Solid-State Physics

Course Name	Course type (credit/hours)	Required course(3/3)	Course code	G040
	Target students Division/major/grade	Physics/Junior	Opening semester	2020 2ND SEMESTER
	Class time and classroom	Tue F(Seong337)Thu E(Seong337)	English Grade	A(100%English)
Reference to this course	Prerequisite courses			
	Related basic courses	Quantum Mechanics		
	Recommended concurrent courses			
	Related advanced courses			

Instructor	Name (title/division)	Hyungwoo Lee(Assistant Professor, Energy Systems Research)				
	Office Room Number	원천관 416호	Office phone Number	2581	e-mail	
	Office hours		Homepage address			
Teaching Assistant	Name (title/division)					
	Office Room Number		Office phone Number		e-mail	

1. Introduction

The physical understanding of various kinds of solids has been developed rapidly since the foundation of quantum mechanics in the early 20th century. Today, solid stae physics is a discipline of physics with the largest number of researchers and is being applied extensively to industries and engineering. The main topic includes the atomic structure of crystals, phonons, free electron gas and the Fermi surface in this course. This course will cover electrical and optical properties of metals, semiconductors, dielectrics, nano-materials.

2. Course Objectives

Students need to understand the basic concepts and theories of solid state physics and acquire an ability to apply them to real physical phenomena observed in nature and in laboratories.

Specifically, students need to understand
1. the atomic structure of crystals
2. the principle of crystal binding
3. elementary excitations in solids including phonons
4. thermodynamics and dynamics of free electrons and the Fermi surface
5. elementary concepts of energy band in semiconductor crystals
6. Nanostructures

3. Class types and activities

In this course, regular video lectures will be given along with weekly homework. The attendance scores will be determined by the homework submission. All the homeworks must be submited by the designated deadlines. Every two weeks, real-time online lecture will be given. Students can ask questions directly to lecturers in the online lecture. Both Mid-term and Final exams will be held off-line.

4. Teaching Method

- [V] lecture
- [ ] discussion and debate
- [ ] team project(presentation and case studies)
- [ ] experiments(role-playing,etc)
- [ ] designing and production
- [ ] on-site learning(on-site training)
- [ ] others

5. Support Systems in Use

- [V] AjouBb
- [ ] automatic recording system
- [ ] web-based assignment
- [ ] cyber lecture
- [ ] online content
- [ ] class behavior analyazing system
- [ ] others

6. Teaching Tools

- [ ] PBL(Problem Based Learning)
- [ ] CBL(Case Based Learning)
- [ ] TBL(Team Based Learning)
- [ ] UR(Undergraduate Research)
- [ ] FL(Flipped Learning)
- [ ] DSAL(Data Science Active Learning)
- [ ] others

7. Knowledge and ability required for taking this course

Basic knowledge on classical mechanics, electromagnetism and quantum mechanics is essential.

8. Method of Evaluation

Evaluation Item	The Number of Times	Evaluation Proportion	Remarks
Attendance			
midterm exam	1	40	
final exam	1	50	
quiz			
presentation			
discussion			
homework	매주	10	
etc			
study hours			

9. Textbook and supplementary material

Main/Sub	Title (Web-site)	Writer	Publisher	Publication year
Main	Introduction to Solid State Physics, 8th Ed.	Charles Kittel	Wiley	2005

10. Class system and Class shedule

The following topics will be covered.
1. Crystal structure
2. Crystal diffraction
3. Crystal binding
4. Phonons
5. Free electron Fermi gas
6. Energy bands
7. Semiconductors
8. Fermi surfaces and Metals

These are essential topics in solid state physics which every student in physics needs to learn.

< Class Schedule >

* language : K-korean, E-English

Weeks	Topics	language	Instructor	Teaching Method	Evaluation Method	Matter to be prepared
1	Crystal Structure 1	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		

< Class Schedule >

* language : K-korean, E-English

Weeks	Topics	language	Instructor	Teaching Method	Evaluation Method	Matter to be prepared
2	Crystal Structure 2	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
3	Wave diffraction and the reciprocal lattice 1	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
4	Wave diffraction and the reciprocal lattice 2	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
5	Crystal binding 1	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
6	Crystal binding 2	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
7	Phonons:Crystal vibrations	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
8	Midterm Exam	E	Hyungwoo Lee		대면 방식의 지필 고사	
9	Phonons:Thermal properties	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
10	Free electron Fermi gas 1	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
11	Free electron Fermi gas 2	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
12	Energy Band 1	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
13	Energy Band 2	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
14	Semiconductor	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
15	Fermi Surfaces and Metals	E	Hyungwoo Lee	온라인 영상강의 및 실시간 화상 강의 혼합		
16	Final Exam	E	Hyungwoo Lee		대면 방식의 지필 고사	

11. Other items of notification