Microsystems and nanoelectronics

Academic Year: (2023 / 2024) **Review date: 24-04-2023**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: ACEDO GALLARDO, PABLO

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

The students are expected to have completed the mandatory courses of the Master, specially the course on Electronic, photonic and electrooptic components.

OBJECTIVES

Knowledge on the last advances on different electronic and components devices.
Knowledge on the current state-of-the-art on microsystems and nanoelectronics and their potential applications.
Knowledge on the fundamentals of MEMS (Microelectromechanical Systems) and MOEMS (Micro-Opto-Electro-Mechanical Systems) and their use in different applications.
Knowledge on microscreen technologies and their different applications.
Knowledge on the new nanoelectronic technologies, materials and components that are slowly being incorporated to high added value electronic systems in fields like nanotechnology and bioengineering.

DESCRIPTION OF CONTENTS: PROGRAMME

In a great number of electronic systems, microsystems like microscreens, MEMS and MOEMS are embedded. In this course the different existing technologies will be presented like those based on liquid crystals, their applications and the challenges associated to the interconnection of such components to other subsystems. Another field of recent interest is nanoelectronics with new technologies, components and materials that are being incorporated in new systems and applications. These new nanoelectronic techniques and components as well as the associated methodologies to incorporate them in electronic systems of high added value will be presented, using examples based on real applications in fields like nanotechnology and bioengineering.

1.- Introduction to Electronic Microsystems and MEMS: History, applications, design and fabrication, integration and packing, etc.
2.- Microsystems Design Fundamentals. Examples.
3.- Optical MEMs: Introduction, chronology, classification. Optical MEMs for displays and optical Communication.
4.- Liquid crystals, micro-screens and displays.
5.- Introduction to Nanoelectronics and Fundamentals: Electronic Properties and Quantum Effects
6.- Technological Aspects: Fabrication and new materials.
7.- Nanoelectronic Logic Devices
8.- Nanoelectronic Sensors and Sensors arrays
9.- Molecular Electronics and Metatronics
10.- Quantum Computing

LEARNING ACTIVITIES AND METHODOLOGY

LEARNING ACTIVITIES:

Lectures.
Tutoring hours
Group work.
Individual work by the students.

TEACHING METHODOLOGY:
Theoretical lectures in which the main concepts of the subject are developed and the bibliography is provided to complement the students' learning.

Critical reading of text,s recommended by the teacher (Press articles, reports, manuals and / or academic articles) either for further discussion in class, or to expand and consolidate the knowledge of the subject.

Resolution of practical cases, problems, etc. individually or in groups

Exhibition and discussion in class, under the teacher's moderation, of topics related to the content of the subject, as well as case studies.

Preparation of reports, either individually or in groups

ASSESSMENT SYSTEM

Ordinary Call:
The students will prepare two works in groups during the course (Case Studies, 25% of the grade each). The group works will be presented in class and discused by all members of the course.

At the end of the course the students will individually discuss two case studies and will have to fill a brief questionary about them.
Extraordinary call:
The student may follow the continous evaluation procedure with the same structure as in the ordinary call, or go for a final exam (100% of the final grade).

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Chang Liu Foundations of MEMS. Second Edition, Prentice Hall, 2013
- George W. Hanson Fundamentals of Nanoelectronics, Pearson, 2009
- Rainer Waser, Ed. Nanoelectronics and Information Technology, Wiley-VCH, 2013
- Stephen D. Senturia Microsystem Design, Springer, 2001

ADDITIONAL BIBLIOGRAPHY

- Ville Kaajakari Practical MEMS, Small Gear Publising, 2009