

SAMPLE SYLLABUS

This syllabus is to be used as a guideline only. The information provided is a summary of topics to be covered in the class. Information contained in this document such as assignments, grading scales, due dates, office hours, required books and materials may be from a previous semester and are subject to change. Please refer to your instructor for the most recent version of the syllabus.

ABET Course Syllabus EEE352

1. **Course: EEE 352 Properties of Electronic Materials**
2. **Credits and Contact Hours:** 4 Credit Hours (lecture), Topics: Engineering
3. **Course Coordinator:** Dr. Meng Tao, Professor
4. **Textbook:** Donald A. Neamen, *Semiconductor Physics and Devices*, McGraw-Hill, 2003.
Supplemental materials:
 - C. Kittel, *Introduction to Solid State and Semiconductor Physics*.
 - J. McKelvey, *Solid State and Semiconductor Physics*, 1982.
 - S. Brandt and H. Dahmen, *The Picture Book of Quantum Mechanics*.
 - L. Solymar and D. Walsh, *Lectures on the Electrical Properties of Materials*, 5th edition, Oxford University Press, New York, 1988.
5. **Specific course information**
 - a. **Catalog description:** Schrodinger's wave equation, potential barrier problems, bonds of crystals, the band theory of solids, semiconductors, p-n junctions, MOSFETs, bipolar transistors, other transistors, superconductor, dielectric, and magnetic properties.
 - b. **Prerequisites or co-requisites:** CHM 114 (or 116); MAT 274; PHY 241.
 - c. **Required/elective/selected elective:** Required
6. **Specific goals for the course**

Students will be introduced to the electronic properties of materials and will learn semiconductor physics and the qualitative principles of solid-state devices.

 - a. **Outcomes of instruction:**
 - i. Students become proficient in applying the basic principles of quantum mechanics.
 - ii. Students develop an appreciation of the microscopic properties of electronic materials.
 - iii. Students understand semiconductor physics and the operation of solid-state devices.
 - b. **Outcomes of Criterion 3 addressed by the course:**

(1) This course support is fundamental since quantum mechanics and properties of electronic materials are basic to understanding current semiconductor device and VLSI technology. It contributes to the students' technical competence because it strengthens their skills in mathematics and physics through use and application of those skills, provides basic knowledge about electronic materials and devices, and gives some practice in developing models, defining problems, and recognizing appropriate solutions, through solution of problems related to electronic materials.

(7) Quantum mechanics is particularly important to understanding future technologies (e.g. 10 years after graduation). It will help our graduates succeed in an environment where technical innovation is important because these modern fundamentals should aid in such innovation.
7. **Brief list of topics to be covered**
 1. Atomic structure of crystals
 2. Classical waves; quantization; wave-particle duality
 3. Elementary quantum mechanics of the electron
 4. Chemical bonding and the periodic table
 5. The free electron theory of metals*

6. Band theory of solids
7. Semiconductors: Doping, holes, statistics, transport, and excess carriers
8. p-n junctions
9. MOSFETs
10. Other transistors
11. Dielectric properties of materials*
12. Magnetic properties of materials*
13. Superconducting properties of materials*

*Coverage varies by instructor; not all starred topics usually covered in one semester

Computer Usage:

Students will be assigned HW problems involving plotting functions, solving nonlinear equations numerically, or doing some type of simulation on a PC, including using available simulators at e.g. Nanohub.org.

Laboratory Experiments: None.

Course Contribution to Engineering Science and Design:

This course contributes primarily to engineering science (close to 100%). It provides the basic knowledge of quantum mechanics, electronic materials properties, and semiconductor physics and qualitative device principles needed to support detailed instruction in the analysis and design of semiconductor devices covered in EEE 436. It provides practice in applying math and science skills to engineering applications and gives substantial practice in formulating and solving engineering-related problems involving electronic materials and quantum mechanics.

Person preparing this description and date of preparation: K. Tsakalis, June, 2021.