



Department (Faculty)

Ingeniería Electrónica (ETSI de Telecomunicación)

Course name

Materials for Electronic and Optoelectronic Devices

Code

43000337

Credits ECTS

4

Type

Optative

Curso/Semestre

1/2

Schedule

Fall semester

Language

English

Objectives

The objective of this course will be to acquire applied knowledge of the functioning of the semiconductor devices used in current electronics and optoelectronics, and about the material and technology selection to fulfill the requirements in commercial applications. Among the different devices, the following will be studied in detail: MOSFET transistors, scaling and application in memories and CMOS circuits, heterojunction HEMTs, and advanced designs of diodes (tunnel effect, hot electrons, etc). Light-emitting diodes (LED) will also be studied, as well as laser diodes (LD), photodetectors and solar cells, concentrating on current usage: white light illumination, infrared communication, high efficient solar cells/LEDs, etc.

Contents

Chapter	Topic
1	p-n and Schottky Junctions <ol style="list-style-type: none"> Current-Voltage Characteristics Static and Transient Characteristics Heterojunctions
2	Bipolar Transistors and Related Devices <ol style="list-style-type: none"> Transistor Action Static Characteristics Frequency Response Heterojunction Bipolar Transistors Thyristors and Power Devices
3	Advanced MOSFETs and Related Devices <ol style="list-style-type: none"> MOSFET Fundamentals MOSFET Scaling CMOS and BiCMOs MOSFET on Insulator MOS Memory Structures Power MOSFETs
4	Microwave Diodes; Quantum Effect and Hot-Electron Devices <ol style="list-style-type: none"> Tunnel Diode IMPATT Diode Quantum-Effect Devices Hot-Electron Devices



	5	Light Emitting Diodes and Laser Diodes <ol style="list-style-type: none"> Radiative Transitions and Optical Absorption Light-Emitting Diodes (LED) Basics Infrared, Visible and Ultraviolet LEDs White LEDs Communication LEDs High Efficiency LEDs Laser Diodes (LD) 	
	6	Photodetectors and Solar Cells <ol style="list-style-type: none"> Photoconductors Photodiodes Avalanche Photodiode Phototransistor Metal-semiconductor-metal photodetectors Quantum well infrared detectors Silicon and Compound-Semiconductor Solar Cells Third Generation Solar Cells Optical Concentration 	

Classes and continuous evaluation

The course will be taught mainly by master classes both theoretical and practical. Interaction between student and professor and student-student will be enhanced by discussions and group exercises. The continuous evaluation will include partial exams, individual and group exercises, and frequent problems solved by the students.

Sistema de evaluación (Técnicas y Calificación)

- Final exam (% final mark): 35
- Partial exam (% final mark): 35
- Exercises and daily work (% final mark): 25
- Oral presentation of news about the course (% final mark): 5

Bibliography

Reference book:

- S.M. Sze, M.K. Lee, "Semiconductor Devices: Physics and Technology", Third Edition, International Student Version, Wiley, 2013.

Additional bibliography:

1. LEDs:
E.F. Schubert, "Light-Emitting Diodes", Second Edition, Cambridge University Press, 2006.
2. Materiales:
-S. Kasap, P. Capper, "Springer Handbook of Electronic and Photonic Materials", Springer, 2006.
3. Dispositivos y tecnología de fabricación:
- Ben Streetman, Sanjay Banerjee, "Solid State Electronic Devices", 6a Edición, Prentice Hall-Pearson, 2006 (tapa dura, edición USA), 2009 (tapa blanda, edición internacional).

Teaching staff

Adrián Hierro Cano, Dr. Ingeniero en Electrónica, PTU (100%)