Universitat Autònoma de Barcelona

2017/2018

Electrical Characterisation and Reliability

Code: 43431
ECTS Credits: 6

Degree	Type	Year	Semester
4314939 Advanced Nanoscience and Nanotechnology	OT	0	A

Contact

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Use of languages

Principal working language: english (eng)

Prerequisites

No prerequisites are required for students accepted to the program. It is advisable to have knowledge in electronic devices and their applications.

Objectives and Contextualisation

This module aims to address the electrical characterization in nanoelectronic devices to assess their performance and reliability.

Skills

- Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
- Continue the learning process, to a large extent autonomously
- Identify the characterisation and analysis techniques typically adopted in nanotechnology and know the principles behind these, within one's specialisation.
- Show expertise in using scientific terminology and explaining research results in the context of scientific production, in order to understand and interact effectively with other professionals.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.

Learning outcomes

1. Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
2. Continue the learning process, to a large extent autonomously
3. Describe the principles and identify the possibilities of electric characterisation techniques at the nanoscale.
4. Design accelerated reliability tests in nanoelectronics.
5. Know the mechanisms of variability and malfunction in nanodevices.
6. Show expertise in using scientific terminology and explaining research results in the context of scientific production, in order to understand and interact effectively with other professionals.
7. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
8. Use device-level instruments and characterisation methods in nanoelectronic devices.

Content

1.- Devices at the nanoscale. Device characterization methods. Advanced Instrumentation.

2.- Failure mechanisms in nanodevices: Dielectric breakdown, Hot Carrier injection (HCI) and BTI. Resistive switching phenomenon in dielectrics and applications. Characterization of Random Telegraph Noise (RTN) in nanodevices.

3.- Effects of variability in nanoscale. Process variability. Degradation mechanisms and time dependent variability. Modeling and simulation of variability in nanodevices.

4.- Reliability in nanoelectronics. Reliability and performance. Reliability models. Reliability test design. Accelerated tests and test conditions.

5.- Advanced electrical characterization at the nanoscale. Operating principles and application to nanoelectronics probes for atomic force conductivity (C-AFM), capacitance (SCM) and contact potential (KPFM). Spreading resistance (SSRM). Other techniques.

Methodology

Students must attend lectures, problem solving classes / cases / exercises and problem-based learning, with an active participation of students in the classroom. Must also make the presentation and defense of works about specific topics and participate in the practical activities at lab.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Classes to solve problems / cases / exercises and problem-based learning	10	0.4	1, 3, 4, 5, 6, 7
Lectures	12	0.48	6
Oral presentation and discussion of works	6	0.24	1, 6
Practical activities	8	0.32	3, 4, 5, 6, 7, 8
Type: Supervised			
Tutorials	8	0.32	6
Type: Autonomous			
Personal study, reading articles and reports of interest	60	2.4	6
Preparation of works	44	1.76	1, 2, 6

Evaluation

The evaluation of the degree of acquisition of skills by students is made taking into account the activities indicated in the table, with their weights. To pass the course as a whole, the student must have an average of 5, whenever there is at least a 3 in each of the evaluation activities.

Tests are planned for final recovery, which can be theoretical and / or practical to recover the parts not previously passed, provided in these previous tests students take at least 3.

For academic needs, according to course development, assessment procedures may be adjusted.

Without prejudice to other disciplinary action deemed appropriate and in accordance with current academic regulations, will qualify with a zero irregularities committed by the student that may lead to a change in the qualification of an act of assessment. Therefore, copying or allowing copying a practice, work, or any evaluation activity will involve suspending it with a zero, if necessary to overcome it passed, the entire course will be suspended. Not be recoverable evaluation activities described in this way and by this procedure, so the course will be suspended directly without the opportunity to recover in the same academic year.

The dates of assessment and delivery of works will be published in the campus virtual, and may be subject to change for reasons of better programming. Always the information about these changes will be announced in campus virtual, as it is understood that this is the common platform for information exchange between teachers and students.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Attendance and active classroom participation	30%	0	0	1, 3, 4, 5, 6, 7, 8
Delivery of reports / works	30%	0	0	1, 2, 3, 4, 5, 6, 8
Oral defense of works	30%	0	0	1, 6
Synthesis tests, theoretical or practical	Between 10% and 60%, according to the part to recover	2	0.08	1, 6

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