

Textbook: Ferry and Goodnick, *Transport in Nanostructures*, Cambridge University Press
There will also be a reading packet and the lecture notes available in the copy center at the base of Engineering Tower.

Prerequisites: ECE 113A and Physics 51A, or consent of instructor

Outline:

- Introduction to nanoscale systems. Length, energy, and time scales
- Top-down approach to nanolithography: Spatial resolution of optical, deep ultraviolet, x-ray, electron beam, and ion beam lithography.
- Wave-particle duality, quantized energies, particle in a box, Fermi-Dirac distribution function, density of states, concept of dimensionality
- Quantum mechanical tunneling, tunnel diodes
- Single electron transistor, coulomb blockade
- Quantum confinement of electrons in semiconductor nanostructures: two-dimensional confinement (quantum wells). Band gap engineering. Epitaxy.
- Landauer-Buttiker formalism for conduction in confined geometries.
- One-dimensional confinement: Nanowires
- Quantization of electrical resistance: quantum point contacts
- Bottom-up approach. Chemical self-assembly, carbon nanotubes.
- Introduction to quantum methods of information processing
- Bio-nano electronics

Lecture Hours: 6-8:50 pm M, PSCB 120

Instructor: Professor Peter Burke, Electrical Engineering and Computer Science
2232 Engineering Gateway
949-824-9326 pburke@uci.edu

Instructor Office Hours: 2:30 p.m. – 5:30 p.m., M

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| Grading Components: | Midterm (Mon., May 17) | 25% |
| | Homework | 10% |
| | Paper (due before the final exam) | 25% |
| | Final Exam | 40% |

Homework: 4 homework assignments will be given. Homework assignments given a check or in rare cases check minus. If you do not do the HWs and understand the solutions you will probably not pass the course.

Questions policy:

There is no such thing as a dumb question. However, there is also a time and a place for everything, so...

The appropriate use of **email**, **lecture**, **discussion section**, **office hours** is as follows:

If you have questions about the **content** of the course or the homework problems, the appropriate venue is to ask questions during **lecture**, the **discussion sections**, or **office hours**. Emails regarding content will be ignored, because it is difficult to explain content related material by email. Questions during lecture are encouraged!

If you have questions about the **administration** of the course, the appropriate venue is to ask questions during the **lecture** if it concerns all students, or during **instructor office hours** if it concerns only you. If it concerns all students it is only fair that all students get to hear the answer during the lecture period!

If you have a question about what is going to be covered on the midterm or final, those questions will only be answered during the **lecture**, not by email or in office hours. No emails about the content of the midterm or final will be answered. The reason is that it is only fair for all the students to hear the answer to your question!