

# IBEHS 4F04

## Biomedical Instrumentation and Measurement

### Fall 2024

## Course Outline

### Calendar/Course Description

An introduction of engineering principals applied to the design of biomedical instrumentation including clinical laboratory testing instruments, electrophysiology systems (ECG, EEG, EMG, etc.), minimally invasive endoscopic and laparoscopic instruments, respiratory devices, therapeutic devices; safety; and other clinical instrumentation.

### Pre-Requisites and Anti-Requisites

Prerequisite(s): IBEHS 3A03 and registration in the Integrated Biomedical Engineering and Health Sciences (IBEHS) program

Antirequisite(s): ELECENG 4BD4

### Course Schedule

The delivery of this course occurs through 3 modules: **lectures**, **tutorials**, and laboratories (**labs**). Lectures and tutorials occur weekly while labs occur biweekly.

**LECTURES:** Mondays **8:30-10:20 EST** & Wednesdays **8:30-9:20 EST**

- *Objective:* Main content delivery through in-person lectures

**TUTORIALS:** T02 Mondays **11:30-12:20 EST** & T01 Tuesdays **10:30-11:20 EST**

- *Check you schedule on Mosaic.*
- *Objective:* Assignment/test take up and Q&A with TA

**LABORATORIES (LABS):** Once a week from **2:30-5:20 EST**, repeats bi-weekly

- *Check your schedule on Mosaic.*
- *Objective:* In group setting, experiential learning of clinical lab microscopy, EMG, ECG, EEG, and EOG instrumentation.

### Instructor Office Hours and Contact Information

Dr. Qiyin Fang  
[qiyin.fang@mcmaster.ca](mailto:qiyin.fang@mcmaster.ca)

**Office Hours:**

- By appointment only

## Instructional Team

**Lab Support TAs:** Several Graduate and Undergraduate TAs have been assigned to facilitate lab learning and support.

## Additional Instructional Support

**Laboratory Technician:** manages the laboratory space; provides training on use of equipment; supports all project and lab activities.

**Leela Pilli**

## Course Delivery

[Avenue-to-Learn](#) and IBEHS 4F04 Microsoft Teams will be the online management systems for the course. Through **Avenue**, you will be able to:

- Find all course materials (lecture slides, lab materials, assignments, etc.)
- View course-related announcements
- Submit course work (lab reports, project deliverables) for grading
- View your gradebook

The course's Teams (IBEHS 4F04 2024) will be used primarily for interactive communications between the instructional team and the students, as well as among group members of the lab module.

## Materials and Fees

### Required Textbooks

Principles of Biomedical Instrumentation

Andrew G. Webb

Cambridge, 2018, ISBN: 9781107113138

<https://doi.org/10.1017/9781316286210>

### Optional Textbooks

Medical Instrumentation: Application and Design

John G. Webster, Amit J. Nimunkar,

Wiley, 5<sup>th</sup> Edition, ISBN: 978-1-119-45733-6 June 2020

<https://www.wiley.com/en-ca/Medical+Instrumentation%3A+Application+and+Design%2C+5th+Edition-p-9781119457336>

### Software

All software is free to download and install for McMaster students and is also available on computers in ETB-534 via remote access.

- MATLAB R2022a with the following toolboxes:
  - Computer Vision Toolbox
  - Image Processing Toolbox



- Image Acquisition Toolbox
- Signal Processing Toolbox
- Data Acquisition Toolbox
- NI-DAQmx Support from Data Acquisition Toolbox
- NI-DAQmx Drivers (already installed in the ETB lab computers, no need for personal computers)

## Course Objectives and Learning Outcomes (LO)

*Disclaimer:* The Learning Outcomes defined in this section are measured for Accreditation purposes only and will not be taken into consideration in determining a student's actual grade in the course.

Upon successful completion of the course, the student should be able to:

<b>LO.01</b>	Analyze a measurement or instrumentation problem and propose a solution.
<b>LO.02</b>	Apply the principles of electronic circuits and devices to design instrumentation.
<b>LO.03</b>	Have knowledge of the principles and use of a variety of electrical and other transducers, analog and digital instrumentation, applied computer signal acquisition and processing.
<b>LO.04</b>	Apply current safety standards in design.
<b>LO.05</b>	Understand the principles and efficacy of instrumentation used in cardiopulmonary, neurological, surgical, analytical and rehabilitation areas of medicine.

## Assessments

The course is assessed as follows.

