



MT213 January 3:0

Electronic Properties of Materials

Instructor

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Teaching Assistant

None

Email: NA

Department: Materials Engineering

Course Time: Mon, Wed, Fri 12:00-1:00 pm

Lecture venue: Materials Engineering lecture theater

Detailed Course Page: <http://materials.iisc.ac.in/~dasgupta/pages/Teaching.html>

Announcements

Brief description of the course

It is an introductory course for students with materials major or materials science background. The course introduces electronic properties of materials, classical and quantum physics, semiconductor physics, polarization theories and also at the end a few most encountered two and three terminal electronic devices.

Prerequisites

None

Syllabus

Introduction to electronic properties; Drude model, its success and failure; energy bands in crystals; density of states; electrical conduction in metals; semiconductors; semiconductor devices; p-n junctions, LEDs, transistors; electrical properties of polymers, ceramics, metal oxides, amorphous semiconductors; dielectric and ferroelectrics; polarization theories; optical, magnetic and thermal properties of materials; application of electronic materials: microelectronics, optoelectronics and magnetoelectrics.

Course outcomes

It is an introductory course to mostly students who did not have much exposure to semiconductor physics

before. So it starts with Classical Drude model, and ends with complex devices. At the end of this course students have a flavor of electronic properties, they start to understand that many physical properties of material are based on their electronic structure. They understand band structures and electronic transport mechanisms of a wide range of material and with the exposure to many functional devices, such as LEDs, photovoltaics, transistors, supercapacitors, magnetoelectrics their academic / research interest broadens into a wider subject space.

Grading policy

Two midterms, 25% each + one end-term (semester exam) 50%

Assignments

3 Assignments are given each after 12-13 lectures.

Resources

Reference Books:

R. E. Hummel, Electronic Properties of Materials

S. O. Kasap, Principles of Electronic Materials and Devices

S. M. Sze, Semiconductor devices: Physics and Technology

D. Jiles, Introduction to the electronic properties of materials

M. Ali Omar, Elementary solid state physics

Dieter Schroder, Semiconductor material and device characterisation