ENGG*6150 Bio-Instrumentation

Winter 2020
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - January 10, 2020

1 Course Details

1.1 Calendar Description

Instrumentation systems. Transducers. Amplifier circuits. Recording methods. Spectroscopy & colorimetry. Radiation, humidity, pH and noise measurements. Chromatography.

Restrictions: ENGG*3450 or equivalent.

1.2 Course Description

Topic Nominal Weeks
Week 1: Overview of course content, instrumentation concepts and systems
Week 2: Review of basic sensors
Week 3: Chemical biosensors
Week 4-5: Design and analysis of signal conditioning circuit, electrical safety
Week 6-7: Amplifiers, biopotential electrodes and biopotential amplifiers
Week 8-10: Clinical laboratory instrumentation and measurement
Week 11 and 12: Technical Presentations

Project:

The instrumentation project may be related to your thesis or dissertation, or of personal interest. Although, there are no scheduled lab hours for this course, you will be given access to the Electrical Labs of SOE, to build or design an instrumentation system. The lab technician and the instructor will be able to accommodate your request for your project.

1.3 Timetable

Wednesdays 2:30-5:20 pm @ MCKN, Room 310

1.4 Final Exam

No final exam.

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2 Instructional Support

2.1 Instructional Support Team

Instructor:	Maher Bakri-Kassem
Email:	maherbk@uoguelph.ca
Telephone:	+1-519-824-4120 x54532
Office:	THRN 3102

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3 Learning Resources

3.1 Required Resources

John G. Webster, Editor. Medical Instrumentation – Application and Design, 4th Edition (Jan, 2009) (Textbook)

3.2 Recommended Resources

Measurement Systems – Application and Design by Ernest O. Doebelin, 5th Edition (Sep, 2003) (Textbook)

Introduction to Biomedical Equipment Technology – J.J. Carr, J.M. Brown 4th Edition (2000) (Textbook)

3.3 Additional Resources

All the lecture notes will be posted on the web page in CourseLink (Notes)

3.4 Assignments will be posted according to the schedule given in this outline. All the solutions will be posted as indicated.

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4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. 1. Identify different types of sensing devices including sensors and transducers
   2. Use CAD tools design signal conditioning circuits including filter, amplifiers and matching circuits
   3. Design active and passive filters to meet the required specifications of the system
   4. Identify sources of errors and noise and propose corrective procedure to reduce their effects
   5- Acquire hands-on experience through applying theories learnt in this course to deign a bio-instrumentation as a part of a project in the course

4.2 School of Engineering - Graduate Degree Learning Outcomes

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome

5 Teaching and Learning Activities

5.1 Lecture

Topics:

1. Explain the instrumentation concepts and systems in general including the sources of errors
2. Review of basic sensors and principles including Resistive, Capacitive, Inductive, Piezoelectric and Radiation sensors
3. Introduce the chemical biosensors including BioMEMS for blood monitoring instrumentation
4. Use the contemporary available CAD tools to design and analysis signal conditioning circuit
5. Design active and passive filters, amplifiers, and biopotential amplifiers
6. Explain and and introduce state of the art clinical laboratory instrumentation and measurement techniques

6 Assessments

6.1 Marking Schemes & Distributions

Assignment 1	10%	February 19, 2020
Assignment 2	10%	March 18, 2020
Midterm Exam	25%	March 25, 2020
Presentation	15%	April 8, 2020
Final Project Report	40%	April 15, 2020

7 School of Engineering Statements

7.1 Instructor's Role and Responsibility to Students

The instructor’s role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

7.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

7.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.
Academic Calendars
https://www.uoguelph.ca/academics/calendars