GRADING MODULE	WEIGHT
<b>Labs</b> Lab 1: Microscopy Lab 2: Differential Amplifiers and EMG Lab 3: ECG Lab 4: EEG Lab 5: EOG	<b>40%</b> (8%) (8%) (8%) (8%) (8%)
<b>Assignments</b> Assignment 1 Assignment 2 Assignment 3 Assignment 4 Assignment 5	<b>5%</b> (1%; P/F) (1%; P/F) (1%; P/F) (1%; P/F) (1%; P/F)
<b>Midterm</b>	<b>15%</b>
<b>Final Exam</b>	<b>40%</b>

## BME 6F04 Option & the Accelerated Masters Program

This course can be taken as BME 6F04 towards a graduate degree program. The additional module involves research on a biomedical device (not covered in IBEHS 4F04). The students taking BME 6F04 will be organized separately to work on their individual topics as a group. The deliverables include a presentation and a report.

A concurrent 4F04/6F04 option is available only to students in the undergraduate Integrated Biomedical Engineering & Health Science (IBEHS) program towards the accelerated M.A.Sc. degree in Biomedical Engineering. Application for entry into the accelerated option occurs in the penultimate year of undergraduate studies. An additional graduate-level module will be required in addition to all IBEHS 4F04 requirements.

To choose this option, general registration of IBEHS 4F04 and permission from the instructor are required. At the end of the term, you will be given two grades: one for IBEHS 4F04 and one for BME 6F04 (recorded by the iBioMed and BME programs). The IBEHS 4F04 grade will appear on your undergraduate transcript. Once you enrol into the accelerated M.A.Sc.-BME program, the BME 6F04 grade will be added to your graduate transcript.

## Completion and Submission of Work

It is the student's responsibility to ensure assessments are correctly submitted to the correct location, on time, and in the specified format. **Failure to correctly submit an assignment will result in a mark deduction** (see below).

### Submission Penalties

Documents must be uploaded to Avenue by the deadline, or they will be subject to a late penalty of **1% each hour**. **Any submissions deemed to be partially or fully copied will be considered an academic offence and be subject to terms laid out under the Academic Integrity Policy.**

## Important Dates

Fall Term	
Tuesday, September 6	Lectures and tutorials begin; labs start the following week
<b>Monday, September 30</b>	<b>National Day for Truth and Reconciliation (no classes)</b>
<b>October 14 – 20</b>	<b>Fall Reading Week (no classes)</b>
Monday, October 28	Midterm Test
<b>December 6 – 19</b>	<b>Fall Term Examinations</b> (the date of <b>Exam</b> is TBD)

## Communication Policy

Please direct all emails to: [qiying.fang@mcmaster.ca](mailto:qiying.fang@mcmaster.ca). Every attempt will be made to reply within 24 hours (excluding weekends). Please include a **subject prefix of "IBEHS 4F04"**. Emails must be sent from your @mcmaster.ca account. Be sure to **include your student number** in your email.

## Inclusive Environment Statement

We consider this classroom to be a place where you will be treated with respect, and we welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

We will gladly honour your request to address you by an alternate name or gender pronoun. Please advise of this preference early in the semester so that we may make appropriate changes to our records.

## Accreditation

The Graduate Attributes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's actual grade in the course. For more information on Accreditation, please visit: <https://www.engineerscanada.ca>. Mapping of the course **Learning Outcomes (LO)** to the Canadian Engineering Accreditation Board (CEAB) **Graduate Attributes (GA)** are outlined in the table below:

GRADUATE ATTRIBUTE	LEARNING OUTCOME(S)
<b>GA01 - Knowledge Base for Engineering</b>	
1.1 – Competence in mathematics	
1.2 – Competence in natural sciences	

## GA02 Problem Analysis

- 2.1 – Identifies and states reasonable assumptions and suitable engineering fundamentals, before proposing a solution path to a problem.
- 2.2 – Proposes problem solutions supported by substantiated reasoning, recognizing the limitations of the solutions.

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

## McMaster Approved Policy Statements

### 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 to 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 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](#), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty:

- Plagiarism, e.g., submission of work not one’s own or which other credit been obtained.
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations.

### Authenticity / Plagiarism Detection

In this course we will be using a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. Students will be expected to submit their work electronically either directly to Turnitin.com or via Avenue to Learn (A2L) plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish to submit their work through A2L and/or Turnitin.com must still submit an electronic and/or hardcopy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com or A2L. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). To see the Turnitin.com Policy, please go to the following website: [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity).

### **Academic Accommodations for 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.

### **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 **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 examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

### **Academic Accommodations for Relief for Missed Academic Work: McMaster Student Absence Form (MSAF)**

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](#)".

- All MSAFs are to be directed to [qiyin.fang@mcmaster.ca](mailto:qiyin.fang@mcmaster.ca). Sending to another email address will delay processing.
- It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
  - In the event an MSAF is applied to either the **Graphics Design Final Assessment** or **Computing Final Assessment**, they **will be rescheduled**.

### **Courses with an Online Element**

In this course, we will be using **Avenue to Learn** and **Microsoft Teams**. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, usernames 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 this course 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.

### **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.

### **Reference to Research Ethics**

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to <https://reo.mcmaster.ca/>.

### **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.



**Notice Regarding Possible Course Modification**

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term