

ESE 372: Electronics

Fall 2017

Stony Brook University
Department of Electrical and Computer Engineering

COURSE DESCRIPTION

Pertinent elements of semiconductor device physics and circuit theory are reviewed and applied to the study of electronic devices and circuits, including junction diodes, bipolar transistors, and field effect transistors (BJT, MOSFET); small-signal and large-signal analysis of amplifiers; amplifier frequency response; and rectifiers and wave shaping circuits.

Prerequisites: ESE 271

Corequisites (EE and CE): ESE 211

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|---------------------------|--|
| Instructor | Ridha Kamoua, 237 Light Engineering ridha.kamoua@stonybrook.edu Office hours: M, W 12:30pm – 2:30pm |
| Class Time | M W 2:30 – 3:50pm Frey Hall 201 |
| Teaching Assistant | Lingqing Gan |

TEXTBOOK

“Microelectronics Circuit Analysis and Design” Donald A. Neamen, McGraw Hill, 4th Edition, 2010, ISBN: 0073380644

On-line Blackboard site:

You can access Blackboard at: <http://blackboard.sunysb.edu>. Homework assignments, homework and exam solutions, and other pertinent information will be posted on the course’s Blackboard site. You can access blackboard using your Net ID username and password. To look up or set your Net ID, you need to login to SOLAR. For help or more information see: <https://tlt.stonybrook.edu/support/Pages/support.aspx>

For problems logging in, please contact blackboard@stonybrook.edu or (631) 632-2777.

Goals:

- 1) Analysis and design techniques of discrete and integrated analog circuits.
- 2) Applications of diodes to waveform shaping and voltage regulation.
- 3) Applications of transistors to signal amplification.

Objectives: At the end of the course, students should be able to:

1. Analyze and design diode circuits such as rectifiers, voltage regulators, clampers, and clippers,
2. Analyze and design single-stage and multi-stage bipolar junction transistor amplifiers,
3. Analyze and design single-stage and multi-stage field effect transistor amplifiers,
4. determine the low and high frequency response of amplifiers.

| Student Outcomes | % contribution |
|---|---------------------------|
| ✓ (a) an ability to apply knowledge of mathematics, science and engineering | 40 |
| <input type="checkbox"/> (b1) an ability to design and conduct experiments | |
| <input type="checkbox"/> (b2) an ability to analyze and interpret data | |
| ✓ (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability | 10 |
| <input type="checkbox"/> (d) an ability to function on multi-disciplinary teams | |
| ✓ (e) an ability to identify, formulate, and solve engineering problems | 30 |
| <input type="checkbox"/> (f) an understanding of professional and ethical responsibility | |
| <input type="checkbox"/> (g) an ability to communicate effectively | |
| <input type="checkbox"/> (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context | |
| <input type="checkbox"/> (i) a recognition of the need for, and an ability to engage in life-long learning | |
| <input type="checkbox"/> (j) a knowledge of contemporary issues | |
| ✓ (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice | 20 |

GRADING SYSTEM

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|----------|-----|--------------------------------|
| Homework | 10% | weekly |
| Exam 1 | 25% | October 4 |
| Exam 2 | 25% | November 8 |
| Final | 40% | December 12 5:30pm – 8:00pm |

COURSE OUTLINE

- 1. *Semiconductor Devices and Diode Circuits*** ***Chapters 1,2***
 - Theory of Semiconductors
 - Semiconductor Diodes
 - Rectifier Circuits
 - Clipper and Clamper Circuits
 - Zener Diode Circuits
 - Other Types of Diode Circuits

- 2. *The Bipolar Junction Transistor(BJT)*** ***Chapter 5***
 - Bipolar Junction Transistor
 - DC Analysis
 - Biasing

- 3. *Design of BJT Amplifiers*** ***Chapter 6***
 - Transistor Models
 - Common-Emitter Amplifier
 - AC Analysis and Design
 - Multistage Circuits (cascade, cascode)

- 4. *Field-Effect Transistors*** ***Chapter 3***
 - Types of FETs
 - MOSFET (Metal Oxide Semiconductor Field Effect Transistor) Operation
 - DC Analysis
 - Current Source Biasing
 - NMOS Inverter

- 5. *FET Amplifiers*** ***Chapter 4***
 - MOSFET Amplifier (Common Source, Gate, Drain)
 - MOSFET Differential Stage

- Multistage Circuits (cascade, cascode)

6. *Frequency Response*

Chapter 7

- Frequency Analysis
- Coupling and Bypass Capacitors
- BJT Frequency Response
- FET Frequency Response
- High-Frequency Response

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at:

<http://www.stonybrook.edu/uaa/academicjudiciary/>

Americans with Disabilities Act

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.