

IBEHS 4F04
Biomedical Instrumentation & Measurements

Fall 2021/22 T1

Course Outline (subject to change at the beginning of September)

CALENDAR/COURSE DESCRIPTION

An introduction of engineering principals applied to the design of biomedical instrumentation including: electrodes, mechanical, chemical and other transducers; signal processing and data acquisition; safety; neuromuscular; cardiovascular, biochemical, biomechanical and other clinical instrumentation.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): IBEHS 3A03, or registration in the Integrated Biomedical Engineering and Health Sciences (IBEHS)
 Cross-List(s): ELECENG 4BD4

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Qiyin Fang
 ETB 405, qiyin.fang@mcmaster.ca

Office Hours:
 by appointment only

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Guha Ganesh
 ETB 303, e-mail

Tianqi Hong
 ETB 303, e-mail

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

<http://avenue.mcmaster.ca/> & IBEHS 4F04 Microsoft Teams

COURSE OBJECTIVES

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

| | |
|-------------|--|
| LO.1 | Analyze a measurement or instrumentation problem and propose a solution. |
| LO.2 | Apply the principles of electronic circuits and devices to design instrumentation. |
| LO.3 | 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. |
| LO.4 | Apply current safety standards in design. |
| LO.5 | Understand the principles and efficacy of instrumentation used in cardiopulmonary, neurological, surgical, analytical and rehabilitation areas of medicine. |

MATERIALS AND FEES

Required Texts:

Medical Instrumentation: Application and Design

John G. Webster, Amit J. Nimunkar,

Wiley, 5th 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>

Calculator:

Only the McMaster Standard Calculator (available at the Campus Store). will be permitted in tests and examinations.

Other Materials:

TBD

COURSE OVERVIEW

| Module | Topic | Readings |
|--------|--|--------------------------|
| 1 | General Overview of Instrumentation (Filters, Amplifiers, etc.) | Textbook & lecture notes |
| 2 | Electrophysiology Instrumentation and Measurement (ECG, EEG, etc.) | |
| 3 | Electrical Safety and Standards in Practice | |
| 4 | Sensors and Instrumentation to Measure other Variables | |
| 5 | Measurement of Cardiopulmonary Function with Instrumentation | |
| 6 | Applications of Instrumentation in Biotechnology | |

ASSESSMENT

| Component | Weight |
|---------------------------------------|--------|
| Assignments (4 assignments @ 5% each) | 20% |
| Labs (5 labs @ 6% each) | 30% |
| Mid-term | 20% |
| Exam | 30% |
| Total | 100% |

LAB OVERVIEW AND OPERATION

- Labs occur on a bi-weekly basis.
- Labs are completed within groups of 4-5
- Labs have pre-lab work which is to be completed by the group prior to the lab.
- The pre-lab is weighted as 1/3 the total score for labs in which it applies
- **The labs will be completed via a hybrid approach with 1-2 members on-site (in person) and 2-3 members working remotely. Details TBA**

| Lab | Topic |
|-----|---|
| 1 | Differential Amplifiers & Filters |
| 2 | ECG and Heart Rate Measurement |
| 3 | EEG Measurement and Analysis |
| 4 | EMG and Motor Control |
| 5 | Estimation of Position, EOG and Accelerometry |

ADDITIONAL DETAILS REGARDING COURSE MANAGEMENT AND ASSESSMENT

- Attendance requirements: Required
- Grade adjustment techniques: N/A
- Group work expectations and how group work will be evaluated: Single grade for the entire group, members are expected to contribute equally.
- Members of a lab group will generally receive the same grade with some exceptions.
- How work is to be submitted: through Avenue to Learn

ACCREDITATION LEARNING OUTCOMES

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.

| Outcomes | Indicators |
|--------------------|------------------------------|
| 1. Knowledge | 1.4 - LO.3 |
| 3. Investigation | 3.1 - LO.5 |
| 3. Investigation | 3.3 - LO.1, LO.2, LO.3, LO.5 |
| 8. Professionalism | 8.1 - LO.4, LO.5 |
| 4. Design | 4.2 - LO.4, LO.5 |
| 4. Design | 4.6 - LO.4, LO.5 |

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.

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.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <http://www.mcmaster.ca/academicintegrity>

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 assignments, tests, and examinations.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for [Academic Accommodation of Students with Disabilities](#).

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

1. The [McMaster Student Absence Form](#) is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note this tool cannot be used during any final examination period.
2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE/A214). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
6. You should expect to have academic commitments Monday through Saturday but not on Sunday or statutory holidays. If you require an accommodation to meet a religious obligation or to celebrate an important religious holiday, you may submit the Academic Accommodation for Religious, Indigenous and Spiritual Observances (RISO) Form to the Associate Dean's Office. You can find all paperwork needed here: <http://www.eng.mcmaster.ca/current/documents.html>

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 and to note any changes.

TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to <http://www.mcmaster.ca/academicintegrity/>.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using Avenue-to-Learn (including its e-mail) 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, 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 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.

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 <http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf>.