16203 - SIME-U1T12 - Mechanical Systems

Coordinating unit: 340 - EPSEVG - Escola Politècnica Superior d’Enginyeria de Vilanova i la Geltrú
Teaching unit: 712 - EM - Department of Mechanical Engineering
Academic year: 2012
Degree: (ENG) ENGINYERIA EN AUTOMATICA I ELECTRONICA INDUSTRIAL (Syllabus 2003). (Teaching unit Compulsory)
Credits: 6  Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: MAURICI SIVATTE ADROER
Others: Maurici Sivatte Adroer

Teaching methodology

Classes of theory and problems
Practical of laboratory

Learning objectives of the subject

The mechanical systems are the material base of the automatism, therefore, an engineer in Automatic and Industrial Electronics, will have to understand his movement, this cause and transmission generate that it. The objective of this subject is the one to transmit to the student these capacities.
### Introduction to the mechanical systems

**Description:**

Objectives

The objective of the subject is to introduce to the student to the symbolism of the mechanical systems and to obtain the knowledge to be able to determine the number of drives that will make the wished movement possible of the system.

Contents

1.1 Kinematic Pairs. Classification.
1.2 Kinematics, opened and closed Chains
1.3 Planes and space mechanisms. Concept of reference.
1.4 Mobility and degrees of freedom of the mechanisms.
1.5 Kinematic scheme and equivalence kinematics.

Activities, knowledge, abilities, aptitudes

- The student will have to be able of:
- To acquire the concepts of machine, mechanism, chain kinematics, element and kinematic pair.
- To identify and to classify the pairs of a mechanism.
- To calculate and to analyze the degrees of freedom and mobility of a mechanism.
- To understand the meaning of reference system.
- To become qualified for the outlining kinematics of mechanisms.
- To dominate to the equivalence concept kinematics

Planning

This module is the introduction to the kinematics of mechanisms, and as so he is indispensable to understand the rest of the subject.

### The movement in the mechanical systems

**Description:**

Objectives

The objective is to understand and to calculate the general movement of the mechanisms, from a kinematic point of view.

Contents

2.1 Calculation of speeds in mechanisms.
2.2 Calculation of accelerations in mechanisms.

Activities, knowledge, abilities, aptitudes

The student will have to be able of:
- Calculate the angular and linear speeds of mechanisms, both as flat space.
- Calculate the angular and linear acceleration mechanisms, both as flat space.
- Resolve problems in relative motion mechanisms

Planning

Aside from the own interest of this module to know the movement the mechanical systems, we will use its results to make later static and dynamic the calculations
Causes of the movement in the mechanical systems

**Description:**
Objectives
The objective is to understand and to calculate the efforts that cause the movement in the mechanical systems.

Contents
3.1 Permanent and transitory movement.
3.2 Diagram of the free body.
3.3 Resolution of statics problems.
3.4 Resolution of problems of dynamics by means of vectorial theorems (Newton).
3.5 Resolution of problems of dynamics by means of fictitious forces of inertia (of Alembert).
3.6 Resolution of problems of dynamics by means of virtual works.

Activities, knowledge, abilities, aptitudes
The student will have to be able of:
- Identifying the causes of the movement.
- Represent and interpret the state of vectorially solicitations outside of a mechanical system.
- Resolve the calculation of efforts to cause the movement mechanical systems.

Transmissions

**Description:**
Objectives
The objective of this subject is the one to know different families from habitually used mechanisms in the transmission of the movement in the mechanical systems.

Contents
4.1 Strap and chains.
4.2 Trains of gears.
4.3 Screws of transmission.

Activities, knowledge, abilities, aptitudes
The student will have to be able of:
- To know the characteristics and fields application of the transmission systems object of the subject.
- To calculate them and to determine the proportions them kinetically.
### Selection of drives

**Description:**

**Objectives**
The objective is the one to know different types from used drives in the mechanical systems automated and the criteria of selection

**Contents**
- 5.1 Receivers. Mechanical characteristic.
- 5.2 Linear drives. Pneumatic and hydraulic cylinders.
- 5.3 Drives of rotation. Electrical motors.
- 5.4 Fast drives.

