

COURSE: EECS 420. TITLE: Physical Principles Underlying Smart Devices. PREREQUISITE: EECS 320 & 330 or Graduate		ELECTIVE.
TEXTBOOK: Course pack written by Professor Jasprit Singh.		
CATALOG DESCRIPTION: Structural properties of materials. Basic quantum mechanics of electrons in solids. Band theory and trap states. Charge transport, band conduction and hopping conduction. Optical properties of materials. Piezoelectric and ferroelectric phenomena. Magnetic effects in materials. Physical phenomena will be related transistors, light emitters, sensor and memory devices.		
COURSE OBJECTIVES: 1. To teach students how semiconductor devices physically operate, using quantum theory; [1,11,14] 2. To teach students how ferro- & piezo-electric devices physically operate, using quantum theory; [“] 3. To teach students how electro-optic devices physically operate, using quantum theory; [1,11,14] 4. To teach students how magnetic material devices physically operate, using quantum theory[1,11,14]		TOPICS COVERED: 1. Basic quantum mechanics 2. Crystal structure (ferro, piezo) 3. Electronic levels & bands (dopants) 4. Charge transport (band conduction) 5. Polarization (ferro, piezo, pyro) 6. Optical effects (electro-optics, absorption and emission) 7. Magnetic materials
COURSE OUTCOMES [Program Outcomes Addressed] 1. Ability to analyze the operation of diodes, transistors, and LEDs using quantum theory; 2. Ability to analyze the operation of SAW, actuators, & accelerometers using quantum theory; 3. Ability to analyze the operation of polarizers, filters, and image storage using quantum theory; 4. Ability to analyze the operation of microwave and spintronic devices using quantum theory.		ASSESSMENT (Course outcomes) 1. Weekly problem sets [1,2,3,4] 2. In-class open-book exams [1,2,3,4]
PROGRAM OUTCOMES ADDRESSED: 1,11 PROFESSIONAL COMPONENT ADDRESSED: 14 PREPARED BY: Andrew E. Yagle on Nov. 19, 2004	CLASS/LABORATORY SCHEDULE: LECTURES: 3 per week @ 50 minutes. RECITATION: 1 per week @ 1 hour	

COURSE DESCRIPTION: University of Michigan, College of Engineering, ELECTRICAL ENGINEERING PROGRAM