

PHYSICAL PROPERTIES OF SOLIDS
(MTEN6010L - MTEN-5110L)

Reference Books:

The Science and Engineering of Materials (6th edition)
Donald R. Askeland
The Solid State Electronic Devices (6th edition), Ben Streetman
Understanding Solids, Richard Tilley
Introduction to Solid State Physics, Charles Kittel (6th edition)

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Objective

This course is intended to provide the background relating to the major physical properties of solids including metallic conductivity, semiconductivity, dielectricity, magnetism, fluorescence, particularly those of emerging advanced electronic materials that are currently in use. It is also intended to prepare both undergraduate and graduate students for the most active research and development areas of today's industry such as semiconducting devices, sensors, photovoltaic, transducers, energy storage, optical devices, and telecommunications.

Teaching philosophy and policies for assignments/tests

No make up exams will be given and I must be notified of any absence in advance.

Grading standard for a class average of 75% or above

90% to 100% - A, 80% to 89% - B, 70% to 79% - C, 60% to 69% - D, 59% or below - F

Grading policy

1.	Midterm1.....	30%
2.	Midterm 2.....	30%
3.	Final.....	40%
	Total	100%

- 1. Quantum Mechanics**
 - Wave-Particle Duality
 - The Uncertainty Principle
 - Schrodinger's Wave Equation
 - Electron in Free Space
 - The Infinite Potential Well
 - The One-Electron Atom
 - Allowed and Forbidden Energy Bands
- 2. Electronic Properties**
 - Ohm's Law and Electrical Conductivity
 - Band Theory
 - Conductivity of Metals
 - Semiconductivity
 - Insulators and Dielectric Properties
 - Polarization in Dielectrics
 - Electrostriction, Piezoelectricity, Pyroelectricity, and Ferroelectricity
- 3. Magnetic Materials**
 - Magnetic Dipoles and Magnetic Moments
 - Magnetization, Permeability, and the Magnetic Field
 - Diamagnetic, Paramagnetic, Ferromagnetic, and Superparamagnetic materials
 - Domain Structure and the Hysteresis Loop
 - The Curie temperature
 - Applications of Magnetic Materials
- 4. Photonic Materials**
 - The Electromagnetic Spectrum
 - Refraction, Reflection, Absorption, and Transmission
 - Luminescence
 - Light-Emitting Diodes
 - Lasers
 - Fiber Optic Communication System
 - Photovoltaic Effect
- 5. Semiconducting Devices**
 - p-n Junctions
 - Equilibrium conditions
 - Forward and Reverse-Biased Junctions
 - Reverse-Bias Breakdown
 - Field-Effect Transistors
 - The Junction FET
 - The Metal Semiconductor FET
 - The Metal-Insulator-Semiconductor FET