

BME501: Biosensors and Imaging for Medical Device Design

Course Dates

CRN(s):	Section A01 CRN: 13933
Term:	2022
Course Start:	2022-09-07
Course End:	2022-12-21
Withdrawal with 100% reduction of tuition fees:	2022-09-20
Withdrawal with 50% reduction of tuition fees:	2022-10-11
Last day for withdrawal (no fees returned):	2022-10-31

Scheduled Meeting Times (M=Mon, T=Tue, W=Wed, R=Thu, F=Fri)

Section:	Location:	Classes Start:	Classes End:	Days of week:	Hours of day:	Instructor:
A01	ELL 160	2022-09-07	2022-12-05	TWF	13:30-14:20	Paris Vakiel

Instructor(s)

Name: **Paris Vakiel**
 Office:
 Phone:
 Email: pvakiel at uvic dot ca

Office Hours: Comments
 Mon 11:00am-12:30pm This may be subject to change.

Online Learning, Teaching, and Tools

As we move through term, we will learn what works, and what doesn't, and adjustments to the course outline might be necessary. Possible changes will be discussed.

Lectures: Lectures will be held on Tuesdays, Wednesdays and Fridays at 13:30 to 14:20 in ELL 160.

Instructors Dr. Paris Vakiel and Dr Elnaz Tamjid

Office Hours Office hours will in-person on Mondays from 11am to 12:30 pm. Additional office hours will be provided via zoom when necessary.the class. You can also contact us through e-mail for appointments.

Please make yourself familiar with Zoom, which we will use for live interaction in tutorial, office hours, etc:
<https://www.uvic.ca/systems/services/avmultimedia/zoomvideoconferencing/index.php>

TA Information

TA Name	E-mail
Aaron Brice	aaronbrice@uvic.ca

Textbooks

There are no required Textbooks for this course

Optional Texts

Title: Introduction to Biosensors From electric circuits to Immunosensors Author: Jeong-Yeol Yoon Publisher/Year: Springer/2016

Title: Nanoparticles in Biomedical Imaging Editors: Jeff W.M. Bulte Publisher/Year: Springer/2016

Title: Fundamentals of Medical Imaging Author: Paul Suetens Publisher/Year: Cambridge University Press/2009

Title: Introduction to Medical Imaging Physics, Engineering and Clinical Applications Author: Nadine B. Smith & Andrew Webb Publisher/Year: Cambridge University Press/2009

Title: Medical Imaging Principles and Practices Editors: Mostafa Analoui, Joseph D. Bronzino Publisher/Year: Cambridge University Press/2011

Course Objectives

Examines the principles of biomedical electronics with emphasis on instruments and systems for biomedical data acquisition, data processing, and medical imaging technologies. Medical imaging technologies such as CT, MRI, ultrasound, X-ray, the principles behind their operations and their applications are introduced. This course will cover the fundamental concepts behind the operation of the most important classes of biosensors, including biopotential electrodes (EEG, ECG, EMG, EOG), electrochemical, thermal, gravimetric, colorimetric, and optical biosensors, as well as how biosensors are characterized, compared to each other, and designed to suit particular applications. The major applications of biosensor technology in diagnostic tests, life science research, and environmental testing will be discussed. The future prospects of the biosensors and medical imaging devices, specifically wearable and point of care sensors and the importance of personalized medicine and application of artificial intelligence in medical imaging as the future prospects are also discussed. The aim of this course is to provide an overview of the main imaging techniques and biosensors such that students will be comfortable selecting appropriate tools and techniques for the design of medical devices.

Learning Outcomes

Learning Outcomes for the course.

1. Recognize the principles of biomedical electronics with emphasis on instruments and systems for biomedical data acquisition and processing.
2. Describe the major characteristics and fundamental concepts behind the operation of biosensors/imaging devices.
3. Categorize the major classes of imaging devices/biosensors.
4. Determine the appropriate imaging technique/biosensor for various diagnostic assessments.
5. Predict how biochemical functionality influences the major characteristics of biosensors.

