ENG PHYS 3W03
Signals and Systems for Engineering
Undergraduate Fall 2023
Course Outline

CALENDAR/COURSE DESCRIPTION

Signals and Systems for Engineering provides an introduction to analog and digital signal processing. The ideas to be explored apply to many areas, including seismic data processing, communications, speech processing, image processing, and electronics. The course presents the basic concepts for continuous and discrete signals and systems in the time and frequency domains. These representations are related through the Laplace and Fourier transform, which are explored in detail. System response modelling, filtering and filter design, modulation, and sampling for both analog and digital systems, as well as the basic concepts of feedback control, are discussed and illustrated.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in Level III or above of any Engineering or Science program
Antirequisite(s): IBEHS 3A03

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

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By email appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://avenue.mcmaster.ca/

- Email, MS Teams and Avenue to Learn will be used in communications with/between students;
- If online learning becomes necessary, lectures/tutorials/quizzes/labs will be run through MS Teams; office hours/lab assistance will then also be provided through MS Teams;
- Note that email messages sent out are deemed to have been read by the students.

COURSE OBJECTIVES

By the end of this course, students should be able to model systems for a range of applications including those associated with:

- Complex system response
- System feedback and control
- Filtering
- Sampling
- Modulation

MATERIALS AND FEES

Required Textbook:
- "Engineering Signals and Systems", Ulaby and Yagle, NTS press. This book is available online from: https://services.publishing.umich.edu/publications/ee

Lecture notes:
- To be posted on Avenue to Learn

Lab manuals:
- To be posted on Avenue to Learn

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

Other Materials:
- The course will make significant use of Matlab. An attempt will be made to make all assignments compatible with Octave, which is freely available and can be installed on Linux. Python may be used as well, but TA support may be limited.

COURSE FORMAT AND EXPECTATIONS

The course is organized as follows:
- Two lectures per week (Wed, Thu)
- One tutorial per week (Mon)
- One two-hour lab every week (12 labs total)

Grading is based on
- Weekly quizzes (online pre-lecture quizzes and tutorial exercises)
- Computer labs
- Midterm and Final exams

NOTE:
- **A passing grade for the midterm and final exam (combined) is required to pass the course.**
- If the midterm mark is lower than the final, the midterm weight will be shifted to the final.

COURSE OVERVIEW

Week	Topic	Readings (textbook)
1	Course Overview, Types of signals, signal transformations, waveforms, power and energy	Chapter 1 sects 1-5
2	LTI systems, impulse response, convolution	Chapter 2 sects 1-3
3	LTI sinusoidal response, impulse response to 2nd order LCCDES, the car suspension model.	Chapter 2 sects 7-9
4	Laplace Transforms, poles and zeros, the transfer function, system stability	Chapter 3 sects 1, 2, 6, 7
5	Applications of the Laplace transform, s-domain circuit analysis	Chapter 4 sects 1-4
	Reading week, no class/labs	
6	Basic control theory, temperature control systems	Chapter 4 sects 8-9
7	Fourier analysis techniques, phasor-domain, Fourier series	Chapter 5 sects 1-4
8	Fourier transform, Parseval's theorem, circuit analysis	Chapter 5 sects 7-13
9	Applications of the Fourier transform, filtering, filter design with poles and zeros	Chapter 6 sects 1-7
10	Amplitude modulation and introduction to sampling theory	Chapter 6 sects 12-13
11	Discrete notation and comparison with continuous signals	Chapter 7 sects 1-5
12	Discrete transfer function, frequency response and the FFT	Chapter 7 sects 12, 16 Chapter 9 sect 13

ASSESSMENT

Component	Weight
Weekly tutorial quizzes	20 %
Weekly pre-lecture quizzes	10 %
Computer labs	20 %
Midterm Exam	10 % (weight shifted to final if lower)
Final Exam	40 %
Total	100 %

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for no good reason and will not be taken into consideration in determining a student's grade in the course.

Outcomes	Indicators
1. Knowledge base for Engineering	1.1 Competence in Mathematics
2. Problem analysis	2.1, 2.2 Identify assumptions, identify fundamentals
5. Use of Engineering Tools	5.2 Use of modern tools (specifically for modelling)

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

EQUITY, DIVERSITY, AND INCLUSION

Every student registered for this course belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You may expect your instructor to be respectful of this diversity in all aspects of the course and the same is expected of you.

The Department of Engineering Physics is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or the Equity and Inclusion Office.

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the Student Wellness Centre.

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:
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.

COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, 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 a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

EXPECTATIONS OF CONDUCT

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 2 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 ACCOMMODATION OF 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 to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students' responsibility to regularly check the course webpage (i.e. Avenue to Learn) for updates and announcements.
2. Submissions of an **msaf:**
    a. The weight of the missed online and/or tutorial quiz is shifted to the other quizzes.
    b. The due date for a lab submission is automatically extended by **three** days, starting from the due date of the missed work, **not the day of the msaf submission.**
3. Online and tutorial quizzes cannot be submitted late.
4. Late submission of lab work will result in a penalty of 10% of the original mark per day.
5. Accommodations for SAS students must be established with the instructor **before** the due date of the work.
    a. Accommodation for the tutorial quizzes is made by sending the quiz to the students on the Friday before the quiz.
    b. Accommodation for the lab write-ups is made by allowing a full week for the two-page report, instead of same-day submission.

SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK: 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".

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:**

   • Use the McMaster Student Absence Form (MSAF) on-line self-reporting tool. No further documentation is required.
   • Students may submit requests for relief using the MSAF once per term.
   • An automated email will be sent to the course instructor, who will determine the appropriate relief.
   • The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
   • The MSAF cannot be used for academic work that has already been completed attempted.
   • An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.

- The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**

   - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
   - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

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

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.

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.