Course and Contact Information

Instructor: Bhaskar L. Mantha
Office Location: ENG 383
Telephone: (925) 413-8365 (Mobile), (408) 924-3950 (Office)
Email: bhaskar.mantha@sjsu.edu
Office Hours: MW 2:15-4:15 pm or by appointment
Class Days/Time: MW 4:30-5:45pm
Classroom: Clark Building 310
Prerequisites: EE128 or Consent of instructor

Faculty Web Page
Copies of the course materials such as the syllabus, major assignment handouts, your grades, etc. can be found in SJSU/Canvas. You are responsible for regularly checking with the messaging system through MySJSU and your email as shown on class roster. Instructor email: bhaskar.mantha@sjsu.edu

Course Description
This course is a prerequisite for all electronics area courses and reviews semiconductor device physics and technology. The students are expected to have some background in atomic physics and solid state physics for this course. The course is divided into four parts- semiconductor fundamentals, p-n junctions, bipolar junction transistors (BJT), and field effect transistors (FET).
Course Goals and Student Learning Objectives

Upon successful completion of this course, students will be able to:

LO1 Describe fundamental concepts of solid-state physics applied to the semiconductor devices by Silicon and compound semiconductor materials.

LO2 Explain general electrical behavior of semiconductor Si and GaAs, construct appropriate physical models.

LO3 Illustrate structural details and current-voltage characteristics of p-n junction diode, BJT, MOSFET, Metal/semiconductor diode, and MESFET.

LO4 Apply the fundamental understandings of semiconductor devices with knowledge on the limitations of physical models.

Required Texts/Readings

Textbook


EE221 Covers most contents of Chapters 0-7 of the book.

Other Readings


Classroom Protocol

Active participation of students is required. Students will turn their cell phones off or put them on vibrate mode while in class. They will not answer their phones in class. They will not engage in conversations among themselves.
Assignments and Grading Policy

a. **Homework**
   Homework is assigned and is posted online during the semester (usually one per chapter). Homework will be collected. The solution will be posted in Canvas.

b. **Quiz**
   Pop quizzes are given during the semester. It is once a week most of the time.

c. **Exams**
   There are two mid-term examinations and one final examination.

d. **Class Participation:**
   Class participation is required and student attendance will be checked.

**Dropping and Adding**

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Add/drop deadlines can be found on the current academic year calendar on the [Academic Calendars web page](http://www.sjsu.edu/provost/academic_affairs/resources/academic_calendars/). Students should be aware of the current deadlines and penalties for dropping classes ([Late Drop Information](http://www.sjsu.edu/aars/policies/latedrops/policy/)).

**Grading Policy**

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>5%</td>
</tr>
<tr>
<td>Quiz</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm Exams (2)</td>
<td>25% each</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Final Grade Percentage Breakdown**

- Above 96%         : A+
- 90% - 95%         : A
- 85% - 89%         : A-
- 80% - 84%         : B+
- 70% - 79%         : B
- 65% - 69%         : B-
- 60% - 64%         : C+
- 55% - 59%         : C
- 50% - 54%         : C-
- 45% - 49%         : D+
- 40% - 44%         : D
- Below 40%         : F


University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs’ Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/”

Academic integrity

Students should know that the University’s Academic Integrity Policy is available at http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf. Your own commitment to learning, as evidenced by your enrollment at San Jose State University and the University’s integrity policy, require you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The website for Student Conduct and Ethical Development is available at http://www.sa.sjsu.edu/judicial_affairs/index.html.

Academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person’s ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, each student should complete all assignments unless otherwise specified.

If there are more sections of the same course and if the same homework problems are assigned in each section, it is expected that the students in both sections do independent work in order to solve the given problems. There should not be any copying or discussions between students in a given section or from different sections.
## Course Schedule

*The schedule is subject to change with fair notice to be announced in class.*

<table>
<thead>
<tr>
<th>week</th>
<th>date</th>
<th>Topic</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>01/30</td>
<td>Class logistics and Introduction to semiconductor device and technology</td>
<td>Chapter 0</td>
</tr>
<tr>
<td>2</td>
<td>02/01, 2/06</td>
<td>Semiconductor materials, energy bands</td>
<td>Chapter 1: 1.1-1.4</td>
</tr>
<tr>
<td>3</td>
<td>02/8, 02/13</td>
<td>Intrinsic semiconductor, doping in semiconductors, Carrier transport: Drift and diffusion</td>
<td>Chapter 1.5-1.6, Chapter 2: 2.1-2.2</td>
</tr>
<tr>
<td>4</td>
<td>02/15, 02/20</td>
<td>Carrier transport: Continuity equation and other processes (generation and recombination)</td>
<td>Chapter 2: 2.3-2.6</td>
</tr>
<tr>
<td>5</td>
<td>02/22, 02/27</td>
<td>p-n Junctions fabrication equilibrium conditions</td>
<td>Chapter 3: 3.1-3.2</td>
</tr>
<tr>
<td>6</td>
<td>03/01, 03/06</td>
<td>p-n junction operation, junction breakdown, hetero junction</td>
<td>Chapter 3: 3.3-3.7</td>
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<tr>
<td>7</td>
<td>03/08, 03/13</td>
<td>Review for 1st exam, 1st Mid-Exam, 03/13, Monday, Clark building 310</td>
<td>Chapter 4: 4.1-4.2</td>
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<tr>
<td>8</td>
<td>03/15, 03/20</td>
<td>1st exam solutions; Bipolar Transistor Fundamentals: The transistor action</td>
<td>Chapter 4: 4.4-4.5</td>
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<td>9</td>
<td>03/22, 03/27</td>
<td>Frequency response and switching of BJT, Heterojunction BJT(HBT)</td>
<td>Chapter 5: 5.1</td>
</tr>
<tr>
<td>10</td>
<td>03/29, 04/03</td>
<td>Review for 2nd exam, 2nd middle exam, 04/03, Monday, Clark building 310</td>
<td>Chapter 5: 5.2, 5.3, Chapter 5: 5.5</td>
</tr>
<tr>
<td>12</td>
<td>04/05, 04/10</td>
<td>2nd mid-exam solutions Ideal MOS-C Capacitor</td>
<td>Chapter 6: 6.1-6.3</td>
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<tr>
<td>13</td>
<td>04/12, 04/17</td>
<td>Real MOS-C Capacitor MOSFET fundamentals</td>
<td>Chapter 7: 7.1</td>
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<tr>
<td>14</td>
<td>04/19, 04/24</td>
<td>Advanced MOSFET: MOSFET Scaling, CMOS, MOSFET on Insulator</td>
<td>Chapter 7: 7.2-7.3</td>
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<td>15</td>
<td>04/26, 05/01</td>
<td>M/S contact</td>
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<tr>
<td>16</td>
<td>05/03, 05/08</td>
<td>MESFET and MODFET; Review for final</td>
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**Final Examination: May. 23, 2017, Tuesday, Clark Building 310, 2:45-5:00pm**
EE Department Honor Code

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

“I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor.”

Measures Dealing with Occurrences of Cheating

- Department policy mandates that the student or students involved in cheating will receive an “F” on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University.
- A student’s second offense in any course will result in a Department recommendation of suspension from the University.