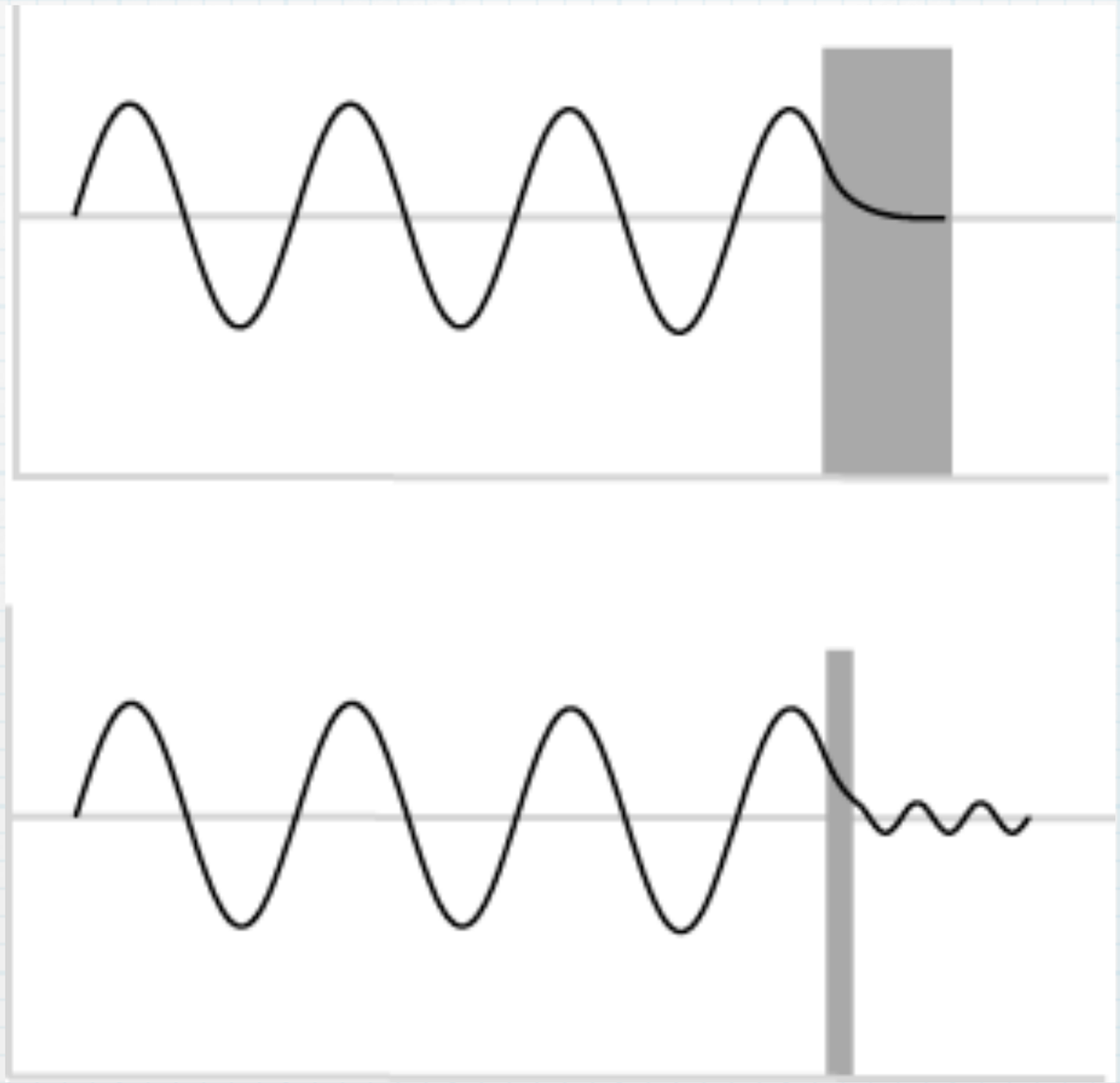
EE 439
Nanoelectronics



E E 439. Nanoelectronics.
(3-0) Cr. 3. S. *Prereq: E E 332/MAT E 332 or MAT E 331*
Concepts of quantum mechanics relevant to nanoelectronic devices, including quantization, tunneling, and transport; overview of some of the leading technologies for nanoelectronics, including carbon nanotubes, quantum dots, and molecular transistors; fabrication methods for building nanoelectronic devices. Nonmajor graduate credit.

Basics

- **Gary Tuttle**
  247 ASC I (MRC) & 335 Durham (ECpE)
  294-1814
  gtuttle@iastate.edu

- **Office Hours** (335 Durham)
  Monday, Wednesday, Friday: 11:00 am. - 2:00 p.m.
  Tuesday & Thursday: 2:30 p.m. - 4:00 p.m.

- **Text**
  No text required.

- **Web site**
  http://tuttle.merc.iastate.edu/ee439/homepage.htm

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Homework (30%)
- can work with one partner, if desired
- allowed two late submissions (Turn it in by the next class period.)

Quizzes (30%)
- almost every day
- closed book and notes
- one or two simple calculations
- no make-up quizzes

Exams - 2 mid-terms (30%)
- 3 or 4 problems
- closed-book, closed-notes. A formula sheet will be provided.

Project (10%)
- A presentation covering some topic of recent interest in quantum mechanics or nanoelectronics
- 15 minutes in length
- can work with one partner, if desired. (A talk with two presenters should be at least 25 minutes long.)

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Quantum Mechanics (approximately 50% of class time)

- An introduction, not a complete treatment
- Somewhere between Phys 321 and Phys 480
- Develop some understanding of the concepts and terminology.
- Be able to work some basic problems.
- You will not become an expert!

QM as applied to semiconductors (about 25%)

- Extend some of the ideas that were introduced in EE 332, like periodic potentials, band theory, scattering, etc.
- Introduce heterojunctions and band-engineering
- Re-examine the MOSFET and what happens as it shrinks down to nothing

Nanoelectronics (about 25%)

- Current flow in mesoscopic and atomic systems
- Carbon-based technologies – buckyballs, nanotubes, and graphene
- Quantum dots and quantum wires
- Spin devices
- other topics of current research interest

Initial reading

- Richard Feynman - “There’s plenty of room at the bottom.” http://www.its.caltech.edu/~feynman/plenty.html