**EE33101: Introduction to Electronic Devices (전자소자개론)** Spring 2016

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***Class Hours:*** Tue/Thu 13:00 – 14:15

***Office Hours:*** Mon/Wed 13:30 – 14:30

***Class Room:*** EB1 E204

***Text Book:*** Semiconductor Device Fundamentals, International ed., Robert F. Pierret (Addison Wesley)

***Additional Reference:*** Semiconductor Physics and Devices 4th Ed., Donald A. Neamen (McGraw Hill)

***Black Board:*** All class-related information including schedules of homeworks and exams will be posted on Black Board. Keep checking updates on BB.

***Course Description:***

This course has two basic purposes: (1) to provide students with a sound understanding of existing devices, so that their studies of electronic circuits and systems will be meaningful; and (2) to develop the basic tools with which they can later learn about newly developed devices and applications. To achieve these goals, this course first covers the fundamental physical concepts related to electronic devices, i.e., crystal structure of semiconductor materials, electronic energy band, dopants, carrier transport. Then it introduces the basic working principles of various electronic devices such as PN junction, Metal/Semiconductor junction, Metal-Oxide-Semiconductor (MOS) capacitor. Advanced emerging devices will be briefly reviewed at the end of the course.

***Grading:***

Class participation 10%

Homework 20%

Mid-term Exam 30%

Final Exam 40%

**Class Attendance:** Class attendance will be checked by offline, and will be used for grading class participation. Being late twice will be regarded as being absent once. 10% of class participation for full attendance, 8% for 1 absence, 6% for 2 absence, 4% for 3 absence, 2% for 4 absence and 0% for 5 absence or more.

**Homework:** Submit homework after class on the due date. Late submission is not allowed and regarded as not submitted.

**Exams:** One midterm exam and one final exam (closed book but one side of a sheet is allowed)

**Honor Code Statement:** You are expected to do homework and exams by yourself, and any plagiarism is strictly prohibited and will be appropriately punished. When preparing homework you are allowed to discuss with other peer students, but all material submitted must be original.

**Notes on exam grading:** For exam problems, reasoning and analysis are typically as or more important than the final answer. You should explain your reasoning clearly and show all work. Be sure to erase or cross out any work you do not want to be considered in grading. If you demonstrate mastery of the key concepts required to solve a problem, you will receive substantial credit even if the final answer is not completely correct. Conversely, a correct final answer without explanation or justification will typically receive very limited credit.

**Policy on Collaboration:**

Discussion of course material and homework problems is permitted (and encouraged!). However, each student should work through the homework problems (and write up his or her solutions) independently. For additional details please see the section of this syllabus on Policy on Academic Integrity.

***Course Schedule***

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| Week | Contents | Chapter |
| 1 | Course overview & Introduction |  |
| 2 | Crystal properties of semiconductors  Introduction to Quantum Mechanics | 1  2, ref ch2 |
| 3 | Energy bands and Electrons/Holes  Doping, Density of states, and Fermi function | 2, ref ch3 |
| 4 | Carrier concentrations  Carrier drift and conductivity/resistivity | 2 |
| 5 | Carrier diffusion and Einstein relationship  Generation/Recombination and Minority carrier lifetime | 3 |
| 6 | Generation/Recombination and Minority carrier lifetime  Continuity equation and Minority carrier diffusion | 3 |
| 7 | P-N Junctions: Introduction and electrostatics | 5 |
| 8 | Midterm Exam |  |
| 9 | P-N Junctions: I-V characteristics | 6 |
| 10 | P-N Junctions: Small-Signal Admittance  No class on Thursday (holiday) | 7 |
| 11 | P-N Junctions: Transient and AC conditions | 8 |
| 12 | Metal-Semiconductor Junctions: contacts and barriers | 14 |
| 13 | Metal-Semiconductor Junctions: Schottky Diode  MOS capacitor: Band diagram and electrostatics | 14,16 |
| 14 | MOS capacitor: C-V characteristics  No class on Thursday (June 2nd ) – conference attendance | 16 |
| 15 | MOS capacitor: Oxide interface  MOSFET: Basic concepts | 17, 18 |
| 16 | Final Exam |  |