



Syllabus: Solid State Physics (PHYS 4240) Spring 2025

Department of Physics

College of Science and Mathematics

Course Catalog Description

In this course, students will apply quantum mechanics to solid materials. Students will study the binding forces and bonding theory in solids along with the mechanical, thermal, and electrical properties of solids. If time permits, an application to solid-state devices will also be presented.

Prerequisites

A grade of "C" or better in PHYS 3710

Learning Objectives

- Represent cubic and hexagonal structures in terms of a lattice and basis.
- Interpret x-ray diffraction techniques in terms of reciprocal lattices.
- Identify different types of crystal binding.
- Describe molecular motion from phonon spectra.
- Describe simple Fermi gases.
- Interpret dispersion curves.

Course Content

Physics 4240 is a course on solid-state physics. The course will cover electrons in crystals, electronic energy bands, lattice vibrations and phonons, electron interactions, dynamics and response, and optical and transport phenomena. Additionally, the students will be exposed to modern concepts of condensed matter physics, such as Dirac-like materials, electronic and magnetic topological states of matter, and topological superconductivity.

Dr. Mahmoud M.

Asmar

Email:

masmar@kennesaw.edu

Phone: 470-578-4208

Office: H 260J,
Academic Building,
Marietta, GA 30060

Class Meets

Lecture

Tuesday and Thursday
09:30 – 10:45 AM
Academic Building 250,
Marietta Campus

Office Hours

Office: H 260J,
Academic Building,
Marietta, GA 30060
Times: Tuesday and
Thursday
11:00 AM – 12:00 PM or
by appointment

Course

Communication

Time-sensitive
information will be
posted on Desire2Learn.
You can contact me by
email or phone or meet
me in person to discuss
questions, absences, or
accommodations.

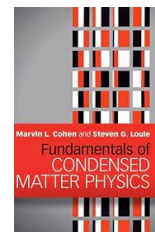


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Textbook

Marvin L. Cohen & Steven G. Louie. “***Fundamentals of condensed matter physics.***” Cambridge: Cambridge University Press, (2016).



Auxiliary Textbooks (you do not have to buy them):

1. Giuseppe Grosso and Giuseppe Pastori Parravicini. “*Solid state physics.*” Academic Press, (2013).
2. Steven M. Girvin, and Yang Kun. “*Modern condensed matter physics.*” Cambridge University Press, (2019).
3. Gerald D. Mahan. “*Condensed matter in a nutshell.*” Princeton University Press, (2010).
4. Steven H. Simon. “*The Oxford solid state basics.*” OUP Oxford, (2013).
5. Eduardo. Fradkin. “*Field theories of condensed matter physics.*” Cambridge University Press, (2013).
6. Henrik Bruus, and Karsten Flensberg. “*Many-body quantum theory in condensed matter physics: an introduction.*” OUP Oxford, (2004).

Note: In this course, Smartphones, iPhones, iPads, Tablets, PDAs, etc., are NOT allowed in classes or exams.

Course Resources

a. Course Materials and Information

All course materials and information are accessible through the [Desire2Learn \(D2L\)](#) account. It is very important that you check your [D2L](#) account regularly. Installing the [Brightspace Pulse Application](#) on your smartphones or tablets is an effective way to get notifications.

b. Homework Assignments

The homework assignments will be available in [D2L](#).

c. Other resources

For additional help, please attend my [office hours](#).

Grading and Evaluation

a. In-class Questions and Quizzes



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Students enrolled in this class are **REQUIRED** to attend. During each class, there will be a set of short in-class questions and/or quizzes.

b. Homework Assignments

Homework assignments will be posted on D2L, and students are required to complete each of them within one (1) week starting from the posting date. Students are encouraged to collaborate on homework assignments; however, each student must turn in his/her own personal.

c. Exams and Project

There will be two (2) in-class exams, one (1) final exam, and a final project.

d. Grading Policies

Category	Category Weight
In-class Questions and Quizzes	10%
Homework Assignments Grade	15%
Cumulative In-class Exam Grade	30%
Final Project	20%
Final Exam Grade	25%

Final letter grades are based on the percentage of total assessment points

Letter Grade	Percentage of Total Assessment Points
A	90 – 100 %
B	80 – 89 %
C	70 – 79 %
D	60 – 69 %
F	Below 60 %

Requests to regrade assignments or in-class exams must be submitted within one (1) week after the item is returned, and the entire assignment or exam needs to be turned in. There will be no make-up of any in-class or final exam. Missing more than one (1) in-class exam will result in a zero (0) grade, which will lower the overall semester grade.

