

# EE3161 Semiconductor Drives

*Updated: Feb. 2 2013*

*This course outline is to serve as a reference for instructors and students. It gives a general overview of course content and ABET Outcomes. Please consult the semester specific syllabus produced by the course instructor for more detailed information.*

## **Course Prerequisites, Basic Content, and Outcomes**

### **Catalog Description:**

(3.0 cr; Prereq-Upper div CSE, 2011, Phys 1302, Phys 2303 or Chem 1022; fall, spring, every year) Elementary semiconductor physics; physical description of pn junction diodes, bipolar junction transistors, field-effect transistors.

### **Contact Hours:**

3 hours of lecture and 1 hour of discussion per week.

### **Text:**

*Semiconductor Device Fundamentals*, R.F. Pierret, Addison-Wesley, 1996

### **Prerequisites by Topic:**

Mathematical skill at the calculus level (Math 1272, 1372, or 1572)

Knowledge of the physical sciences (Phys 1302, Phys 2303, or Chem 1022)

Understanding of device applications (EE 2011)

### **Course Outcomes:**

The student will be able to:

1. Calculate transport and equilibrium properties of uniformly doped semiconductors
2. Calculate dc and ac characteristics of junction diodes
3. Calculate dc and ac characteristics of bipolar junction transistors (BJT)
4. Calculate dc and ac characteristics of metal oxide semiconductor field effect transistors (MOSFET)

### **Relationship to Student Outcomes:**

In accordance with ABET accreditation criteria, all engineering programs must demonstrate that their students achieve certain outcomes. This list of outcomes may be found on the ABET.org website. Of the outcomes listed in the ABET criteria (enumerated as (a) through (k)), this course teaches skills which help the student achieve the following outcomes:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (i) a recognition of the need for, and an ability to engage in life-long learning

## Course Outline

<u>Week</u>	<u>Lecture Topics</u>
1	Introduction, Classical and Modern Physics
2	Semiconductor Physics
3	Fermi-Dirac Statistics and Fermi Level
4	Drift-Diffusion
5-6	Generation, Recombination and Absorption
7-8	PN junction: Electrostatics
9	PN junction: I-V characteristics
10	PN Applications
11	BJT
12	MOS capacitor introduction
13-14	MOSFET I-V relationship

## Departmental and University Policies

**Student Academic Integrity and Scholastic Dishonesty:** Academic integrity is essential to a positive teaching and learning environment. All students enrolled in University courses are expected to complete coursework responsibilities with fairness and honesty. Failure to do so by seeking unfair advantage over others or misrepresenting someone else's work as your own, can result in disciplinary action. The University Student Conduct Code defines scholastic dishonesty as follows:

**Scholastic Dishonesty:** Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering forging , or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis.

Within this course, a student responsible for scholastic dishonesty can be assigned a penalty up to and including an "F" or "N" for the course. If you have any questions regarding the expectations for a specific assignment or exam, ask.

**Incompletes:** A grade of I for Incomplete is given at the discretion of the course instructor when, due to extraordinary circumstances, the student who has successfully completed a substantial portion of the course's work with a passing grade was prevented from completing the work of the course on time. Students must fill out an Incomplete Grade Agreement form found in Keller 3-166. The maximum time to remove and replace an incomplete grade is one year.

**Makeup Work for Legitimate Absences:** Consult university policy here:  
<http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>

**Personal Electronic Devices:** Consult university policy here:  
<http://policy.umn.edu/Policies/Education/Education/CLASSROOMPED.html>

**Mental Health:** As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website at <http://www.mentalhealth.umn.edu>