

**Faculty of Science Course Syllabus (Section A)
Department of Physics and Atmospheric Science**

PHYC 4230/5230

Introduction to Solid State Physics

Winter 2023

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor: Penghao Xiao (E-Mail: pxiao@dal.ca; Office: Dunn 230)

Lectures: Tuesday and Thursday 1:05-2:25 PM

Office hours: Tuesday 2:30-3:30 PM; Dunn building, Room 230

Course delivery: In-person, LSC-Common Area C220

Course Description

An introduction to the basic concepts of solid-state physics that are related to the periodic nature of the crystalline lattice. Topics include:

1. Chemical bonding
2. Crystal structure and X-ray diffraction
3. Lattice dynamics and thermal properties
4. The free electron theory of metals
5. Electrons in a periodic potential
6. Semiconductors
7. Magnetism if time permits

Course Prerequisites

PHYC 3640.03 Quantum Mechanics I is required. PHYC 3210.03 Statistical Mechanics is central to the study of solids. PHYC3210 can be taken concurrently with PHYC4230 if not taken before. I will introduce the necessary results of statistical mechanics as needed.

Learning Objectives

The goal of this course is to provide you with both a conceptual and quantitative understanding of solids. By the end of the course, you will be able to:

1. Describe the structures of solids.
2. Classify the underlying interactions that hold atoms together.
3. Solve the wave equations for vibration modes and electrons.
4. Describe the physical meanings from the above solutions (phonon, density of state, band structure).
5. Rationalize the response of solids to external disturbances (heat, electric field, light).

Course Materials

- Required textbook:
“The Oxford Solid State Basics”, by Steven H. Simon. Note that a rough draft of the textbook is available for free from the author’s homepage, although is missing some of the figures in the published version:
<http://www-thphys.physics.ox.ac.uk/people/SteveSimon/condmat2012/LectureNotes2012.pdf>
 Steven Simon has also made video podcast of his lectures available:
<https://podcasts.ox.ac.uk/series/oxford-solid-state-basics>
- Recommended reference textbook:
“Introduction to Solid State Physics”, by Charles Kittel. This is a classic that many undergraduate courses choose. Older versions are better: Version prior to the 6th edition (pre-1986) are best.
“Solid State Physics, 2nd Ed.”, by J. R. Hook and H. E. Hall. This is also a popular introductory textbook, that many students like better than the more traditional Kittel.

Course Assessment

Assessment	Weight (% of final grade)	Date
Midterm	20%	In the week of Feb. 27
Assignments	50%	
Final Exam	30%	(Scheduled exam period)
<i>The final exam will be cumulative.</i>		100%

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (<50)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

- The assignments will be approximately every week with the due date specified. A penalty (-20% per day) will be applied for late assignments unless a good reason has been communicated prior to the deadline.
- Students may use the Student Declaration of Absence form for late assignments to avoid the late penalty. The form can be used 2 times in this course.

Course Policies related to Academic Integrity

You are encouraged to work on problem sets together, but the assignment that you hand in must be in your own words, and the calculations must be your own. When you complete your assignments, make sure that you explain what you are doing. Putting your thoughts into words is a very useful way of learning the material more deeply. In terms of marks, the reasoning process is more valuable than the final answer.

Faculty of Science Course Syllabus (Section B)*PHYC 4230/5230**Introduction to Solid State Physics**Winter 2023***University Policies and Statements**

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <http://www.dal.ca/cultureofrespect.html>

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

<https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loaduseredits=False>

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Faculty of Science Course Syllabus (Section C)*PHYC 4230/5230**Introduction to Solid State Physics**Winter 2023***Student Resources and Support****Advising****General Advising** https://www.dal.ca/campus_life/academic-support/advising.html**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>**Indigenous Student Centre:** https://www.dal.ca/campus_life/communities/indigenous.html**Black Students Advising Centre:** https://www.dal.ca/campus_life/communities/black-student-advising.html**International Centre:** https://www.dal.ca/campus_life/international-centre/current-students.html**Academic supports****Library:** <https://libraries.dal.ca/>**Writing Centre:** https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html**Studying for Success:** https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html**Copyright Office:** <https://libraries.dal.ca/services/copyright-office.html>**Fair Dealing Guidelines** <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>**Other supports and services****Student Health & Wellness Centre:** https://www.dal.ca/campus_life/health-and-wellness.html**Student Advocacy:** <https://dsu.ca/dsas>**Ombudsperson:** https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html**Safety****Biosafety:** <https://www.dal.ca/dept/safety/programs-services/biosafety.html>**Chemical Safety:** <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>**Radiation Safety:** <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>**Scent-Free Program:** <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>**Dalhousie COVID-19 information and updates:** <https://www.dal.ca/covid-19-information-and-updates.html>