

## Syllabus

Instructor	<b><i>Sheng-Chiang (John) Lee</i></b>	<b>Textbooks</b>
Office/Contact	SEB 244; 478-301-2599 <a href="mailto:Lee_SC@Mercer.Edu">Lee_SC@Mercer.Edu</a>	<i>Solid State Electronic Devices</i> , by Ben G. Streetman and Sanjay Kumar Banerjee, 6 <sup>th</sup> Edition
Office Hour	MW 2~3pm; F 1~2:30pm or by appointment	
Pre-Requisite	PHY 162	

### ***Course Description:***

This is an upper level course focusing on the physical principles of solid state devices, which essentially shape our lives around modern technologies. Though this is not a traditional solid state physics course, some basics of solid state physics will be discussed to prepare students for the study of operation principles behind semiconductor devices. Some common devices will be discussed, including transistors, LED's, and solar cells. Laboratory exercises will be accompanied to supplement the materials in the lectures.

### ***Objectives:***

After taking this course, you should be

- Familiar with some basic concepts in solid state physics, e.g. lattice structures, energy bands/gaps, and the quantum mechanic description of conduction process in solids.
- Familiar with the fabrication process of semiconducting materials and devices.
- Familiar with the physical behavior of “junctions” and be able to carry out basic numerical analysis of a junction with respect to its physical properties.
- Familiar with the operation principles of transistors (of different kinds), LED’s, and solar cells.
- Able to carry out simple numerical analysis on above mentioned solid state devices.

### ***Tentative Coverage:***

Ch1 Crystal Properties and Growth of Semiconductors

Ch2 Atoms and Electrons

===== 1<sup>st</sup> Test =====

Ch3 Energy Bands and Charge Carriers in Semiconductors

Ch4 Excess Carriers in Semiconductors

===== Midterm =====

Ch5 Junctions

===== 3<sup>rd</sup> Test =====

Ch6 Field-Effect Transistors

Ch7 Bipolar Junction Transistors

Ch8 Photo-electronic Devices (Optional)

===== Final Exam =====

# PHY 335 Solid State Devices

## **Grading Methods:**

### Grading Scale:

Score:	90+	85~89	80~84	75~79	70~74	60~69	59-
Grade:	A	B+	B	C+	C	D	F

### Grading Components:

	Homework	Exams (3 tests + 1 comprehensive final)	Laboratory
Weight	15%	$3 \times \text{Tests (10\%)} + 1 \times \text{Final (20\%)} = 50\%$	35%

## **Homework:**

Homework will be graded and must be the original work of a student. You are encouraged to discuss the problems with each other and with the instructor, but the submitted work must be original. Late homework will suffer late penalty within one week after due date. No homework will be accepted after this week without legitimate excuses.

*Special Note:* Since *Mathematica*® is now available in the physics department, you are welcome to use it for your homework. It makes typing equations and documenting your work much easier. It may also help you visualize your results and advance your appreciation of physics. However, you should NOT use *Mathematica*® to help you solve equations/differential equations, perform vector analyses, and so on, unless permitted by the instructor. YOU should have the ability to perform analytical calculations by hands.

## **Tests/Final:**

There will be three midterm tests and one comprehensive final exam. Tentative coverage of each exam is listed above. You may bring a letter-size sheet with any equations and numerical constants that you expect to use in the test. **NO** textbook, class notes, or work-out problems are allowed on the sheet.

## **Laboratory:**

Laboratory exercises will be designed along the lectures to supplement and enrich the knowledge taught in class. Formal laboratory reports in compliance with the format of a standard scientific report are required. The lab grade is evaluated on the performance and participation in the physical laboratory exercises and the quality of the lab reports. The late-work policy for the homework is applied to laboratory reports as well.

## **Class Evaluation**

In an ongoing effort to improve the quality of instruction, each student enrolled in this course is required to complete an end-of-semester course evaluation, to be administered through **BlackBoard** during the last week of the semester. Students failing to submit the evaluation by 5/08 will be assigned the grade of "Incomplete," which will automatically turn into an "F" if the evaluation is not submitted by the midterm of the very next semester.

## **Important Dates:**

**Last Day for Course Withdrawal: 3/25!!!!**

**Final Exam: 5/07, 9am ~ 12am**

## PHY 335 Solid State Devices

### ***Class Policies:***

**Attendance Policy:** Attendance is not mandatory. However, students with more than an occasional absence usually perform poorly in the class.

***Special Note:*** To prevent the spread of H1N1 (Swine Flu) or Seasonal Flu virus, if students have influenza-like symptoms, it is recommended to remain at home until at least 24 hours after you are free of fever (100°F or 37.8°C), or signs of a fever without the use of fever-reducing medications. Do not physically visit Student Health Center for it may help further spread the virus. The preferred method of making contact is via phone or e-mail.

**Class Etiquette:** You are expected to conduct yourself in a respectful manner to your fellow classmates and the instructor. The instructor may ask you to leave the classroom/lab if your behavior is disturbing to the instructor or other students.

**Honor Code:** You are bound by the Mercer honor code. The College's academic misconduct policy will be followed. All work, for which a grade is received, must be the **original** work of the **student** without aid or assistance of another party, or any printed and or electronic data/information. Academic misconduct cases will be referred to the honor council and the student will automatically receive a grade of incomplete (IC) pending a ruling by the honor council.

**Cell Phone and Pager Usage:** Out of courtesy for all those participating in the learning experience, all cell phones and pagers must be **kept in your pocket/backpack with power/ringer off** before entering any classroom, lab, or formal academic or performance event. Warning will be given for the first-time violation. One semester credit will be taken for each following violation up to three times. If a student keeps violating the policy, one may be asked to leave the room by the instructor.

**Documented Disability Statement:** Students with a documented disability should inform the instructor at the close of the first class meeting. The instructor will refer you to the office of Student Support Services (SSS) for consultation regarding evaluation, documentation of your disability, and recommendations for accommodation, if needed. Students will receive from SSS the *Faculty Accommodation Form*. On this form SSS will identify reasonable accommodations for this class. The form must be given to the course instructor for signature and then returned to SSS.

To take full advantage of disability services, it is recommended that students contact the Office of Student Support Services, immediately. The office is located on the third floor of the Connell Student Center.