Microsystems and nanoelectronics

Academic Year: (2019 / 2020) **Review date: 29/04/2020 11:14:15**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: GARCIA CAMARA, BRAULIO

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

LEARNING OUTCOMES:

After completing this subject, the students will have acquired the following Competences and Skills:

Have demonstrated knowledge and understanding that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context.

Can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) context related to their field of study.

Have the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous.

Have demonstrated the ability of understanding, making use and integrating of new technologies in electronic systems, to solve new problems or applications.

Adopting the scientific method as a fundamental working tool in both professional and research careers.

Have demonstrated knowledge of new analog and power electronics, and photonic components (including those based on new materials and structures) for improving the performance of current applications or systems.

Have the ability to be effective in looking for information, identifying the state of the art of a technological problem in the field of Electronics System Engineering and integrating this knowledge in future systems.

Have demonstrated the knowledge of current state of the art and future trends in any of the following areas: power electronics and/or photonics components and subsystems, integrated circuits, integrated optic circuits, microsystems, nanoelectronics, identification and/or disabled people aided systems.

Learning Outcomes:

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

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

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

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

call, or go for a final exam (100% of the final grade).

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