Course Instructor
Kagan Kerman, e-mail: kagan.kerman@utoronto.ca

Office hours: Fridays 1-3 pm live on Zoom or by making an appointment for an alternate date by posting a request message in the Discussion Board. The Zoom links will be posted as Announcement emails on the course page. Students are encouraged to discuss about their assignments and practice for their oral presentations with Dr. Kerman during the office hours.

Course time: Thursdays 2-4 pm live on Zoom. The Zoom links will be posted as Announcement emails on the course page. If you miss the live lectures, the video recordings will be posted in the Files section each week.

Discussion Board: Students are encouraged to discuss about their assignments and practice for their oral presentations with Dr. Kerman during the office hours.

Reference Texts:
There is no individual textbook assigned for the course and students should rely on course notes, literature articles, and lectures for the topics covered. The following is a list of suggested texts you may use for extra reading on covered topics:


All textbooks can be found as digital-copy or hard-copy in the UTSC Library and Gerstein Science Library.

Course Objectives:
This course is meant to provide an overview of the field of bioelectrochemistry with a focus on the development of biosensors. It covers the principles, technologies, methods, and recent applications of electrochemical biosensors.

Course Topics
Sept. 9 Introduction to Biosensors and Bioelectrochemistry
Learning objectives: Fundamentals of biosensors and bioelectrochemistry
Sept. 16 Electrodes and Voltammetry-1
Learning objectives: Solid electrodes (Glassy carbon, carbon paste, metal electrodes), mercury electrodes, microelectrodes, screen-printed electrodes, reference electrodes, cyclic voltammetry-1

Sept. 23 Voltammetry-2
Learning objectives: Cyclic voltammetry-2, differential pulse voltammetry, square wave voltammetry, stripping voltammetry, amperometry

Sept. 30 Electrochemical Impedance Spectroscopy
Learning objectives: AC voltammetry, Nyquist plot, Bode plot, Equivalent circuits.

Oct. 7 Potentiometry
Learning objectives: pH electrodes, membrane electrodes, chronopotentiometric stripping analysis.

Oct. 14 Reading Week

Oct. 21 Biosensors-1
Learning objectives: Challenges and future of biosensors

Oct. 28 Biosensors-2
Learning objectives: Glucose biosensors
Printable nonenzymatic glucose biosensors using carbon nanotube-PtNP nanocomposites modified with AuRu for improved selectivity, T. N. H. Nguyen et al., *ACS Biomater. Sci. Eng.* 2020, 6, 5315-5325.

**Nov. 4 Biosensors-3**
Learning objectives: DNA biosensors

**Nov. 11 Biosensors-4**
Learning objectives: Immunosensors, Aptasensors, Wearable sensors

**Nov. 18 Biosensors-5**
Learning objectives: Biosensors for neurodegenerative diseases
Nov. 25 Oral presentations-1

Dec. 2 Oral presentations-2

Evaluation:
The grading scheme for the course is shown in the table below:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Take-home Mid-term</td>
<td>30%</td>
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<tr>
<td>Take-home Final Exam</td>
<td>40%</td>
</tr>
<tr>
<td>Assignment</td>
<td>15%</td>
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<tr>
<td>Oral presentation</td>
<td>15%</td>
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**Take-home Mid-term**

From October 20\(^{\text{th}}\), Wednesday 9 am to October 22\(^{\text{nd}}\), Friday 5 pm (EST)

Mid-term will contain reading articles and critically reviewing them as well as short-answer and multiple-choice questions. The mid-term questions will be posted in the Files folder of the course page. The students will submit the completed mid-term as a Word or PDF file through the Quercus Assignments page.

**Take-home Final Exam**

From December 13\(^{\text{th}}\), Monday 9 am to December 17\(^{\text{th}}\), Friday 5 pm (EST)

Final exam will contain reading articles and critically reviewing them as well as short-answer and multiple-choice questions. Entire course topics including the assignments and oral presentations will be included in the exam with more emphasis on the topics covered after the mid-term. The final exam questions will be posted in the Files folder of the course page. The students will submit the completed final exam as a Word or PDF file through the Quercus Assignments page.

