Cinematic elements
Degrees of freedom
Schematization

Specific objectives:
Introduce students to the symbolism of the mechanical systems and gain the knowledge to determine the number of drives that will allow the desired motion of the system:
Acquire the concepts of machine, mechanism, kinematic chain element and kinematic pair.
Identify and classify the pairs of a mechanism.
Calculate and analyze the degrees of freedom and mobility of a mechanism.
Understand the meaning of the reference system.
Training for outlining kinematic mechanisms.
Mastering the concept of kinematic equivalence.

Related activities:
CLASS THEORY AND PROBLEMS
LABORATORY PRACTICE
LEARNING ASSESSMENT

Full-or-part-time: 30h
Theory classes: 8h
Laboratory classes: 4h
Self study : 18h

Elements of Machines

Description:
Transmission Axes. Elements of Union
Gears and Gear TrainsBelts and Transmission Chains
Bearings and Bearings
Brakes and Clutches
Springs. Linear guides. Actuators

Specific objectives:
The objective is to understand and know how to analyze the main elements of machines

Related activities:
CLASS THEORY AND PROBLEMS
LABORATORY PRACTICE
LEARNING ASSESSMENT

Full-or-part-time: 45h
Theory classes: 16h
Laboratory classes: 2h
Self study : 27h

Space kinematics

Description:
Calculation of velocities in spatial mechanisms.
Calculation of accelerations in spatial mechanisms.

Specific objectives:
Understand and calculate the general movement of spatial mechanisms, from a cinematic point of view

Related activities:
CLASS THEORY AND PROBLEMS
LABORATORY PRACTICE
LEARNING ASSESSMENT

Full-or-part-time: 17h 30m
Theory classes: 4h
Laboratory classes: 3h
Self study : 10h 30m

Space Dynamics

Description:
Newton's laws. Diagram of the free body.
Resolution of static and dynamic problems

Specific objectives:
Identify the causes of movement.
Represent and interpret vectorially the state of exterior solicitations of a spatial mechanical system.
Solve the calculation of the stresses that cause movement in the space mechanical systems.

Related activities:
THEORY CLASSES AND PROBLEMS
LABORATORY PRACTICES
LEARNING ASSESSMENT

Full-or-part-time: 20h
Theory classes: 2h
Laboratory classes: 6h
Self study : 12h

ACTIVITIES

THEORY CLASSES AND PROBLEMS

Description:
Classroom work

Specific objectives:
Know the symbology of the mechanical systems and obtain the knowledge to be able to determine the number of drives that will make possible the desired movement of the System
Know and calculate the main elements of machines
Acquire the ability to generate and solve the equations of motion for the mechanical space systems

Material:
Notes from the Digital Campus
Transparencies

Full-or-part-time: 28h
Theory classes: 28h

LABORATORY PRACTICE

Description:
Conduct by the student of practical work and mechanical computer simulations

Specific objectives:
Perform model analysis of a mechanism and simulate its movements to solve cinematic and dynamic analysis and design problems

Material:
Computer and software simulation
Mechanical models

Full-or-part-time: 10h
Laboratory classes: 10h

LEARNING ASSESSMENT

Description:
Individual written tests

Specific objectives:
Certify the level of achievement of learning

Full-or-part-time: 7h
Guided activities: 7h

GRADING SYSTEM

The qualification of the subject takes into account all the work done throughout the course.
The final grade (QF) of the subject is obtained from the following expression:
QF = 0.25 x Internship Qualification + 0.35 x Partial Exam + 0.40 x Final Exam.
An individual practice will be carried out that will serve for the qualification of the Practices.

BIBLIOGRAPHY

Basic:

- Beer, Ferdinand Pierre. Mecánica vectorial para ingenieros. Vol. 2, Dinámica [on line]. 11a ed. México: McGraw-Hill Education, 2017 [Consultation: 20/02/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=11979. ISBN 9781456255268.

- Calero Pérez, Roque ; Carta González, José Antonio. Fundamentos de mecanismos y máquinas para ingenieros. Madrid [etc.]: McGraw-Hill, 1999. ISBN 844812099X.

- Beer, Ferdinand Pierre. Mecánica vectorial para ingenieros. Vol. 1, Estática [on line]. 11a ed. México: McGraw-Hill Education, 2017 [Consultation: 20/02/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=11980. ISBN 9781456255275.

- Budynas, Richard G.; Nisbett, J. Keith. Diseño en ingeniería mecánica de Shigley [on line]. 10a ed. Ciudad de México: McGraw-Hill, 2018 [Consultation: 14/02/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5485813. ISBN 9781456262112.

- Norton, Robert L. Diseño de maquinaria : síntesis y análisis de máquinas y mecanismos [on line]. 6a ed. Aravaca: McGraw Hill/Interamerica de España, 2020 [Consultation: 19/02/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=5701. ISBN 9788448620998.

- Cardona i Foix, Salvador; Clos Costa, Daniel. Teoria de máquinas [Recurs electrònic] [on line]. 2a ed. Barcelona: Edicions UPC, 2008 [Consultation: 02/05/2022]. Available on: https://upcommons.upc.edu/handle/2099.3/36645. ISBN 9788498803808.