

# PHYS 386: Solid State Physics

Syllabus, Spring 2021



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Course Websites: <http://www.geneseo.edu/~mclean/SolidState/> and in [Canvas](#)

## Learning Outcomes:

This course covers the basics of the physics of crystalline materials. You will become familiar with the concepts and terminology from the topics of classical and semi-classical models, crystal structure, lattice vibrations/phonons, the quantum mechanical description of electrons in crystals, and the physical principals underlying solid state electronics. In each area, you should also become proficient with the basic calculation methods.

## Times and places:

Lectures: ISC 229, Mon, Wed, and Fri 10:30–11:20AM

Exams: ISC 219, Thu evenings (see below)

Office hours: Either in-person at my office or via Zoom at <https://geneseo.zoom.us/j/7708139384>  
Mon, Wed, Thu 1:30–3:30PM (*tentative*)

I am also available at other times; see the schedule on my web site. Feel free to phone or stop by my office. Email or phone can be used to make an appointment.

## Required materials:

Textbook: *The Oxford Solid State Basics*, by Steven Simons

Other good texts: *Solid State Physics*, by N. Ashcroft and N. D. Mermin, *Introduction to Solid State Physics*, by C. Kittel.

## Required coursework (with fraction of final course grade):

40% Homework: due by 11:59pm on Wednesday, except in exam weeks.

Roughly 50% of homework questions will be graded in detail. The remainder will be graded for effort; it will be your responsibility to review the posted solutions to assess correctness.

10% Quizzes: To be held occasionally, always announced in the previous class.

30% Exams: Two exams, each worth 15% of the course grade.

20% Final Exam: The final will mostly concentrate on the last third of the course. However, it will have a cumulative section.

## Exam Schedule:

Exam 1: Thu, Mar. 18 7:00 – 9:00pm (subject to approval by the class)

Exam 2: Tue, Apr. 20 7:00 – 9:00pm (subject to approval by the class)

To balance, two class will be periods skipped, expected to be Mar. 19 (or 22 ?) and Apr. 23.

Final Exam: Thu, May 20 8:00–10:30am

## Course Structure & Procedures

Although listed in KnightWeb as “Hybrid,” this course will run essentially as Face-To-Face. A very limited number of students can participate through Zoom; that option is therefore reserved for students who are physically beyond the Geneseo area.

Canvas Announcements will be used for important messages; you can configure Canvas to send you emails when these are posted. All messages will also be repeated in class. Email to the

instructor is fine, but may not receive a response for a day, sometimes two. For urgent communications, call my office phone; leave a voicemail if there is no answer.

Exams and homework will require work that is written-out. Submissions will be accepted as either a multipage PDF uploaded to Canvas, or on physical paper (but NOT a mixture of both within one assignment).

- For Canvas uploads, you will need software to quickly photograph pages and package them into a PDF file. A good free example is the basic version of CamScanner for a smart phone (<https://www.camscanner.com/>).
- For physical paper, staple pages together in one corner. To hand in materials outside of class, your best option is to bring it to my office. If I'm not in, deposit in the door-tray.

Homework will be accepted for full credit if submitted before solutions are posted. After this, partial credit may be given. More late-partial credit is possible for "exercise" style questions than "problem solving" style questions.

### Copyright

Materials provided for this course are intended for the sole use of registered students. Sharing of course materials outside that audience without express permission of the instructor, including uploading to websites open to the general public (with or without a subscription or membership) is strictly prohibited.

### General Comments:

In a small class of friends, be careful not to cross the line between "getting help on homework" and "copying homework." Rule of thumb: don't be looking at someone else's work at the same time as you are writing your own.

In all work for this course, if you make any mathematical step using a tool other than your brain (e.g., integral tables or Google or Mathematica), you must indicate on your work what tool you used. Simply writing the correct result, without an indication of how you obtained it mathematically, will typically be worth 50% credit.

There are many resources available to you if you need help.

- If you have difficulties accessing any online materials (including needs for alternative formats), please let me know as soon as possible.
- **Instructor office hours** are regularly scheduled, and I am happy to meet with you at other times as well.
- In Canvas, the Help menu on the left side of the screen provides quick access to...
  - **[KOALA \(Knights' Online Academic Learning Assistance\)](#)**, run by the Office of the Dean for Academic Planning and Advising, which is particularly for help with online learning strategies. They will assist you with identifying resources and strategies for success.
  - **[Canvas Self Help Guides](#)**, with help pages on many Canvas topics.
  - **[CIT Remote Help](#)**, to chat (during the day) with CIT personnel for technology support.
- The web page **[cit.geneseo.edu](http://cit.geneseo.edu)** is a good starting point for technology help, including **[Self Help Guides](#)** and calling the Help Desk (585-245-5588).
- Information about ***Student Success Resources*** provided by the college is available at **<https://wiki.geneseo.edu/x/2QBoC>**.
- SUNY Geneseo is dedicated to providing an equitable and inclusive educational experience for all students. The Office of Accessibility will coordinate reasonable accommodations for persons with physical, emotional, or cognitive disabilities to ensure equal access to academic programs, activities, and services at Geneseo. Students with letters of accommodation should submit a letter to each faculty member and discuss their needs at the beginning of each semester. Please

contact the Office of Accessibility Services for questions related to access and accommodations (Erwin 22, 585-245-5112, [access@geneseo.edu](mailto:access@geneseo.edu), <https://www.geneseo.edu/accessibility-office>).

### **Rough Schedule**

The course topics will follow the textbook closely. In the past, I have taught the course based on a different schedule inspired from a different book. Therefore, the lecture topics in the following plan are quite tentative, and almost certainly will be modified as we work through the semester.

<b>Week of...</b>	<b>LECTURE TOPICS</b>	<b>EXAM</b>
Feb. 1	Ch 1, 2: Specific Heat	
8	Ch 3: Drude Model	
15	Ch 4: Sommerfeld Model	
22	Ch 5, 6, 7: Crystal Binding	
Mar. 1	Ch 8, 9.1, 9.2: Monatomic Lattice Vibrations	
8	Ch 9.3, 9.4: Phonons	
15 only MW	Ch 10: Diatomic Lattice Vibrations	Exam 1 on $\Theta$
22 only MF	Ch 11: Tight Binding Chain of Electrons	
29	Ch 12: Crystal Structure	
Apr. 5	Ch 13: The Reciprocal Lattice	
12	Ch 14: X-Ray Crystallography	
19 only MW	Ch 15: Nearly Free Electrons: Energy Bands	Exam 2 on T
26	Ch 16: Metals & Insulators	
May 3	Ch 17: Semiconductor Physics	
10 only T	Ch 18: Semiconductor Devices	
17 on $\Theta$ , May 20, 8:00–10:30		Final Exam