**Assignment**

The students will prepare a short review (approximately 2000 words excluding the references) on the topic of their oral presentations. You will follow the guidelines for authors of the journal “Current Opinion in Electrochemistry”. Each student will have to post their choice of topic/paper on the Discussion Board, so that there would be no overlaps. More details to be given in lectures. The guidelines for authors can be downloaded following the link below: [https://www.elsevier.com/journals/current-opinion-in-electrochemistry/2451-9103/guide-for-authors](https://www.elsevier.com/journals/current-opinion-in-electrochemistry/2451-9103/guide-for-authors)

**Oral presentation**

The students will prepare a 15-min oral presentation about a recent interesting topic or a cutting-edge technology in electrochemical biosensors. Each student will have to post their choice of topic/paper on the Discussion Board, so that there would be no overlaps. More details to be given in lectures.
Course Policies and General Information:

**Course Announcements:** Announcements, updates to readings, assignment topics, requirements, and evaluation, etc. will be posted to the course site. Students are responsible for checking the course website regularly. **Please, arrange your UTORONTO emails to accept the course announcements.**

**Office Hours:** Students are welcome to ask questions or resolve course-related problems by contacting the Course Instructor either by joining Zoom during scheduled office hours or by making an appointment by posting a request message on the Discussion Board. Students are responsible for work missed as a result of absence; the Course Instructors will not re-teach material covered in the lectures and lab sessions.

**e-mail Communication:** The Course Instructors may be contacted via the course email addresses to get clarification on course-related issues, or to ask brief questions. The Course Instructor will endeavour to provide responses to emails within 48 h. Urgent issues must be communicated in person or by telephone (with a follow up email message).

**Missed Mid-term Test:** The exact dates of the mid-term tests are provided in the Course Topics schedule. Students who miss the term test will be assigned a mark of zero for the test unless they can document a compelling reason for missing it. Students in that position must submit a written request to the Course Instructor with appropriate documentation as listed below:

https://www.utsc.utoronto.ca/physsci/self-declaration-absence-form-0

For the **Fall 2021** term, missed term tests due to medical illness will require **ALL** of the following:

1. Completed Student Absence form
2. Self-Declaration on ACORN

All items must be submitted within three (3) business days of the term test date. If a request is accepted for the mid-term test, the weighting of the mid-term will be in an extra-assignment. **There will be no make-up mid-term tests.**

**AccessAbility:** Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. The sooner you let us know your needs the quicker, we can assist you in achieving your learning goals in this course.

**Cell Phones:** During lectures and labs please put your cell phones in silent mode to avoid disruption of the class. If circumstances warrant use of your cell phone and you must receive an emergency call, please inform the Course Instructor at the beginning of the session in advance and then excuse yourself from the session to respond to the call outside the lecture hall or laboratory.

**Academic Calendar:** Further information about academic regulations and course withdrawal deadlines can be found in the UT Calendar. You are encouraged to read this material.

**Academic Integrity:** Honesty and fairness are considered fundamental to the University's mission, and, as a result, all those who violate those principles are dealt with as if they were damaging the integrity of the University itself. When students are suspected of cheating or a
similar academic offence, they are typically surprised at how formally and seriously the matter is
dealt with - and how severe the consequences can be if it is determined
that cheating did occur. The University of Toronto treats cases of cheating and plagiarism
very seriously.
Examples of offences for which you will be penalized include (but are not limited to):
• Using any unauthorized aids on an exam or test (e.g., "cheat sheets")
• Representing someone else's work or words as your own - plagiarism (see web document
  “How not to plagiarize” available online at http://www.utoronto.ca/writing/plagsep.html
• Falsifying documents or grades
• Purchasing an essay
• Submitting someone else's work as your own
• Submitting the same essay or report in more than one course (without permission)
• Looking at someone else's answers during an exam or test
• Impersonating another person at an exam or test or having someone else impersonate you
• Making up sources or facts for an essay or report.
As a student it is your responsibility to ensure the integrity of your work and to understand
what constitutes an academic offence. If you have any concerns that you may be crossing the
line, please, read from the website
http://www.utoronto.ca/academicintegrity/resourcesforstudents.html
and always consult your instructor. Your instructor can explain, for example, the nuances of
plagiarism and how to use secondary sources appropriately; he or she will also tell you what
kinds of aids - calculators, dictionaries, etc. - are permitted in a test or exam. Ignorance of the
rules does not excuse cheating or plagiarism.
This information is taken from the brochure, "Academic Integrity" and website, part of a
series of UT publications to help students understand the University's rules and decision
making structures. For copies, visit the Office of the Registrar at UT. All of the policies and
procedures surrounding academic offences are dealt with in one policy: "The Code of
Behaviour on Academic Matters". The full text is located in the back of the UT Calendar.