Advanced sensors and measurements techniques

Academic Year: (2023 / 2024) **Review date: 12/02/2024 11:53:35**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: ACEDO GALLARDO, PABLO

Type: Compulsory ECTS Credits : 3.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electromagnetism and Optics
Solid State Fundamentals for Engineering
Electronic Engineering Fundamentals
Statistical Physics
Instrumentation and Measurements
Photonics

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB4. Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG2. Learn new methods and technologies from basic scientific and technical knowledge, and being able to adapt to new situations.
CG3. Solve problems with initiative, decision making, creativity, and communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the engineering activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG4. Solve mathematical, physical, chemical, biological and technological problems that may arise within the framework of the applications of quantum technologies, nanotechnology, biology, micro- and nano-electronics and photonics in various fields of engineering.
CG5. Use the theoretical and practical knowledge acquired in the definition, approach and resolution of problems in the framework of the exercise of their profession.
CG6. Develop new products and services based on the use and exploitation of new technologies related to physical engineering.
CG7. Undertake further specialized studies, both in physics and in the various branches of engineering.
CE14. Specify and use electronic instrumentation, measurement systems, sensors, techniques and experimental procedures usual and advanced in physics, engineering and biology, including electromechanical and microfluidic microdevices, and design experiments using the scientific method.
CT1. Work in multidisciplinary and international teams as well as organize and plan work making the right decisions based on available information, gathering and interpreting relevant data to make judgments and critical thinking within the area of study.

RA1. To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them.
RA2. To be able, using arguments, strategies and procedures developed by themselves, to apply their

knowledge and abilities to the successful solution of complex technological problems that require creating and innovative thinking.
RA3. To be able to search for, collect and interpret relevant information and data to back up their conclusions including, whenever needed, the consideration of any social, scientific and ethical aspects relevant in their field of study.
RA4. To be able to successfully manage themselves in the complex situations that might arise in their academic or professional fields of study and that might require the development of novel approaches or solutions.
RA6. To be aware of their own shortcomings and formative needs in their field of specialty, and to be able to plan and organize their own training with a high degree of independence.

OBJECTIVES

To know the fundamentals behind various advanced sensors of relevance in scientific and industrial applications such as MEMS, MOEMS, microfluidic systems and chemical sensors, as well as the latest developments in new materials and manufacturing processes for sensors, as well as their field of application in instrumentation and measurement systems in biomedical and biological environments.
To know various experimental instruments and techniques of general use in research (microscopy and spectroscopy among others) and the most relevant scientific instruments.

DESCRIPTION OF CONTENTS: PROGRAMME

1.- Introduction. Review of metrological concepts and the International System.
2.- Technological aspects of electronic sensors.
3.- Microsystems: MEMS and MOEMS
4.- Microfluidic Systems and Sensors. Functionalization.
5.- Chemical Sensors
6.- Spectroscopy and Spectroscopic Techniques
7.- Scientific Instruments.

LEARNING ACTIVITIES AND METHODOLOGY

AF1. THEORETICAL-PRACTICAL CLASSES.
AF3. STUDENT INDIVIDUAL WORK OR GROUP WORK.
AF8. WORKSHOPS AND LABORATORY SESSIONS.
AF9. FINAL EXAM.
MD1. THEORY CLASS.
MD2. PRACTICAL CLASS.

ASSESSMENT SYSTEM

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

SE1. FINAL EXAM. 50%.
SE2. CONTINUOUS EVALUATION.

Partial exam: 30%
Seminars: 20%

BASIC BIBLIOGRAPHY

- Liu C. Foundations of MEMS. Second Edition, Prentice Hall , 2012

ADDITIONAL BIBLIOGRAPHY

- Kaajakari V. Practical MEMS, Small Gear Publising , 2009

- Tkachenko N.V. Optical Spectroscopy. Methods and Instrumentations, Elsevier, 2006