

IBEHS 3A03
Biomedical Signals and Systems
Fall 2019
Course Outline

CALENDAR/COURSE DESCRIPTION

Linear systems, signals, input-output relations of linear systems; discrete and continuous time systems; transfer functions, Fourier transforms, Laplace transforms; sampling theory; stability.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): MATH 2Z03 and registration in the Integrated Biomedical Engineering and Health Sciences (IBEHS) program

Antirequisite(s): SFWRENG 3MX3, ELECENG 3TP3

SCHEDULE

Lecture: Monday & Wednesday 8:30am – 9:20am, Friday 10:30 – 11:20am

Tutorial: T01 - Friday 2:30 – 3:20pm; T02 - Monday 11:30am – 12:20pm; T03 - Wednesday 10:30 – 11:20am; T04 - Monday 2:30 – 3:20pm

Lab: (None)

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Ian C. Bruce

ITB-A213

e-mail: ibruce@mail.ece.mcmaster.ca

e-mail alias: ibruce@ieee.org

For MSAF use: brucei@mcmaster.ca

ext. 26984

Office Hours:

Wednesdays 9:30 – 10:20am

Fridays 11:30am – 12:20pm

Or by appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

TA	Larissa Taylor	Melih Yayli	Calvin Zhu	Lauren Anderson
E-mail	taylorla@mcmaster.ca	yaylim@mcmaster.ca	zhuc@mcmaster.ca	anderl22@mcmaster.ca
Office Hours	Wednesdays 11:30am – 12:20pm	Tuesdays 10:30am – 11:20am	Fridays 3:30pm – 4:20pm	Mondays 3:30pm – 4:20pm
Location	ETB-432	ETB-432	ETB-432	ETB-432

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

<http://avenue.mcmaster.ca/>

COURSE OBJECTIVES

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

- understand the concepts underlying analysis and visualisation of systems and signals commonly encountered in biomedical engineering
- derive mathematical expressions for the convolution of simple discrete time and continuous time signals
- apply mathematical operations such as the Fourier and Laplace transforms to signals and systems
- understand the properties of linear time-invariant (LTI) systems
- understand the frequency domain descriptions/analysis of continuous time signals and systems both periodic and non-periodic, e.g., working knowledge of Fourier series and Fourier transform analysis including their properties
- understand the Laplace transform and analysis of continuous-time systems using the transfer function representation
- use MATLAB to conduct basic analysis and visualisation of biomedical signals and systems

MATERIALS AND FEES

Required Texts:

[Fundamentals of Signals and Systems \(Third Edition\), E. W. Kamen and B. S. Heck, Pearson, 2007. ISBN-10: 0131687379; ISBN-13: 978-0131687370](#)

Calculator:

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

Other Materials:

Laptop with MATLAB + Signal Processing Toolbox installed (required for tutorials and assignments)

Lecture slides and accompanying material will be posted on Avenue to Learn

Textbook companion website at: <http://bonnie.ece.gatech.edu/book3/>

COURSE OVERVIEW

Week	Topic	Readings
1-2	Introduction to Signals and Systems	Ch. 1 in textbook
3-4	Time Domain Models of Systems	Ch. 2 in textbook
5-6	Fourier Series and Fourier Transforms	Ch. 3 in textbook
7	Fourier Analysis of Systems	Ch. 5 in textbook
8-9	The Laplace Transform and the Transfer Function Representation	Ch. 6 in textbook
10-11	Analysis of Continuous-Time Systems Using the Transfer Function Representation	Ch. 8 in textbook
12-13	Filtering of biomedical signals	

ASSESSMENT

Component	Weight
Tutorial Assignments (4×10%)	40%
On-line Quizzes (4×2.5%)	10%
Midterm Exam	15%
Final Exam	35%
Total	100%

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes 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.

Outcomes	Indicators	Measurement Methods(s)
able to derive mathematical expressions for the convolution of simple discrete time and continuous time signals	1.1	Quizzes and Exams
understands the frequency domain descriptions/analysis of continuous time signals and systems both periodic and non-periodic, e.g., working knowledge of Fourier series and Fourier transform analysis including their properties	1.3	Quizzes and Exams
able to use Matlab to conduct basic analysis and visualisation of biomedical signals and systems	5.2	Tutorial assignments

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

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 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. 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.