

**ECE102/ECE102L**  
**Properties of Materials/Laboratory**

### **1. Course Description**

The course covers the fundamental electrical, optical, and magnetic properties of materials, focusing on metals and semiconductors.

### **2. Course expectations**

Effective learning requires active student engagement, which this course will facilitate through various opportunities, including cooperative problem-solving in lab sessions. Students are expected to come prepared to participate actively in both lectures, which will cover fundamental concepts, and lab sessions, which will focus on developing engineering skills like problem-solving and data analysis. Regular lab quizzes and a thorough review of Learning Objectives will help track progress. To get the most out of this course, it is crucial to read the assigned textbook sections and Lab Notes before attending class and lab sessions.

### **3. Topics Covered in the Lectures**

- Introduction, atomic structure
- Chemical bonds
- Crystals, lattice and basis, kinetic gas theory
- The Drude model, electrical and thermal conduction
- Hall effect, quantum physics, Schrodinger equation
- Heisenberg uncertainty, quantum well, tunneling
- Hydrogen atom, Band theory
- Effective mass, density of states
- Electron statistics, quantum theory of semiconductors and metals
- Intrinsic semiconductors
- Extrinsic semiconductors
- Generation and recombination
- Drift and diffusion, optical absorption, photoconductivity
- Dielectric properties
- Magnetic properties

### **4. Topics Covered in the Laboratory Sessions**

- Structures of Crystalline Solids
- Temperature Dependence of Metal Resistivity
- Solar cell

### **5. Text Book**

S.O. Kasap, Principles of Electronic Materials and Devices, McGraw Hill, 2017, 4<sup>th</sup> Edition or a newer edition.

### **6. Grading (ECE102)**

Quiz (5): 40%, Midterm (1): 30%, Final (1): 30% (Late submissions will not be accepted)

### **7. Grading (EE145L)**

Lab report (3): 100% (Overdue lab report results in -5%/day penalty)