**Activities, knowledge, abilities, aptitudes**
The student will have to be able of:
- To know the parameters that defines the requirements of entrance to the mechanical system to be able to obtain the wished functionality.
- To select the most suitable drives to secure the entrance requirements.
- To analyze the behaviour of answer of the set and to compare it with the initial specifications.

### Commercialized components of the mechanical systems

**Description:**

**Objectives**
The objective is the one to present the different families from commercialized elements employees in the mechanical systems and their implementation.

**Contents**
- 6.1 Guides for the tumbling: pads and bearings.
- 6.2 Guides for the linear movement.
- 6.3 The screw mechanism.
- 6.4 Trees and axes.
- 6.5 Connections.
- 6.6 Brakes.
- 6.7 Clutches.
- 6.8 Levies.

**Activities, knowledge, abilities, aptitudes**
The student will have to be able of:
- To know these elements, their applications and the main parameters define those them.
- To implement these elements in the mechanical systems.
Mechanical vibrations

Description:
Objectives
The objective is to observe the importance of the mechanical vibrations in the industrial world, its measurement, control and application

Contents
The basic apparatuses of measurement of vibrations are described and the associate one to its calculation is formulated mathematical. With this, the student will realize different acquisitions he will analyze and them.

Activities, knowledge, abilities, aptitudes
The student will have to be able of:
- To know the problematic one appeared before phenomena of vibrations nonwished.
- To know the different measurement systems from mechanical vibrations.
- To understand and to evaluate the phenomenon of the mechanical resonance and the determination of frequencies and own ways of vibration.

Commentaries
The student will elaborate a report in each one of the sessions of practices that part of the continued evaluation will form.

Obtaining of the characteristic line of a rotation drive

Description:
Objectives
The objective is to fix the most elementary concepts of the dynamics of the mechanical systems and their practical application.

Contents
The reading of encoder, located in the axis of an electrical motor, during the transitory one of starting is obtained. The experiment with two configurations of inertia steering wheel is realized and the calculations of the speed characteristics, acceleration, pair and engine power are analyzed, as well as, the situation of deceleration and grazes of the system.

Activities, knowledge, abilities, aptitudes
The student will have to be able of:
- To calculate the pair of a motor of experimental form.
- To understand and to evaluate the corresponding theoretical formulation.
- To reason the differences of the results obtained in different speeds and with different steering wheels.

Commentaries
The student will elaborate a report in each one of the sessions of practices that part of the continued evaluation will form.
Balance of steering wheels

Description:
Objectives
The objective is the one to expose the problematic one appeared in a movable axis unbalanced and its resolution, theoretical as as much practical.

Contents
Will be an unbalanced steering wheel and its dynamic balance will be realized locating masses compensatory in two planes.

Activities, knowledge, abilities, aptitudes
The student will have to be able of:
- To measure the vibrations appeared in an unbalanced revolving axis.
- To know the applied formulation the phenomena mechanical vibration.
- To determine the value of the masses of compensation and the situation where it is necessary to locate them to balance the system.

Commentaries
The student will elaborate a report in each one of the sessions of practices that part of the continued evaluation will form.

Qualification system

The qualification of the subject considers all the work carried out throughout the course. The final qualification (QF) of the subject is obtained from the following expression:

\[
QF = 0.2 \times \text{Qualification Practical} + 0.3 \times \text{Partial Examination} + 0.5 \times \text{Final Examination}
\]

Where the evaluative acts and their corresponding weight are:
- 1st evaluative act (weight 0.2):
  Practical (realized in the laboratory of mechanics in groups of two students with the support of the teacher. Later a report is given that is used for the qualification.)
- 2nd evaluative act (weight 0.3):
  Partial examination (it includes the 2 first subjects)
- 3rd evaluative act (weight 0.5):
  Final examination. (it includes all the matter)

The students who do not surpass the subject with the continued evaluation will have a recovery examination, which includes all the agenda.

Regulations for carrying out activities

Without documentation
Without calculator
Bibliography

Basic:

Moliner P.R.. Vibracions. CPDA,


Complementary:


Moliner P.R.. Cinemática de Máquinas. CPDA,

Moliner P.R.. Dinámica de Máquinas. CPDA,
