



MR301 Aug 3:0

Quantum Mechanical Principles in Materials

Instructor

Abhishek Kumar Singh
Email: abhishek@iisc.ac.in

Teaching Assistant

Email:

Department: MRC

Course Time: Tue., Thu., 9:00 - 10:30 AM

Lecture venue: MRC Seminar hall

Detailed Course Page:

Announcements

Brief description of the course

Dr. Singh has been instrumental in redesigning the MR301 (Quantum Mechanical Principles in Materials) and has been offering this course every August semester. This course stands out due its unique flavor, which combines the quantum mechanical principles with their usage in materials science. Every major portion of quantum mechanics is immediately followed by its application in materials science. This removes whatsoever doubts the students have about the applicability of quantum mechanics. He makes students comfortable with the basic postulates of quantum mechanics as well as the necessary tools such as orthonormal, completeness, probabilities as well as eigenvalue and eigenstates, to tackle problems. After building a solid foundation, he demonstrates how these principles lead to the understanding of the electrical, optical, and thermal properties of the materials. This course has helped cater to the needs of both experimentalists, interested in learning the theory behind their science, as well theorists, who are beginning their journey in this field.

Prerequisites

None

Syllabus

Basics of quantum mechanics (atoms to materials). Classification of materials based on quantum mechanical principles. Classical and quantum mechanical treatment of lattice vibrations. Quantum mechanical treatment of electrical, optical and thermal properties of materials. Semiconductors, superconductors, foundations of magnetism, magnetic phenomena and their interpretation (classical and quantum mechanical approach).

Course outcomes

The appeal of this course goes beyond the divisions as the students attending this course are from both sciences as well as engineering backgrounds. It is also very popular among the senior undergraduate students.

Grading policy

10% for assignment 40% midterm 40% final 10% project

Assignments

Resources

Claude Cohen-Tannoudji, Bernard Diu, Frank Laloe. Quantum Mechanics (2 vol. set), John Wiley & Sons.

Charles Kittel., Introduction to Solid State Physics, John Wiley and Sons

Neil W. Ashcroft, and David Mermin N., Solid State Physics, Brooks/Cole

Brandt and Dahmen. The Picture Book of Quantum Mechanics

Stephen Elliott, The Physics and Chemistry of Solids