Assessment

Weight & Date(s) of Assessment	Weight	Date
Assignments	10%	TBD
Exam 1	30%	TBD
Exam 2	30%	TBD
Project	20%	TBD
Presentation	10%	TBD

Details will be provided during class and posted on Brightspace.

Notes

NOTES ON WORK COMPLETION Failure to complete and submit all assessment requirements will result in a grade of N.

NOTES The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

COURSE LECTURE NOTES Unless otherwise noted, all course materials supplied to students in this course are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

Grading System

The University of Victoria follows a percentage grading system in which the instructor will submit grades in percentages. The University will use the following Senate approved standardized grading scale to assign letter grades. Both the percentage mark and the letter grade will be recorded on the academic record and transcripts.

Passing Grades	GPA	Percentage	Description
A+	9	90 - 100	Exceptional work. Technically flawless and original work demonstrating insight, understanding and independent application or extension of course expectations; often publishable.
A	8	85 - 89	Outstanding work. Demonstrates a very high level of integration of material demonstrating insight, understanding and independent application or extension of course expectations.
A-	7	80 - 84	Excellent work. Represents a high level of integration, comprehensiveness and complexity, as well as a mastery level of relevant techniques/concepts.
B+	6	77 - 79	Very good work. Represents a satisfactory level of integration, comprehensiveness and complexity; demonstrates a sound level of analysis with no major weakness.
B	5	73 - 76	Acceptable work that fulfills the expectations of the course. Represents a satisfactory level of integration of key concepts/procedures. However, comprehensiveness or technical skills may be lacking.
B-	4	70 - 72	Unacceptable work revealing some deficiencies in knowledge, understanding or techniques. Represents an unacceptable level of integration, comprehensiveness and complexity. Mastery of some relevant techniques or concepts lacking.
C+	3	65 - 69	Unacceptable work revealing some deficiencies in knowledge, understanding or techniques. Represents an unacceptable level of integration, comprehensiveness and complexity. Mastery of some relevant techniques or concepts lacking.
C	2	60 - 64	Unacceptable work revealing some deficiencies in knowledge, understanding or techniques. Represents an unacceptable level of integration, comprehensiveness and complexity. Mastery of some relevant techniques or concepts lacking.
D	1	50 - 59	Unacceptable work revealing some deficiencies in knowledge, understanding or techniques. Represents an unacceptable level of integration, comprehensiveness and complexity. Mastery of some relevant techniques or concepts lacking.
F	0	0 - 49	Failing grade. Unsatisfactory performance. Wrote final examination and completed course requirements.

Note: Every grade of 4.0 (B-) or lower in a course taken for credit in the Faculty of Graduate Studies must be reviewed by the supervisory committee of the student and a recommendation made to the Dean of Graduate Studies. Such students will not be allowed to register in the next session until approved to do so by the Dean.

Course Experience Survey (CES)

We value your feedback on this course. Towards the end of term you will have the opportunity to complete a confidential course experience survey (CES) regarding your learning experience. The survey is vital to providing feedback to us regarding the course and our teaching, as well as to help the department improve the overall program for students in the future. When it is time for you to complete the survey, you will receive an email inviting you to do so. If you do not receive an email invitation, you can go directly to the [CES site](#)

You will need to use your UVic NetLink ID to access the survey, which can be done on your laptop, tablet or mobile device. We will remind you closer to the time, but please be thinking about this important activity, especially the following three questions, during the course.

- What strengths did your instructors demonstrate that helped you learn in this course?
- Please provide specific suggestions as to how the instructors could have helped you learn more effectively.
- Please provide specific suggestions as to how this course could be improved.

General Information

Note to Students: Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Assistant to the Chair to set up an appointment.

