UE Semiconductor physics

Niveau d'étude
Bac +4

ECTS
6 crédits

Composante
UFR Physique, Ingénierie, Terre, Environnement, Mécanique (PhITEM)

Période de l'année
Automne (sept. à dec./janv.)

Diplômes intégrant cet élément

- Master Nanosciences et nanotechnologies

Langue(s) d'enseignement: Anglais

Ouvert aux étudiants en échange: Oui

Code d'export Apogée: PAX7NQAE

Présentation

Description

Semiconductors are fundamental materials for modern technologies. During the last century, the invention of the semiconductor devices enabled the first quantum revolution with the development of the microelectronics industry. Nowadays, researchers are pushing the semiconductor nanostructures to the quantum limit with the objective to produce a second revolution based on quantum information processing. This lecture describes the main electronic properties of the semiconductor materials and explains the working principle of basic electronic devices such as diodes and transistors. The objective is to give the students the ability to analyze various semiconductor configurations involving doping, gating, illumination, voltage bias, and to calculate physical quantities such as carrier concentrations, electrostatic potentials, and electrical currents.

Content

- electronic structure : crystal, energy bands, holes, effective mass, density of states.
- free carrier population : thermal equilibrium, chemical doping, degenerate limit.
- weak non-equilibrium transport : diffusion, conduction, Hall effect.

Informations non contractuelles.
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- light-induced effects : generation, recombination, light emission.
- electrostatics : self-consistent equations, screening, depletion.
- pn junctions : space charge region, carrier injection, diffusion currents, photodiode.
- metal-semiconductor contacts : work function, Schottky barrier, ohmic contact.
- metal-oxide-semiconductor devices : capacitors, field-effect transistors.

Labwork

Microfabrication and electrical characterization of a semiconductor device in the cleanroom facility of the CIME-Nanotech.

Heures d'enseignement

CM	CM	20h
TD	TD	16h
TP	TP	12h

Pré-requis recommandés

Solid-state physics, Statistical physics, Quantum physics.

Période : Semestre 7

Infos pratiques

Campus

Grenoble - Domaine universitaire

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