

ENG PHYS 4B03  
Biosensors  
Fall 2021  
Course Outline

**CALENDAR/COURSE DESCRIPTION**

This course covers the underlying operating principles and defining metrics of biological sensors, and it will discuss the integration of these sensors into systems for diagnostics and health monitoring applications.

**PRE-REQUISITES AND ANTI-REQUISITES**

Prerequisite(s): Registration in Level III or above in any engineering program or registration in Level IV or above in the Integrated Biomedical Engineering & Health Sciences (IBEHS) Program.

**INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION**

**Dr. Leyla Soleymani**

**Office Hours:** By appointment

**TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION**

**Jieci Yang**

[yangj217@mcmaster.ca](mailto:yangj217@mcmaster.ca)

**Office Hours:** By appointment

**COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION**

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

The course will be delivered through a combination of live sessions delivered using an online platform during the assigned course times and pre-recorded lectures. This information is available in the course schedule provided below.

**COURSE INTENDED LEARNING OUTCOMES**

The objective of this course is to give an introduction to the operating principles and applications of biosensors for disease management and health monitoring. Principles such as biorecognition, mass transport, and signal transduction in biosensing will be covered, and the cutting-edge technologies for *in vitro* and *in vivo* sensing will be covered through instructor-led lectures, guest lectures, and student led journal discussions.

At the end of the course, students should have a good understanding of the operating principles of biosensing, important figures-of-merits, and should be able to design biosensing based on practical requirements.

**MATERIALS AND FEES**

**Required Text:**

NA

**Reference Text:**

NA

**Calculator:**

NA

**Other Materials:**

All students require access to a computer for attending lectures and performing course-related assignments

<b>COURSE FORMAT AND EXPECTATIONS</b>
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The course includes live student-led journal discussions and instructor-led recorded lectures, in addition to four mandatory live guest lectures covering various topics of the course. The live components of the course will be delivered at the timeslots assigned by the registrar (see the schedule below) through an online platform announced on Avenue to Learn. The course includes the following components.

<b>Asynchronous Lectures</b>	The lectures presented by the instructor will be presented asynchronously and posted on the course website
<b>Guest Lectures</b>	There will be four live guest lectures as per the schedule presented below and participation in these lectures will be mandatory.
<b>Student-led journal discussions</b>	Every student will select a date and an associated topic for presentation during the 1-hour student-led journal discussion. During this time, the student will present the findings from three journal publications related to the topic to the entire class. They will then lead discussions in this area with the entire class. All students (not just the presenter) are required to have read the required publications.
<b>Lecture reports</b>	Each student is required to write a 1-page report on 5 lectures from the asynchronous instructor lectures or guest lectures and post these on the course website for their peers to review by the end of each week, Sunday 11:59 PM. Late reports will not be accepted and a grade of ZERO will be allocated.
<b>Project grant proposal</b>	A project grant proposal will be developed for a novel wearable or an in vivo biosensor that uses the concepts learnt in the course. The proposal should follow the grant proposal guidance document. In addition to the written report, the students should present and defend their grant proposal in an oral defense. <b>The grant proposal should be developed in groups of 2, but a separate written report is required for each team member, with a single presentation per team.</b> Each team member is graded individually for the written report and the oral presentation. <b>The written report is due on November 28<sup>th</sup> at 11:59 PM and the oral presentations are delivered during the week of November 29<sup>th</sup> during class time.</b>

**COURSE SCHEDULE**

Week #	Week of Monday	Tuesday (9:30-11:30)	Wednesday (9:30-10:30)
1	6-Sep	Asynchronous Introduction to biosensors	Live, course organization
2	13-Sep	Asynchronous Bio-recognition	Live, journal club 1
3	20-Sep	Live, Dr. Juewen Liu @10:30 Functional DNA based biosensors	Live, journal club 2
4	27-Sep	Asynchronous Mass transport	Live, journal club 3
5	4-Oct	Live, Dr. Dirk Kuhlmeier @ 9:30	Live, journal club 4
6	11-Oct	Study break	Study break
7	18-Oct	Asynchronous Assay designs	Live, journal club 5
8	25-Oct	Asynchronous Non-specific binding and mitigation	Live, journal club 6
9	1-Nov	Live, Dr. Tohid Didar @ 9:30	Live, journal club 7
10	8-Nov	Asynchronous Signal transduction methods 1	Live, journal club 8
11	15-Nov	Asynchronous Signal transduction methods 2	Live, Dr. Mahla Poudineh @ 9:30
12	22-Nov		Live, journal club 9
13	29-Nov	Live, Student presentations	Live, Student presentations

**ASSESSMENT**

Component	Weight
Participation in student-led discussions and guest lectures	10%
Student-led journal discussion	20%
1-page report on 5 asynchronous or guest lectures posted on Avenue to Learn on a weekly basis	10%
Project grant proposal-oral defence	25%
Project grant proposal-written document	35%
Total	100%

### ACCREDITATION LEARNING OUTCOMES

Outcomes

Indicators

**The students will learn the engineering processes involved in biosensor design**

**The students will learn to propose solutions to open-needed problems in designing their grant proposal**

**The students will demonstrate an ability to respond to technical and non-technical questions through implementing their grant proposal report and presentation**

**The students will learn to present information clearly and concisely as appropriate to the audience**

For more information on Accreditation, please visit: <https://www.engineerscanada.ca>

### 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](http://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.

#### 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](mailto: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.