

Course guide

230666 - ESIOT - Electronic Systems for Internet of Things

Last modified: 08/03/2016

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: **Academic year:** 2016 **ECTS Credits:** 5.0
Languages: Catalan, English

LECTURER

Coordinating lecturer: J. CABESTANY

Others: J.M. MORENO, J. MADRENAS, F. MOLL, A. RUBIO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:

1. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.
2. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
3. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
4. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- Lectures
- Laboratory classes
- Laboratory practical work
- Group work (distance)
- Oral presentations
- Extended answer test (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

Body area networks (BANs) are networks of wireless sensors and medical devices embedded in clothing, worn on or implanted in the body and have the potential to revolutionize healthcare by enabling pervasive healthcare. "Electronic design of BANs" will allow the design of intelligent, autonomous electronic personal companions that will assist us from infancy to old age. The devices and systems must be private and secure featuring sensing, computation and communication beyond human capabilities. It will explore and develop "zero-power" technologies that push the scientific and technological limits of energy per processed bit of information, with a possible harvest of their own energy. Low power and ultra-low energy technology will be presented.

Zero power technologies will become a key innovation platform for European industry, large component manufacturers, system integrators, service providers and SMEs. Additionally, these devices and systems must consider usability concepts and they must include the user in the design cycle from the very beginning.

Learning results of the subject:

- Ability to understand and differentiate the main building blocks and functionality of a Body Area Network (BAN) system.
- Ability to analyze and use zero power concepts for the specification and design of the system.
- Ability to understand, select and implement correct communication protocols for BAN systems
- Ability to understand, manage and use usability concepts for design ("usability for design")
- Ability to develop techniques for the design, analysis and evaluation of electronic systems in applications such as automation, aerospace, energy distribution and generation, consumer electronics, biomedicine, etc.
- Ability to synthesize and solve problems related to the electronic engineering discipline, to apply learning techniques in complex and multiple contexts, to apply previous knowledge to new situations and contexts, as well as the ability to coordinate and work in a team.
- Ability to design electronic systems with specific constraints (low-power, real-time processing capability, sensor integration)
- Ability to design wearable electronic systems for telecare and eHealth purposes (usability concepts must be considered)

STUDY LOAD

Type	Hours	Percentage
Hours small group	13,0	10.40
Hours large group	26,0	20.80
Self study	86,0	68.80

Total learning time: 125 h

CONTENTS

1. Introduction

Description:

- Concept of a BAN system. The typical chain and components of a BAN system
- Fields of application. Market and social opportunities.
- Usability concepts
- Security and regulatory issues.
- Examples and case studies in brief.

Full-or-part-time: 20h

Theory classes: 4h

Laboratory classes: 2h

Self study : 14h

2. Power supply system consideration and design

Description:

- Concepts of power and energy budget of the system
- Battery technology and operation
- Energy harvesting systems for BAN

Full-or-part-time: 26h

Theory classes: 6h

Laboratory classes: 6h

Self study : 14h

3. Low power data processing

Description:

- Clock management system
- Low power operating modes
- Wake-up and sleep procedures
- Power management at the system level
- Existing examples

Full-or-part-time: 26h

Theory classes: 6h

Laboratory classes: 6h

Self study : 14h

4. Sensors and interfaces

Description:

- Body and health related sensors. The case of inertial sensors
- Safety of BAN sensors
- Low power digital sensors
- Communication protocols: 1-wire, I2C, SPI,...

Full-or-part-time: 26h

Theory classes: 6h

Laboratory classes: 6h

Self study : 14h

5. Communication protocols in BAN

Description:

- Bluetooth 4.0
- ANT+
- IEEE 802.15.5 standard
- Health profiles and security issues.

Full-or-part-time: 26h

Theory classes: 6h

Laboratory classes: 6h

Self study : 14h



ACTIVITIES

LABORATORY

Description:

- Introduction
- Presentation of the platform for BAN development
- Presentation of a work group.

Full-or-part-time: 25h

Laboratory classes: 25h

ORAL PRESENTATION

Description:

Presentation of a work group.

Full-or-part-time: 20h

Laboratory classes: 20h

EXTENDED ANSWER TEST (FINAL EXAMINATION)

Description:

Final examination.

GRADING SYSTEM

Final examination: from 20% to 30%

Group assessments: from 40% to 50%

Laboratory assessments: from 20% to 40%

BIBLIOGRAPHY

Basic:

- Yang, G.-Z. Body sensor networks. New York: Springer, 2006. ISBN 978-1-84628-272-0.

Complementary:

- Gupta, S. K.S.; Mukherjee, T.; Venkatasubramanian, K.K. Body area networks: safety, security, and sustainability [on line]. Cambridge University Press, 2013 [Consultation: 28/09/2015]. Available on: <http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10679171>. ISBN 9781107347915.