

## Syllabus(2021–1st semester)

Course	Solid State Physics	Department	Physics	Office Hours	
Course No. and Class	20507–01	Hours	3.0	Academic Credit	3.0
Professor	Fabio Donati		Office		
Telephone			E–MAIL		
Value of competence			Keyword		

## 1. Course Description

Solid–state physics studies how the macroscopic scale properties of solid materials result from their atomic–scale properties. In this course we will learn how to use the methods of classical and quantum physics to explain the behavior of matter. The course will mainly focus on thermal, electronic and magnetic properties of materials.

## 2. Prerequisites

Basic mechanics, thermodynamics and electromagnetism are required for the course. The students should be familiar with basic quantum mechanics.

## 3. Course Format

Lecture	Discussion/Presentation	Experiment/Practicum	Field Study	Other
80 %	20 %	0 %	0 %	0 %

– explanation of course format :

Lectures will be taught in English. Two lectures per week are scheduled. Depending on the corona situation, on–line or off–line lectures will be scheduled. On–line lectures will consist of recorded videos uploaded on Cybercampus. Weekly zoom sessions will be scheduled to summarize the content of the previous week lecture and allow for live Q&A. In case of off–line lectures, every lecture will include a dedicated session for questions and answers. Sessions of interactive discussions among students will be scheduled periodically.

## 4. Course Objectives

- 1) Understand the fundamental properties of matter based on classical and quantum mechanics.
- 2) Understand the logical steps to formulate models and rationalize experimental evidences.
- 3) Develop a critical approach to knowledge and open–minded attitude in discussions.

## 5. Evaluation System

\* Absolute evaluation

Midterm Exam	Final Exam	Quizzes	Presentation	Projects	Assignment	Participation	Other
30 %	40 %	0 %	0 %	0 %	10 %	10 %	10 %

\* Evaluation of group projects may include peer evaluations.

– explain of evaluation system

Mandatory mid–term exam will be scheduled after 8 weeks and will cover the first part of the course (30 pts). Final exam will cover the full content of the course, with more focus on the second part (40 pts). Additional points to the final grade can be obtained by attendance (10 pts), participation to discussion sessions (4/5 sessions, 10 pts total), and assignments (5 assignments, 10 pts).

## 6. Required Materials

Steven H. Simon–The Oxford Solid State Basics–Oxford University Press (2013)

## 7. Supplementary Materials

## 8. Optional Additional Readings

## 9. Course Contents

Week	Date	Topics, Materials, Assignments
Week 1	2021/03/03(WED)	Course Introduction. Specific heat in solids (Boltzmann, Einstein models).
	2021/03/08(MON)	Specific heat in solids (Debye model).
Week 2	2021/03/10(WED)	Electrons in solids (Drude Theory).
	2021/03/15(MON)	Electrons in solids (Drude Theory).
Week 3	2021/03/17(WED)	Electrons in solids (Sommerfeld Theory)
	2021/03/22(MON)	Electrons in solids (Sommerfeld Theory)
Week 4	2021/03/24(WED)	Chemical Bonds in Solid
	2021/03/29(MON)	Vibrations in a one-dimensional mono-atomic chain
Week 5	2021/03/31(WED)	Vibrations in a one-dimensional mono-atomic chain
	2021/04/05(MON)	Tight binding chain
Week 6	2021/04/07(WED)	Tight binding chain
	2021/04/12(MON)	Crystal Structure
Week 7	2021/04/14(WED)	Reciprocal lattice
	2021/04/19(MON)	Electrons in a periodic potential
Week 8	2021/04/21(WED)	Electrons in a periodic potential
	2021/04/26(MON)	Mid Term Exam
Week 9	2021/04/28(WED)	Insulators, semiconductors and metals
	2021/05/03(MON)	Insulators, semiconductors and metals
Week 10	2021/05/05(WED)	어린이날
	2021/05/10(MON)	Semiconductor physics
Week 11	2021/05/12(WED)	Semiconductor physics
	2021/05/17(MON)	Semiconductor devices
Week 12	2021/05/19(WED)	부처님 오신 날
	2021/05/24(MON)	Magnetic properties of atoms
Week 13	2021/05/26(WED)	Magnetic properties of atoms
	2021/05/31(MON)	창립 135주년 기념일
Week 14	2021/06/02(WED)	Spontaneous Magnetic order: Ferro, anti-ferro and ferrimagnetism
	2021/06/07(MON)	Spontaneous Magnetic order: Ferro, anti-ferro and ferrimagnetism
Week 15	2021/06/09(WED)	Domains and Hysteresis
	2021/06/14(MON)	Mean Field Theory
Week 16	2021/06/16(WED)	Mean Field Theory
	2021/06/21(MON)	Magnetism from Interactions: The Hubbard model
Makeup Classes 1	2021/06/23(WED)	Final Exam

## 10. Course Policies

- 1) If the class absence is equal or more than 10 times, the evaluation will be F regardless of other evaluation scores.
- 2) Important information about lectures, quizzes, and exams will be posted to Cyber Campus.
- 3) The lecture schedule may change from time to time depending on students' understanding and progress.

## 11. Special Accommodations

\* According to the University regulation #57, students with disabilities can request special accommodation related to attendance, lectures, assignments, and/or tests by contacting the course professor at the beginning of semester. Based on the nature of the students' requests, students can receive support for such accommodations from the course professor and/or from the Support Center for Students with Disabilities (SCSD).

\* The contents of this syllabus are not final—they may be updated.