IoT Electronic Systems Packaging and Assembly

Academic Year: (2019 / 2020) **Review date: 04-05-2020**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: FERNANDEZ HERRERO, CRISTINA

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

OBJECTIVES

CB6: Possessing and understanding knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.
CB10: Students possess the learning skills that enable them to continue studying in a way that is largely self-directed or autonomous.
CG1: Ability to identify, define and formulate problems to be solved related to IOT applications. This ability includes the simultaneous assessment of all factors at play, not only technical, but also environmental and civil liability.
CG6: Ability to apply acquired knowledge and solve problems in new or poorly known environments within broader, multidisciplinary contexts, with the ability to integrate knowledge.
CG7: Ability to communicate (orally and in writing) conclusions - and the knowledge and ultimate reasons behind them - to specialized and non-specialised audiences in a clear and unambiguous manner.
CG8: Capacity for continuous, self-directed and autonomous learning in advanced areas linked to IoT.
Learning outcomes:
- Knowing the state of the art of the current assembly techniques for applications related to the IoT.
- Knowing the most relevant issues of packaging, thermal management, electromagnetic interference, and energy management.
- Knowing the state of the art in energy harvesting and batteries.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to the assembly of electronic circuits
2. Design and manufacture electronic circuits
   - 2.1. Manufacturing possibilities
   - 2.2. Design steps
   - 2.3. Packaging
   - 2.4. Physical Layer Security
3. Power management and batteries
   - 3.1. Power management challenges
   - 3.2. Power conversión
     - 3.2.1. Switched power converters
     - 3.2.2. Switched capacitor power converters
     - 3.2.3. Linear regulators
   - 3.3. Power management techniques
     - 3.3.1. Maximum power point
     - 3.3.2. Energy storage
     - 3.3.3. Adaptive voltage and frequency
     - 3.3.4. Multiphase converters
     - 3.3.5. Cold start
   - 3.4. Energy harvesting
   - 3.5. Battery
4. Thermal management
   - 4.1. Environment challenges
   - 4.2. Thermal design
     - 4.2.1. Size constraints
     - 4.2.2. Thermal vias
     - 4.2.3. Copper thickness
     - 4.2.4. Heatsinks
5. Electromagnetic compatibility issues
   - 5.1. Basic concepts of EMC

5.2. Perturbations and coupling
5.3. Design criteria based on EMC

LEARNING ACTIVITIES AND METHODOLOGY

Learning activities.
Theoretical classes, practical classes, tutoring hours, individual or group work of the student.

Teaching Methodology.
Classroom lessons by means of presentations and simulations. In these lessons, the main concepts of the subject will be developed by teacher and complementary references will be given to students.
Practical case studies and problems resolution will be proposed by the teacher to be solved individually or in groups.
Project and reports development, individually or in group.

ASSESSMENT SYSTEM

Individual or group work or exam done during the course (60%) and final term exam (40%).
In the extraordinary examination, the final term exam can be 100% of the final grade.

% end-of-term-examination:	80
% of continuous assessment (assigments, laboratory, practicals…):	20

BASIC BIBLIOGRAPHY

- Massimo Alioto Enabling the Internet of Things: From Integrated Circuits to Integrated Systems, Springer International Publishing, 2017 - ISBN 978-3-319-51480-2

ADDITIONAL BIBLIOGRAPHY

- D. Newell and M. Duffy Review of Power Conversion and Energy Management for Low-Power, Low-Voltage Energy Harvesting Powered Wireless Sens, IEEE Trans. Power Electron., vol. PP, no. c, pp. 1¿1, 2019

- H. Jayakumar, A. Raha, Y. Kim, S. Sutar, W. S. Lee, and V. Raghunathan Energy-efficient system design for IoT devices, Proc. Asia South Pacific Des. Autom. Conf. ASP-DAC, vol. 25-28-January-2016, pp. 298¿301, 2016

- J. Estrada-López, A. Abuellil, Z. Zeng, and E. Sánchez-Sinencio Multiple Input Energy Harvesting Systems for Autonomous IoT End-Nodes, J. Low Power Electron. Appl., vol. 8, no. 1, p. 6, 2018
- J. Mcmillan and M. Graphics 7 DESIGN ASPECTS OF IoT PCB DESIGNS, White paper of Mentor Graphics, 2017