Syllabus

Solid State Physics (PHYC 6201)

Department of Physics and Atmospheric Science

Winter 2026

Dalhousie University operates in the unceded territories of the Mi'kmaw, Wolastoqey, and Peskotomuhkati Peoples. These sovereign nations hold inherent rights as the original peoples of these lands, and we each carry collective obligations under the Peace and Friendship Treaties. Section 35 of the Constitution Act, 1982, recognizes and affirms Aboriginal and Treaty rights in Canada.

We recognize that African Nova Scotians are a distinct people whose histories, legacies, and contributions have enriched the part of Mi'kma'ki known as Nova Scotia for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Jesse Maassen	jmaassen@dal.ca	Tuesdays, 10am - noon, Dunn 234

Course Description

Fundamentals of solid state physics, including: energy band calculations, introduction to density functional theory, semiconductor physics and devices, Boltzmann transport equation, electron scattering physics, thermoelectric phenomena, magnetic effects in solids, optical and dielectric properties.

Course Prerequisites

PHYC 4151, "*Quantum Physics II*"
PHYC 4230, "*Introduction to Solid State Physics*"
Basic knowledge of quantum mechanics, statistical physics, and introductory condensed matter physics.

Course Exclusions

None.

Student Resources

Office hours will be held weekly on Tuesdays from 10am to noon (in Dunn 234). If students need to meet outside these hours, email me to arrange a meeting or to ask questions.

Course Structure

Course Delivery
The course will be delivered in-person (and not recorded).

Lectures
Tuesdays and Thursdays, 4:05pm-5:25pm, LSC Common Area C212.

Laboratories
None.

Tutorials
None.

Course Materials

Lecture notes

- Lecture notes, in PDF format, will be shared with the class.

Some (optional) reference textbooks

- "*Solid State Physics*", by N.W. Ashcroft and N.D. Mermin.
- "*Introduction to Solid State Physics*", by C. Kittel.
- Additional references for specific topics will be provided in the lecture notes.

Lecture notes, syllabus, assignments, and project guidelines will be made available through the course Brightspace page.

Assessment

There will be **4 homeworks** and a team project (of two students) that will involve a **mid-term presentation**, a **final presentation,** and a **project report**.

Assessment	***Weight (% of final grade)***	***Due date***
Homeworks (4)	*40% (10% each)*	*Jan 27, Feb 12, March 5, March 19*
Mid-term presentation	*10%*	*March 12*
Final presentation	*25%*	*April 7*

Project report *25%* *April 9*

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale:

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Late assignments and/or late final report will have 5% deducted per day after the due date, with a maximum of 50% marks removed for lateness. In the case of illness, students can submit a Student Declaration of Absence (SDA) via email to the instructor to request an extension (up to 3 days) on the due date of an assignment.

Course Policies related to Academic Integrity

Regarding the assignments, discussions among students is permitted but the submitted work must present your own calculations and be written in your own words. When preparing assignments, be sure to explain the steps followed and avoid simply presenting a series of equations. The use of generative AI and large language models (e.g., ChatGPT) is not permitted for any assessment in this course.

Learning Objectives

Familiarity with the physical concepts and theoretical approaches for calculating and analyzing the electronic, thermal, magnetic, optical and transport properties of solids.

Course Content

- Electronic band calculations: k·p theory, density functional theory.
- Semiconductor physics: band structure, effective mass, carrier concentration, doping, mobility, recombination, generation.
- Semiconductor devices: band diagram, p-n junction, metal-semiconductor junction.
- Boltzmann transport equation: semi-classical particle dynamics and transport.
- Electron scattering physics: Fermi's golden rule, electron-phonon scattering and electron-impurity scattering.
- Thermoelectric phenomena.
- Beyond the independent electron approximation: Hartree-Fock, exchange and correlation effects, screening.

- Magnetic effects in solids: Hall effect, Landau levels, spin waves, spin-orbit interaction, spintronics.
- Optical properties and dielectric response of solids.

University Policies and Statements

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 at 1321 Edward St or elders@dal.ca. Additional information regarding Mi'kmaq and Indigenous Relations (including the Elders in Residence program, Land Acknowledgements, Understanding Our Roots, and much more) can be found at: https://www.dal.ca/about/mission-vision-values/mikmaq-indigenous-relations.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: https://www.dal.ca/about/mission-vision-values/global-relations.html

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all 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. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (https://www.dal.ca/campus_life/ssc.html).

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

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 (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion.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. The full Code of Student Conduct can be found at: https://www.dal.ca/content/dam/www/about/leadership-and-governance/governing-bodies/code-student-conduct.pdf

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/fair-dealing-policy.pdf

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.