Centre for Accessible Learning (CAL) <https://www.uvic.ca/services/cal/>

Discrimination and Harassment Policy (GV0205)

Sexualized Violence Prevention and Response at UVic: UVic takes sexualized violence seriously, and has raised the bar for what is considered acceptable behaviour. We encourage students to learn more about how the university defines sexualized violence and its overall approach by visiting <https://www.uvic.ca/sexualizedviolence/>. If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support please contact the sexualized violence resource office in Equity and Human Rights (EQHR). Whether or not you have been directly impacted, if you want to take part in the important prevention work taking place on campus, you can also reach out: **Where:** Sexualized violence resource office in EQHR; Sedgewick C119 **Phone:** 250.721.8021 **Email:** svpcoordinator@uvic.ca **Web:** <https://www.uvic.ca/sexualizedviolence/>

Office of the Ombudsperson: The Office of the Ombudsperson is an independent and impartial resource to assist with the fair resolution of student issues. A confidential consultation can help you understand your rights and responsibilities. The Ombudsperson can also clarify information, help navigate procedures, assist with problem-solving, facilitate communication, provide feedback on an appeal, investigate and make recommendations. **Phone:** 250-721-8357 **Email:** ombuddy@uvic.ca **Web:** <https://uvicombudsperson.ca/>

Electronic devices in labs and lectures: No unauthorized audio or video recording of lectures is permitted.

Electronic devices in midterms and exams: Calculators are only permitted for examinations and tests if explicitly authorized and the type of calculator permitted may be restricted. No other electronic devices (e.g. cell phones, pagers, PDA, etc.) may be used during examinations or tests unless explicitly authorized.

Faculty of Engineering, University of Victoria Standards for Professional Behavior

It is the responsibility of all members of the Faculty of Engineering, students, staff, and faculty, to adhere to and promote standards of professional behavior that support an effective learning environment that prepares graduates for careers as professionals... You are advised to read the Faculty of Engineering document [*Standards for Professional Behavior*](#) which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Graduate Students' Society The Graduate Students' Society (GSS) serves all students registered in an Graduate degree program. For information on GSS activities, events and services navigate to <https://gss.uvic.ca/> .

Attendance

Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw from a course if the student is registered in another course that conflicts with it in time. An instructor may refuse a student admission to a lecture or laboratory because of lateness, misconduct, inattention or failure to meet the responsibilities of the course. Students who neglect their academic work, including assignments, may be refused permission to write the final examination in a course. Instructors must inform students at the beginning of term in writing of the minimum attendance required at lectures and in laboratories in order to qualify to write examinations. Students who are absent because of illness, an accident or family affliction should report to their instructors upon their return to classes.

https://www.uvic.ca/calendar/future/grad/index.php#/policy/SJJ2lif_V?bc=true&bcCurrent=09%20-%20Attendance&bcGroup=Faculty%20Academic%20Regulations&bcltemType=policies

Academic Integrity

Academic integrity is intellectual honesty and responsibility for academic work that you submit individual or group work. It involves commitment to the values of honesty, trust, and responsibility. It is expected that students will respect these ethical values in all activities related to learning, teaching, research, and service. Therefore, plagiarism and other acts against academic integrity are serious academic offences.

The responsibility of the institution Instructors and academic units have the responsibility to ensure that standards of academic honesty are met. By doing so, the institution recognizes students for their hard work and assures them that other students do not have an unfair advantage through cheating on essays, exams, and projects.

The responsibility of the student Plagiarism sometimes occurs due to a misunderstanding regarding the rules of academic integrity, but it is the responsibility of the student to know them. If you are unsure about the standards for citations or for referencing your sources, ask your instructor. Depending on the severity of the case, penalties include a warning, a failing grade, a record on the student's transcript, or a suspension.

It is your responsibility to understand the University's policy on [Academic Integrity](#).

Equality

This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Centre for Accessible Learning (formerly the Resource Centre for Students with a Disability) located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.