COURSE NUMBER: Ve420	**COURSE TITLE:** Physical Principles Underlying Smart Devices
CREDIT: 4	**PREREQUISITES:** Ve320, or graduate standing
TEXTBOOKS/REQUIRED MATERIAL: "Semiconductor Physics and Devices: Basic Principles," 4th ed, Donald A. Neamen	**INSTRUCTOR:** Yaping Dan **DATE OF PREPARATION:** Oct. 30, 2012 **DATE OF UC APPROVAL:** Oct. 30, 2013
INSTRUCTOR(S): Yaping Dan	**SCIENCE/DESIGN:** n/a
CATALOG DESCRIPTION: This course provides a general introduction to the underlying physics behind solid state devices. General topics include: Introduction to Quantum Mechanics; Low dimensional conductors; Electronic band structure; Ballistic transport; Carrier generation-recombination; Minority carrier diffusion and drifting process; Light absorption and emission; Magnetic effects; Low dimensional optoelectronic devices and CMOS transistors. In addition to studying these topics, students are expected to have a reasonably good understanding of today's advanced research topics in the related fields by reading research articles in top journals.	**COURSE TOPICS:** 1. Introduction to Quantum Mechanics (3 hrs) 2. Theory of Electronic Band Structure (6 hrs) 3. Charge Carrier Transport (6 hrs) 4. Electron-hole Generation and Recombination (3 hrs) 5. PN junction and the related devices (6 hrs) 6. CMOS transistors and their scaling-down challenges (6 hrs)
COURSE STRUCTURE/SCHEDULE: Lecture: twice per week, 90 minutes each;	

COURSE OBJECTIVES [Course Outcomes in brackets]	1. To help understand semiconductor physics and device principles at an advanced level. [1, 2, 3, 4] 2. To provide training for graduate research. [4, 5] 3. To train the students to be a critical thinker. [2,3]
COURSE OUTCOMES [Program Outcomes in brackets]	After completing VE420, students should be able to: 1. Have a deep understanding of semiconductor physics. [a, e] 2. Interpret the essential principles of semiconductor devices. [a, e] 3. Read and understand research articles in top journals in this field. [a, c, e, k, h, I, j] 4. Understand the challenges and motivations of research topics in this field. [g, c, h, I, j] 5. Present a well-organized scientific talk. [g, f, I, j]
ASSESSMENT TOOLS [Course Outcomes in brackets]	Homework [1,2, 3] Midterm Exam [1,2,3,4,5] Final Exam [4,5] Oral reports [4,5] Peer evaluations [5]