Course guides
230692 - TECHDEV - Fabrication and Characterization Technologies for Micro and Nano Devices

Last modified: 06/05/2019

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

Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2019 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: Sandra Bermejo

Others: Joaquim Puigdollers
Isidro Martin

PRIOR SKILLS

Basic knowledge of semiconductor physics and technology

REQUIREMENTS

Student must have passed or being simultaneusly enroled to Micro and Nano Technologies (MNT, core subject of the Master)

TEACHING METHODOLOGY

Face to face classes and laboratory sessions

LEARNING OBJECTIVES OF THE SUBJECT

- Ability to characterize basic semiconductor devices
- Ability to fabricate and characterize basic organic devices
- Ability to learn basic nano fabrication and charaterization techniques

STUDY LOAD

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

Total learning time: 125 h

CONTENTS

Basic semiconductor device characterization: the crystalline silicon diode

Description:
Theory: (8 h)
Review of current flow through energy barriers
Calculation of recombination current at the space charge region.
Dependence of current on the temperature.
Impact of series and shunt resistance
Analysis of impedance response of c-Si diodes up to 1 MHz. Simplified model with lumped elements and complete model from EDO?s solution.

Related activities:
Lab: (4h)
1 session: c-Si diode characterization: I-V-T. Fitting with two diode and two resistor model. Calculation of activation energy of diffusion current.
1 session: impedance measurement of the diode up to 1MHz. Fitting the results and determination of characteristic diode parameters: n, Rs, lifetime, etc.

Full-or-part-time: 44h
Theory classes: 8h
Laboratory classes: 4h
Self study : 32h

Organic semiconductor devices and technologies

Description:

Theory: (8h)
Introduction to organic semiconductors
Organic devices. Flexible electronics
Organic Thin-Film Transistors (OTFTs)
Organic Solar cells (OSCs)

Related activities:
Lab: (4h)
1 session. Fabrication of Organic Thin-Film Transistor (OTFT) based on pentacene semiconductor.
1 session. Measurement of the electrical characteristics of a OTFT: output, transfer and saturation characteristics.

Full-or-part-time: 44h
Theory classes: 8h
Laboratory classes: 4h
Self study : 32h

Fabrication and characterization of nanostructured devices

Description:

Theory: (8 h)
Fabricating technology: review basic clean room fabrication techniques
Nanolitography: Optical lithography, Electron-beam lithography, Nanoimprint lithography, Multiphoton lithography,Scanning probe lithography,
Characterization: Superficial (SEM, FIB, TEM, AFM), structural (XDR, topography), energy (electrowetting, contact angle), chemical (XPS), mechanical (internal stress/residual stress, microindentation-nanoindentation, adhesion tests) , optical (ellipsometry)
Case study: colloidal crystal fabrication and characterization.

Related activities:
Lab: (4 h)
1 session: electrospray deposition.
1 session: SEM characterization and optical characterization.

Full-or-part-time: 43h
Theory classes: 8h
Laboratory classes: 4h
Self study : 31h

GRADING SYSTEM

Short answer exams: 40%
Labopratory assessments: 40%
Small Project: 20%

BIBLIOGRAPHY

Basic:
- Muller, Richard S; Kamins, Theodore I; Chan, Mansun. Device electronics for integrated circuits. 3rd ed. New York: John Wiley and Sons, 2003. ISBN 9780471593980.