COURSE SYLLABUS

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YEAR COURSE OFFERED: 2015

SEMESTER COURSE OFFERED: Spring

DEPARTMENT: Electrical and Computer Engineering

COURSE NUMBER: ECE 4339 – 16479 / 4119-16478

NAME OF COURSE: Physical Principles of Solid State Devices and Lab
(Introduction to microelectronics)

NAME OF INSTRUCTOR: Han Q. Le

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The information contained in this class syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.

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Learning Objectives/Expected Outcomes

- To give/reinforce each student a solid knowledge base in the fundamentals of mathematics, physical science, and specifically the fundamental of electrical and computer engineering through the following course topics: modern and quantum physics, electron devices, electronics materials technology, applications, and an introduction to the semiconductor industry.
- To develop in each student the basic skills of problem solving and critical thinking with special assignments designed to reinforce students' learning of the basic course materials, to hone their ability of critical thinking and integration of knowledge.
- To give each student the knowledge of contemporary issues that relate to engineering in assignments involving "real world" materials that involve topics and issues related to this course material.

Major Assignments/Exams

Homework, exams (which can be take-home), and term paper or projects.

Required Reading

Recommended Reading/Textbooks

There are many excellent textbooks on solid state devices. Any one of these three would be useful for the course:

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- Semiconductor Device Fundamentals by *Robert F. Pierret*
- Understanding Semiconductor Devices by *Sima Dimitrijev*
- Solid State Electronic Devices by *Ben Streetman* and *Sanjay Banerjee*

In addition, there are extensive materials available on the Internet. The students are encouraged to use online resources, as the act of searching and organizing the mass knowledge to filter down into essential knowledge is a very important learning process on its own.

List of discussion/lecture topics

- A basic overview of the semiconductor technology and industry and its role in present global economy
- Basic material science, semiconductors, crystallography, modern physics (quantum physics concepts) of atoms, molecules, and condensed matters
- Energy bands in solid, charge carriers, transport theory, and carrier statistics (Fermi-Dirac)
- Fundamentals of semiconductor device structures: junctions
- Transistors: FET, BJT
- Optoelectronic devices; lasers, photonics and integrated photonics
- Integrated circuits and special devices
- Others: Note: semiconductor electronics is rapidly evolving and developing field, scientifically, technologically, industrially, and business-wise. The emphasis of the course material is not only on the specific topics and details above, but also the overarching principles that guide the development of this field over the last 50 years. Apart from the topics listed above, students will be asked to analyze and critique new developments in the field reported in the news media from time to time during the course, which are different for each semester. Learning process, critical thinking, and breadth of knowledge and perception will be emphasized.