Solid State Physics

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Course website:
https://www.phys.sinica.edu.tw/TIGP-NANO/Course/2024_Fall/2024_Fall_SolidStatePhysics.html

NST Program Secretary

Ms. Flora Wu

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Credits: 3

Classroom: P101 Meeting Room,
Institute of Physics, Academia Sinica

Class hour: Tuesday, 9:10-12:00

Course Objectives:

This course intends to equip students with some basic understanding about the current research in condensed matter physics. From the fundamental to more sophisticated phenomena, it covers a wide scope with emphasis on more conceptual building than the rigorous formulation. Students are required to have some quantum mechanics and statistical physics background, in order to digest the comprehensive content of this subject and appreciate its profound implication in today's technological applications.

Textbooks

1) *Introduction to Solid State Physics, Charles Kittel, the 8th edition (2005)*

2) *Condensed Matter Physics, Michael P. Marder (2000)*

3) *Solid-State Physics, James Patterson and Bernard Bailey, the 2nd edition (2010)*

4) *Solid-State Physics, Harald Ibach and Hans Luth, the 4th edition (2009)*

5) *Solid State Physics, Ashcroft and Mermin, (1976)*

Course Syllabus

Week 01	**(09/03)**	**Introduction and General Guidelines**
Week 02	**(09/10)**	Crystal Symmetries and Bindings
Week 03	**(09/24)**	Reciprocal Lattice and Diffraction
Week 04	**(10/01)**	Electrons in Periodic Potentials
Week 05	**(10/08)**	Dynamics of Bloch Electrons
Week 06	**(10/15)**	Transport Phenomena
Week 07	**(10/22)**	Lattice Vibrations and Elasticity
Week 08	**(10/29)**	**Midterm Written Exam (40%)**
Week 09	**(11/05)**	Semiconductors and Devices
Week 10	**(11/12)**	Superconductivity
Week 11	**(11/19)**	Magnons and Magnetic Resonance
Week 12	**(11/26)**	Dielectrics and Ferroelectric
Week 13	**(12/03)**	Optical Properties of Solids
Week 14	**(12/10)**	**Final Presentation (20%)**
Week 15	**(12/17)**	**Final Written Exam (40%)**

Fundamentals

- Crystal Symmetries and Bindings
- Reciprocal Lattice and Diffraction
- Electrons in Periodic Potentials
- Dynamics of Bloch Electrons
- Transport Phenomena
- Lattice Vibrations and Elasticity

Applications

- Semiconductors and Devices
- Superconductivity
- Magnons and Magnetic Resonance
- Dielectrics and Ferroelectric
- Optical Properties of Solids

Grading

Midterm Written Exam (40%)

Final Written Exam (40%)

Final Presentation(20%)

The problems in the exams will mainly be taken from the exercises of the textbooks