Solid State Physics

Jason (Chia-Seng) **Chang**

Email: jasonc@phys.sinica.edu.tw

Course website: https://www.phys.sinica.edu.tw/TIGP-NANO/Course/2021_Fall/2021_Fall_SolidStatePhysics.html

NST Program Secretary

Ms. Flora Wu

lhwu@phys.sinica.edu.tw

Credits: 3

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

Class hour: Thursday, 14:10-17:00

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)

Course Syllabus

Week 01	**(09/16)**	**Introduction and General Guidelines**
Week 02	(09/23)	Crystal Symmetries and Bindings
Week 03	(09/30)	Reciprocal Lattice and Diffraction
Week 04	(10/07)	Electrons in Periodic Potentials
Week 05	(10/14)	Calculations of Energy Bands
Week 06	(10/21)	Lattice Vibrations and Elasticity
Week 07	(10/28)	Dynamics of Bloch Electrons
Week 08	(11/04)	Transport Phenomena
Week 09	**(11/11)**	**Midterm Written Exam (50%)**
Week 10	(11/18)	Semiconductors
Week 11	(11/25)	Electronics
Week 12	(12/02)	Magnons and Magnetic Resonance
Week 13	(12/09)	Superconductivity
Week 14	(12/16)	Dielectrics and Ferroelectric
Week 15	(12/23)	Optical Properties of Solids
Week 16	(12/30)	Nanostructures
Week 17	**(01/06)**	**Final Written Exam (50%)**

Fundamentals

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

Applications

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

Grading

Midterm Written Exam (50%)

Final Written Exam (50%)

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