A make-up final exam will be given only to students with legitimate and documented reasons. As soon as the student is aware of the unavoidable situation regarding the final exam, they must contact me (instructor) and present sufficient documentation justifying their absence.



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Withdrawal Policy

Students are solely responsible for managing their enrollment status in a class; non-attendance does not constitute a withdrawal. **The last day to withdraw without academic penalty is Friday, March 28, 2025, by 11:45 PM.** Additional information can be found [here](#). This and other important dates can be found on the [Academic Calendar](#).

Reading Assignments

Students are required to read assigned textbook sections before those topics are discussed in class. Regular reading is an important part of class preparation and allows the student to ask questions to improve his/her understanding of the subject.

Academic Honesty Statement

Every KSU student is responsible for upholding the provisions of the [Student Code of Conduct](#), as published in the Undergraduate and Graduate Catalogs. The Student Code of Conduct addresses the University's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of University records or academic work, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the University.

Disability and Accommodations

Any student with a documented disability or medical condition requiring accommodations must contact the instructor immediately and present a Written verification from the KSU Student Disability Services (<http://sds.kennesaw.edu>). All discussions are confidential.

Student Responsibility

Students are expected to attend all lectures, take all tests and exams, and complete all homework assignments. You are expected to read the textbook. Class time will be used for discussion and problem-solving. The sections of the text we will be covering are on the syllabus.



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Tentative Class Schedule

TOPICS	NUMBER OF LECTURES	NOTES AND EXAMS
What is condensed matter? The concept of a solid	2 Lectures	
Crystal Structures and Electrons in Crystals	3 Lectures	
Electronic Energy Bands: a Wave Mechanical Approach	2 Lectures	
Electronic Energy Bands: Second Quantization	4 Lectures	First Exam: Thursday, February 13
Lattice Vibrations and Phonons	3 Lectures	
Electrons Dynamics in a Crystal	2 Lectures	
Spring Break	March 10-16	No Lectures
Many Electrons Interactions and the Dielectric Function for Solids	5 Lectures	
Optical and Transport Properties	5 Lectures	Second Exam: Thursday, April 03
Dirac Materials, the Berry Phase, and Topology	2 Lectures	
Final Project Presentation	2 Lectures	
Final Exam	May 1 @ 08:00 AM	The Final exam is comprehensive!

I reserve the right to modify the schedule as required based on the pace and interest level of the entire class.

Exam Schedule

Exam	Date	Time
In-Class Exam #1	02/13/2024(R)	09:30-10:45 AM
In-Class Exam #2	04/03/2024(R)	09:30-10:45 AM
Final Exam	05/01/2024(R)	08:00-10:00 AM



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Course Delivery

KSU may shift the method of course delivery at any time during the semester in compliance with the University System of Georgia health and safety guidelines. In this case, alternate teaching modalities that may be adopted include hyflex, hybrid, synchronous online, or asynchronous online instruction.

COVID-19 illness

If you are feeling ill, please stay home and contact your health professional. In addition, please email your instructor to say you are missing class due to illness. Signs of COVID-19 illness include, but are not limited to, the following:

- Cough
- Fever of 100.4 or higher
- Runny nose or new sinus congestion
- Shortness of breath or difficulty breathing
- Chills
- Sore Throat
- New loss of taste and/or smell

COVID-19 vaccines are a critical tool in “Protecting the Nest.” If you have not already, you are strongly encouraged to get vaccinated immediately to advance the health and safety of our campus community. As an enrolled KSU student, you are eligible to receive the vaccine on campus. Please call (470) 578-6644 to schedule your vaccination appointment or you may walk into one of our student health clinics.

For more information regarding COVID-19 (including testing, vaccines, extended illness procedures, and accommodations), see KSU’s official [Covid-19 website](#).

Face Coverings

Based on guidance from the University System of Georgia (USG), all vaccinated and unvaccinated individuals are encouraged to wear a face-covering while inside campus facilities. Unvaccinated individuals are also strongly encouraged to continue to socially distance while inside campus facilities, when possible.