

**ECE113A ELECTRONICS I  
FALL 2003**

- Catalog Data:** **ECE113A Electronics I (Credit Units: 4) F.** The properties of semiconductors, electronic conduction in solids, the physics and operation principles of semiconductor devices such as diodes and transistors, transistor equivalent circuits, and transistor amplifiers. Corequisite: ECE113LA. Prerequisites: Physics 7E, ECE70A, ECE70B. (Design units: 1).
- Textbook:** **Semiconductor Device Fundamentals**, Robert F. Pierret, Addison-Wesley, 1996
- References:** **Solid State Electronic Devices**, Ben G. Streetman, 5<sup>th</sup> edition, Prentice-Hall, 2000  
**Microelectronics**, Jacob Millman and Arvin Grabel, 2<sup>nd</sup> edition, McGraw Hill, 1987
- Coordinator:** Chin C. Lee
- Course Objective:**
1. To understand the properties of semiconductors
  2. To understand electronic conduction in solids
  3. To understand the physics and operation principles of diodes and transistors
  4. To learn transistor equivalent circuits
  5. Ability to analyze and design single-stage amplifiers
- Course Outcomes and Relationship to Program Outcome:**
1. Students learn the properties of semiconductors (Program Outcome 3, 9)
  2. Students learn carrier transport in semiconductors (Program Outcome 1, 3)
  3. Students learn to analyze p-n junction diodes and bipolar junction transistors (Program Outcome 1,3)
  4. Students learn transistor equivalent circuits and single stage amplifiers (Program Outcome 1,3)
  5. Students are able to design doping processes, basic p-n junction diodes, basic bipolar junction transistors, and single-stage transistor amplifiers (Program Outcome 1, 3)
- Prerequisites By Topic:** Calculus, fundamental electromagnetic theory, fundamental atomic physics, basic quantum mechanics, and fundamental circuit analysis  
List prerequisite course numbers that present the required content listed above: Physics 7E, ECE70A, ECE70B
- Lecture Topics:**
- Introduction
  - Energy bands and charge carriers in semiconductors
  - Carrier transport in semiconductors
  - Device fabrication
  - PN junction diodes
  - Bipolar junction transistors (BJT)
  - BJT equivalent circuits

-Single stage amplifiers  
-Fundamental MOS devices

**Class Schedule:** Each class meets 4 hours per week, 3 hours of lecture and 1 hour of discussion.

**Computer Usage:** Only to solve homework

**Laboratory Projects:** Offered in the accompanying laboratory course ECE113LA

**Professional Component:** Contributes to both the Electrical and Computer Engineering major requirements as 4 units of engineering science required in the Professional Component

**Design Content Description:** Three weeks of this course are devoted to elementary design of doping processes, p-n junction diodes, bipolar junction transistors, and transistor amplifiers. In particular, time is devoted to (a) the design of doping processes, (b) the design of basic p-n junction diodes, (c) the design of bipolar junction transistors, and (d) the design of single stage transistor amplifiers.

Approach: Homework – 50%, Lectures: 50%

**Grading Criteria:** Attendance  
Homework  
First Midterm  
Second Midterm  
Final exam  
(Percentages at discretion of instructor.)

**Estimated ABET Category Content:** Use percentages

Engineering Science: 3 credit units or 75%

Engineering Design: 1 credit units or 25%

Prepared by: Chin C. Lee; Revised by: Peter Burke

Last modified: April 2003; revised September 2003