

ENG PHYS 4UB2

Modern and Applied Physics Laboratory: Biomedical
Undergraduate Studies
Winter 2021
Course Outline

CALENDAR/COURSE DESCRIPTION

Students will complete the fabrication and testing of a working MOSFET/ISFET using semiconductor fabrication methods.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): one of ENGPYS 3PN4, MATLS 3Q03 or ELECENG 3EJ4, and registration in one of the Faculty of Engineering or the Integrated Biomedical Engineering & Health Sciences (IBEHS) program.

Antirequisite(s): ENGPYS 4U02, 4U04

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Leyla Soleymani
ETB 407
soleyml@mcmaster.ca

Office Hours: By appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Roderick MacLachlan

maclacrd@mcmaster.ca

Office Hours: By appointment

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

<http://avenue.mcmaster.ca/>

COURSE INTENDED LEARNING OUTCOMES

The objective of this course is to design, fabricate/simulate, and test a semiconductor device that can be used in a wide range of biosensing applications. The students will learn to develop application-specific devices from the design to implementation stage and test a biosensing device.

MATERIALS AND FEES

Required Texts:

NA

Other Materials:

Access to a personal computer that can connect remotely to the SILVACO simulation software.

COURSE FORMAT AND EXPECTATIONS

The course includes one 3-hour session per week, which will be used to provide instructions on the SILVACO simulation software and for the student presentation. The project and oral presentations will be performed in groups of two. The reports will be submitted individually, demonstrations will be performed individually, and the presentations will be graded individually. The course is focused on developing a biological sensor (biosensor) based on a semiconductor device such as a field effect transistor (examples of these types of sensors are presented in the paper bank on ATL).

Biosensing Proposal (Oral Presentation and Written Report)

The students will present their plan and proposed approach for using the simulation software SILVACO for building and simulating to a biosensor in the form of a 15 minute oral presentation (+ 5 minute question and answer period) and a two-page document. In this proposal, they will present introduction, background and justification for the chosen topic, project objectives, proposed methods, and expected outcomes. The oral presentations will be held during the week of February 8th remotely. Oral presentations and the two-page document are evaluated individually for each presenter.

Simulation Checkpoint

During the week of March 8^h, each group will **demonstrate** their device architecture and build in the simulation software to their TA and two other peer groups. The TA and the peer groups will assess the team's progress based on their progress and their understanding of the device operation and simulation setup.

Final Report (Oral Presentation and Written Report)

The final report will have a written and oral presentation component and will be focused on the test results obtained from the simulation. The oral presentation will be 20 minutes (+5 minute question and answer period). The final written report (maximum 5 pages) should include the following headings: introduction of the biosensor and its operating principles, fabrication process flow and modifications to a published device for making simulation possible (if applicable), results (device pictures, IV curves before and after functionalization, before and after the introduction of the target, and discussion). The final presentation and report will be due during the week of April 5th virtually at an exact date and time finalized with the students during the first/second week of class. Oral presentations and the written document are evaluated individually for each presenter.

COURSE SCHEDULE

Date/Week	Topic	Readings
Week 1	Course introduction/Introduction to the simulation software	
Week 2	Simulation lecture 1/topic search/proposal preparation	
Week 3	Simulation lecture 2/topic search/proposal preparation	
Week 4	Simulation lecture 3/topic search/proposal preparation	
Week 5	Proposal presentation	
Week 6	Study break	
Week 7	Building the simulation	
Week 8	Building the simulation	
Week 9	Simulation checkpoint	
Week 10	Building the simulation	

Week 11	Building the simulation
Week 12	Building the simulation
Week 13	Final report and presentation
Week 14	Final report and presentation

ASSESSMENT	
	Weight
Biosensing Proposal-Oral Presentation	15%
Biosensing Proposal-Written Report	15%
Simulation checkpoint	20%
Final Oral Presentation	20%
Final Report-Written	30%
Total	100%

All course deliverables are due on the announced time and date. Failure to submit on time will result in a grade of ZERO.

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 is 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](#).

PHYSICAL AND MENTAL HEALTH

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

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](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), 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 Avenue 2 Learn, 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.

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students' responsibility to regularly check the course webpage (ex. Avenue to Learn) for updates and announcements.
2. All course materials are due at the date, time, and format announced on Avenue to Learn. Failure to submit your work on time will lead to a grade of ZERO

SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:**
 - Use the [McMaster Student Absence Form \(MSAF\)](#) on-line self-reporting tool. No further documentation is required.
 - Students may submit requests for relief using the MSAF once per term.
 - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
 - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
 - The MSAF cannot be used for academic work that has already been completed attempted.
 - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
 - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.
2. **For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**
 - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
 - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

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.