

Department	Electrical and Computer Engineering
Course Number	EELE 409
Course Title	EE Material Science
Total Credit Hours and Format	3 Credits. (3 Lec) F
Catalog Description	PREREQUISITE: EELE 317 Basic material properties of dielectrics, magnetic materials, conductors, and semiconductors. Practical applications of materials to semiconductor devices.
Faculty Coordinator	Todd Kaiser
Course Designation	Required
Textbook	Principles of Electronic Materials and Devices 3E, Kasap, 2006
Course Learning Outcomes	At the conclusion of EELE 409, students are expected to be able to: 1) Understanding of the physical processes in a material which determine the specifications of a particular electronic device. 2) Be able to break a complex electronic materials problem down into smaller pieces, each of which can be more easily solved, with the interactions between each sub-problem clearly identified and quantified. 3) An understanding of the limits material properties impose upon electronic device specifications. 4) Given a design specification, a student should be able to select a set of candidate materials which can provide a solution for the design problem. From these materials, the student should then be able to find commercially available devices which use these materials. 5) Given a set of specifications claimed for a device, a student should be able to confirm the validity of those specifications based on the properties of the materials used in the device and the device geometry.
Program Outcomes	EELE 409 supports following Program Outcomes: a. an ability to apply knowledge of mathematics, science and engineering b. an ability to design and conduct experiments, as well as to analyze and interpret data e. an ability to identify, formulate, and solve engineering problems. g. an ability to communicate effectively. i. a recognition of the need for, and an ability to engage in life-long learning. k. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice l. been exposed to the principles of project management and design trade-offs.

Topics Covered	1) Atomic Bonding and types of bonds 2) Kinetic Molecular Theory 3) Thermally Activated Processes 4) Solid Solutions 5) Phase Diagrams 6) Thermal Conduction in solids 7) Electrical Conduction 8) Band Theory of solids 9) Thermionic Emission and Vacuum Tubes 10) Piezoresistivity 11) Metal Semiconductor contacts 12) Thermoelectric coolers 13) Semiconductor Basics 14) Carrier Generation and Recombination 15) Semiconductor Devices 16) Dielectric Materials 17) Polarization Mechanisms 18) Piezoelectricity 19) Magnetization and Magnetic Properties 20) Magnetic Domains 21) Optical Properties of Materials
Prepared by	Todd Kaiser (04/27/2015)