

230666 - ESIOT - Electronic Systems for Internet of Things

Coordinating unit:	230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit:	710 - EEL - Department of Electronic Engineering
Academic year:	2016
Degree:	DEGREE IN ELECTRONIC ENGINEERING (Syllabus 1992). (Teaching unit Optional) MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2009). (Teaching unit Optional) MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional) MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits:	5
Teaching languages:	Catalan, English

Teaching staff

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

Opening hours

Timetable:	To be announced
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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

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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

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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

Total learning time: 125h	Hours large group:	26h	20.80%
	Hours small group:	13h	10.40%
	Self study:	86h	68.80%

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Content

<p>1. Introduction</p>	<p>Learning time: 20h Theory classes: 4h Laboratory classes: 2h Self study : 14h</p>
<p>Description:</p> <ul style="list-style-type: none"> - 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. 	
<p>2. Power supply system consideration and design</p>	<p>Learning time: 26h Theory classes: 6h Laboratory classes: 6h Self study : 14h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Concepts of power and energy budget of the system - Battery technology and operation - Energy harvesting systems for BAN 	
<p>3. Low power data processing</p>	<p>Learning time: 26h Theory classes: 6h Laboratory classes: 6h Self study : 14h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Clock management system - Low power operating modes - Wake-up and sleep procedures - Power management at the system level - Existing examples 	

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4. Sensors and interfaces	Learning time: 26h Theory classes: 6h Laboratory classes: 6h Self study : 14h
Description: <ul style="list-style-type: none">- Body and health related sensors. The case of inertial sensors- Safety of BAN sensors- Low power digital sensors- Communication protocols: 1-wire, I2C, SPI,...	
5. Communication protocols in BAN	Learning time: 26h Theory classes: 6h Laboratory classes: 6h Self study : 14h
Description: <ul style="list-style-type: none">- Bluetooth 4.0- ANT+- IEEE 802.15.5 standard- Health profiles and security issues.	

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Planning of activities

LABORATORY	Hours: 25h Laboratory classes: 25h
Description: - Introduction - Presentation of the platform for BAN development - Presentation of a work group.	
ORAL PRESENTATION	Hours: 20h Laboratory classes: 20h
Description: Presentation of a work group.	
EXTENDED ANSWER TEST (FINAL EXAMINATION)	
Description: Final examination.	

Qualification 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.