## Summary

Lectures on the fundamental aspects of semiconductor physics and the main properties of the p-n junction that is at the heart of devices like LEDs & laser diodes. The last part deals with light-matter interaction phenomena in bulk semiconductors such as absorption, spontaneous & stimulated emission.

## Content

1. **Electronic properties of semiconductors**
   - Crystalline structures and energy band diagrams
   - Impurities and doping
   - Carrier statistics in equilibrium and out-of-equilibrium
   - Electron transport in weak and strong fields
   - Generation and recombination processes

2. **Theory of junctions and interfaces**
   - p-n and metal-semiconductor junctions
   - Heterojunction interfaces

3. **Light-matter interaction in semiconductors**
   - Fermi's golden rule, absorption, optical susceptibility, Bernard-Duraffourg condition
   - Spontaneous and stimulated emission of radiation
   - Dielectric function, optical constants
   - Radiative lifetime, photoluminescence spectra

## Learning Prerequisites

**Recommended courses**

Solid State Physics I and II (Bachelor, 3rd year) and Quantum Electrodynamics and Quantum Optics (Master)

## Learning Outcomes

By the end of the course, the student must be able to:

- Argue
- Contextualise
- Sketch
- Synthesize
- Generalize
- Structure
- Propose
• Assess / Evaluate

**Transversal skills**

• Use a work methodology appropriate to the task.
• Plan and carry out activities in a way which makes optimal use of available time and other resources.
• Take feedback (critique) and respond in an appropriate manner.
• Communicate effectively with professionals from other disciplines.

**Teaching methods**

Ex cathedra with exercises

**Expected student activities**

Read the bibliographical ressources in order to fully integrate and properly use the physical concepts seen in the lectures and the exercises

Be able to generalize the above-mentioned concepts to a wide variety of systems/devices

**Assessment methods**

Written exam (100%)

**Supervision**

Office hours: Yes

Assistants: Yes

Others: Office hours: appointments to be arranged by emails.

**Resources**

**Bibliography**


**Ressources en bibliothèque**

• Fundamentals of Semiconductors / Yu
• Solid State Physics / Ashcroft
• Physics of semiconductor devices / Sze