Course guides
220621 - 220621 - Nano&Microtechnology

Last modified: 22/04/2021

Unit in charge:	Terrassa School of Industrial, Aerospace and Audiovisual 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: 2021 **ECTS Credits:** 5.0 **Languages:** Spanish, English

LECTURER

Coordinating lecturer: Jasmina Casals
Soria Perez, Jose Antonio

Others:

PRIOR SKILLS

Basic electronics, basic mechanics

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Research, design, develop and characterization of complex systems dynamics that have to be controlled during the its operation such as security, motion restriction or failures in the control system.

Transversal:
2. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
4. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

The teaching methodology is divided in three parts:
- Theoretical contents sessions.
- Lab sessions or Probleme solving sessions.
- Autonomous work and homeworks.

LEARNING OBJECTIVES OF THE SUBJECT

The aim of this class is not only to make students familiar with recent developments and process technology of the microsensors, MEMS, and smart devices in the classroom. In the classroom, the first part of this lecture will review briefly on various application fields of the microsensors, MEMS, and smart devices. Then we will concentrate on the materials and on processes required to make different kinds of the microdevices. Most of these technologies have been derived from silicon integrated circuit (IC) technologies, so the standard microelectronics technology to produce ultra large-scale integrated circuits and package them will also be reviewed. Then, the new techniques that have been developed to make microsensors and microactuators, such as bulk and surface silicon micromachining will be followed. In addition, the emerging technology of microstereolithography that can be used to form true three-dimensional micromechanical structures will be included and the softlithography used in bio applications will be also covered.

STUDY LOAD

Type	Hours	Percentage
Hours large group	31,0	24.80
Hours small group	14,0	11.20
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

Module 1 MEMS/ NEMS Introduction

Description:
Module 1 MEMS/ NEMS Introduction

Specific objectives:
Scaling benefits
Fabrication processes:
Oxidation, film deposition, litography, etching, ion implantation and difusion
Surface micromachinig
Bulk Micromachining

Related activities:
Activity 1-2-3

Full-or-part-time: 62h 30m
Theory classes: 5h
Practical classes: 4h
Self study (distance learning): 25h
Theory classes: 11h
Practical classes: 2h 30m
Self study : 15h

Module 2.- Micromechanics

Description:
Module 2.- Micromechanics

Specific objectives:
Mechanics of materials
Microestructural elements
Energy methods

Related activities:
Activity 1-2-3

Full-or-part-time: 29h
Theory classes: 11h
Practical classes: 3h
Self study (distance learning): 15h

(ENG) m3

Full-or-part-time: 38h
Theory classes: 10h
Practical classes: 3h
Self study (distance learning): 25h

(ENG) m4

Full-or-part-time: 24h
Theory classes: 5h
Practical classes: 4h
Self study (distance learning): 15h

(ENG) -

ACTIVITIES

THEORY SESSIONS

Description:
Description in class of the theoretical contents of the subject

Specific objectives:

After these classes, the student should have consolidated and adquired all the knowledges enumerated in the general learning goals of subject.

Material:
Basic and specific bibliography
Atenea Handouts

Delivery:
This activity is graded through two written exams: midterm (activity 3) and final (activity 4)

Full-or-part-time: 49h
Theory classes: 29h
Self study: 20h

LAB SESSIONS

Description:
In this activity the student will set up practical experiments related to the subject contents

Specific objectives:
Improve and use concepts related to MEMS design and manufacturing

Material:
Bibliography and Lab guide

Delivery:
Lab report

Full-or-part-time: 34h
Theory classes: 14h
Self study: 20h

MIDTERM EXAM

Description:
Individual test related to the aquired contents.

Specific objectives:
Contents related to module 1 and 2.

Material:
Exam and handouts provided

Delivery:
Solved exam is handed to the professor
It is part of continuos evaluation systems

Full-or-part-time: 16h
Theory classes: 1h
Self study: 15h

FINAL EXAM

Description:
Individual test related to the aquired contents.

Specific objectives:
Contents related to module 3 and 4

Material:
Exam and handouts provided

Delivery:
Solved exam is handed to the professor
It is part of continuos evaluation systems

Full-or-part-time: 26h
Theory classes: 1h
Self study: 25h

(ENG) RESOLUCIÓ D'EXERCICIS

GRADING SYSTEM

Activity 1 (Resolution of exercises), weight: 10%
Activity 2 (Lab sessions), weight: 30%
Activity 3 (Midterm), weight: 35%
Activity 4 (Final), weight: 35%
The subject will foresee procedures that allow recovering unsatisfactory results obtained in the first evaluation.
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.

EXAMINATION RULES.

All the activities are compulsory