

Engineering Physics
ENG PHYS/MATLS 782
Solid State Electronics
Winter 2027
Course Outline

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

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Office Hours:
By appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

The official means of communication with students is via the course webpage on [Avenue to Learn](#). It is the students' responsibility to regularly check the course webpage for updates and announcements.

Alternate method of communication: e-mail (McMaster e-mail addresses only).

CLASS FORMAT

Course Dates: 01/04/2027 - 04/07/2027

Units: 3

Course Delivery Mode: All classes are in-person

Course Description: The course serves as a first graduate course in Solid State Electronics and covers the following topics: Crystallography - bonding and structure, free and nearly free electrons, energy bands; Electronic aspects of semi-conductors - doping, carrier statistics; Point defects - energy levels, atomic configuration, thermodynamics; Experimental aspects of defect spectroscopy.

The course is organized as follows:

2 in-class lectures per week (2 hours each, times and locations TBD)

1 in-class presentation per student (dates/times TBD)

Prerequisite(s): Registration in an Engineering Physics or Materials Science and Engineering graduate program or permission by the instructor

Antirequisite(s): N/A

COURSE INTENDED LEARNING OUTCOMES

By the end of this course, students should be able to:

- Understand the relationship between bonding and structure
- Relate symmetries to general features of electronic band structures
- Use band structure diagrams to assess electronic properties of semiconductors
- Understand the role of impurities (dopants) and defects in determining the electronic properties of solids
- Understand the concept of defect engineering

COURSE SCHEDULE

A weekly breakdown of the course schedule

Date/Week	Topic	Readings
1	General Solid-State Physics – Bonding and Structure	Custom Courseware
2-4	The Perfect Lattice - Real Space and Reciprocal Lattices; Free and Nearly Free Electrons	Custom Courseware
5-8	Semiconductors - Energy Bands; Methods of Band Structure Calculations; Experimental Confirmation; Intrinsic and Extrinsic Semiconductors	Custom Courseware
9-13	Defect Engineering - Doping and Impurities; Electronic Configuration; Energy Levels (Shallow and Deep States); Vacancies and Interstitials; Lattice Relaxations and Metastabilities; Diffusion	Custom Courseware

This lecture schedule is based upon current university and public health guidelines and may be subject to changes during the term. Any changes to the schedule or course delivery will be communicated on the course announcements section on Avenue to Learn. Please check the announcements prior to attending class.

REQUIRED/OPTIONAL MATERIALS AND FEES

Required Texts:

Custom courseware on eReserves:

<https://avenue.cilmcmaster.ca/d2l/le/lessons/716627/topics/5231382>

Optional Additional Texts:

See list posted on the A2L course page.

Other Materials:

From time to time, additional lecture notes will be posted on the A2L course page.

COURSE ASSESSMENT DETAILS

Component	Due Date	Weight
Presentation	March/April (exact dates TBD)	35%
Report	March/April (exact dates TBD)	30%
Final Exam	April (exact dates TBD)	35%
Total		100%

GRADING SCALE

Grade	Points	Equivalent Percentages	Pass/Fail
A+	12	90 – 100	P+
A	11	85 – 89	P
A-	10	80 – 84	P
B+	9	77 – 79	P
B	8	73 – 76	P
B-	7	70 – 72	P
F	0	69 and under	F

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

Reports are due two (2) days before the presentation date. Extensions may be granted under extenuating circumstances. Late penalties are two (2) marks per day.

GENERATIVE AI

USE PROHIBITED

Students are not permitted to use generative AI in this course. In alignment with [McMaster academic integrity policy](#), it “shall be an offence knowingly to ... submit academic work for assessment that was purchased or acquired from another source”. This includes work created by generative AI tools. Also stated in the policy is the following, “Contract Cheating is the act of “outsourcing of student work to third parties” (Lancaster & Clarke, 2016, p. 639) with or without payment.” Using Generative AI tools is a form of contract cheating. Charges of academic dishonesty will be brought forward to the Office of Academic Integrity.

Also see [Guidelines on the Use of Generative AI in Teaching and Learning - Academic Excellence - Office of the Provost](#) for more information. Please note how this intersects with the following guidance on academic dishonesty.

APPROVED ADVISORY STATEMENTS

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your Instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics and the Faculty of Engineering are committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the [Equity and Inclusion Office](#).

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the [Academic Integrity Policy](#), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>.

The following illustrates only three forms of academic dishonesty:

1. plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. improper collaboration in group work.
3. copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of A2L, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University’s [Academic Accommodation of Students with Disabilities](#) policy.

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University’s resources, please refer to the [Student Wellness Centre](#).

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar’s Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.