



ENGG*3390 Signal Processing

01

Fall 2021

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 08, 2021

1 Course Details

1.1 Calendar Description

This course will establish the fundamental analysis and design techniques for signal processing systems. Topics covered include: definition and properties of linear time-invariant systems; impulse response and convolution; continuous-time Laplace transform, Fourier series, Fourier transform; discrete-time Fourier transform, discrete-time Fourier series, fast Fourier transform, Z transform; complex frequency response; filter analysis and design for both continuous and discrete time systems. Students will be able to design continuous-time filters and both design and implement discrete-time digital filters using computer-based tools.

Pre-Requisites:

ENGG*2400

Restrictions:

This is a Priority Access Course. Enrolment may be restricted to the BME, CENG and ESC specializations in the BENG and BENG:C programs. See department for more information.

1.2 Timetable

Lectures:

Tuesdays and Thursdays from 10:00 am to 11:20 am. The lectures will be offered virtually on Zoom.

Laboratory:

Friday	Sec 101	3:30-5:20 PM	THRN, Room 2307
Friday	Sec 102	1:30-3:20 PM	THRN, Room 2307
Tuesday	Sec 103	3:30-5:20 PM	THRN, Room 2307

1.3 Final Exam

Time: December 17 2021, Time: 7 pm - 9 pm.

Exam time is subject to change. Please see WebAdvisor/CourseLink for the latest information

2 Instructional Support

2.1 Instructional Support Team

Instructor: Eran Ukwatta
Email: eukwatta@uoguelph.ca
Telephone: +1-519-824-4120 x53404
Office: Richards 1507
Office Hours: Tuesdays from 11.20 am to 12.20 pm. Meetings will take place virtually. Please also email to schedule individual appointments.

2.2 Teaching Assistants

Teaching Assistant (GTA): Zach Szentimrey
Email: zszentim@uoguelph.ca
Office: Thrn 2319

Teaching Assistant (GTA): Rohini Prabhakar Gaikar
Email: rgaikar@uoguelph.ca
Office: Thrn 2319

Teaching Assistant (GTA): Abolfazl Rahimnejad
Email: arahimne@uoguelph.ca

3 Learning Resources

3.1 Required Resources

Course Website (Website)

<http://courselink.uoguelph.ca>

Course material, news, announcements, and grades will be regularly posted to the ENGG*3390 Courselink site. You are responsible for checking the site regularly.

Haykin, S., Van Veen, B., Signals and Systems, 2nd edition, Wiley, 2004. (Textbook)

3.2 Recommended Resources

Hwei P. Hsu, Schaum's Outline of Signals and Systems, McGraw-Hill, 1995 (Textbook)

On Reserve

Monson H. Hayes, Schaum's Outline of Digital Signal Processing, McGraw-Hill, 1999 (Textbook)

On Reserve

Bary Van Veen (Website)

<http://AllSignalProcessing.com>

4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Define the attributes of linear time-invariant systems and use convolution by the impulse response to calculate responses to arbitrary functions.
2. Identify the basic properties of signals and systems and identify what transforms and relationships apply to the various signals and system properties.
3. Define and apply the various continuous-time signal transforms, including: Laplace transform, Fourier series, Fourier transform.
4. Define and apply the various discrete-time signal transforms, including: discrete-time Fourier transform, discrete-time Fourier series, fast Fourier transform, Z transform.
5. Identify the relationships between the transforms, when they are and are not applicable to problems in signal processing systems design and analysis.
6. Design both electronic and digital filters to enhance signal quality; Enumerate the advantages and disadvantages of filter types; Evaluate their general frequency response, and design specific filters to meet performance requirements.
7. Apply the above transforms and design techniques to real systems and applications such as audio processing, communication systems, biological systems and biomedical

systems

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2
1.2	Recall, describe and apply fundamental principles and concepts in natural science	2
2	Problem Analysis	1, 3, 4, 6, 7
2.1	Formulate a problem statement in engineering and non-engineering terminology	3, 4
2.2	Identify, organize and justify appropriate information, including assumptions	3, 7
2.3	Construct a conceptual framework and select an appropriate solution approach	7
2.4	Execute an engineering solution	1, 4, 6
4	Design	6
4.1	Describe design process used to develop design solution	6

5 Teaching and Learning Activities

5.1 Lecture

Week 1

Topics: Introduction

Learning Outcome: 2

Week 2

Topics: Signals and Systems

Learning Outcome: 2

Week 3**Topics:** Laplace Review, Discrete Time**Learning Outcome:** 2, 3**Week 4****Topics:** Linear Time Invariant Systems**Learning Outcome:** 1, 2**Week 5****Topics:** Z Transform**Learning Outcome:** 4, 5**Week 6****Topics:** System Transfer Function, Convolution**Learning Outcome:** 1, 4, 5**Week 7****Topics:** Convolution cont., Properties of Impulse Response**Learning Outcome:** 5**Week 8****Topics:** Frequency Response, Filters (Active and Passive, IIR and FIR)**Learning Outcome:** 6**Week 9****Topics:** Filter Design, Fourier Representation: Continuous Time**Learning Outcome:** 3, 6**Week 10****Topics:** Fourier Representation: Discrete Time**Learning Outcome:** 3, 4, 5**Week 11**

Topics: Properties of Fourier Representation

Learning Outcome: 3, 4, 5

Week 12

Topics: Sampling and Quantization

Learning Outcome: 5

Week 13

Topics: Final Review

Learning Outcome: 2, 5

5.2 Lab

Tue, Sep 14 - Fri, Sep 17

Topics: Safety training, group formation and lab kit assignment

Tue, Sep 21 - Fri, Sep 24

Topics: Lab 1: Digital Signal Processing

Learning Outcome: 2

Tue, Sep 28 - Fri, Oct 1

Topics: Lab 1: Follow-up Hour(s)

Tue, Oct 5 - Fri, Oct 8

Topics: Lab 2: Convolution

Learning Outcome: 1, 7

Tue, Oct 19 - Fri, Oct 22

Topics: Lab 3: Filtering and Frequency Response

Learning Outcome: 2, 3, 4, 5

Tue, Oct 26 - Fri, Oct 29

Topics: Lab 3: Follow-up Hour(s)

Tue, Nov 2 - Fri, Nov 5

Topics: Lab 4: FIR and IIR Filter Design

Learning Outcome: 6, 7

Tue, Nov 9 - Fri, Nov 12

Topics: Lab 4: Follow-up Hour(s)

Tue, Nov 16 - Fri, Nov 19

Topics: Lab 5: Frequency Domain Filtering

Learning Outcome: 5, 6, 7

Tue, Nov 23 - Fri, Nov 26

Topics: Lab 5: Follow-up Hour(s)

5.3 Lecture Schedule

*Lecture schedule is subject to change.

5.4 Other Important Dates

Monday, October 11, 2021: Holiday -- **No Classes Scheduled** -- Classes rescheduled to Friday, December 3

Tuesday, October 12 2021: Fall Study Break Day -- **No Classes Scheduled** -- classes rescheduled to Thursday, December 2

Thursday, December 2, 2021: Make up for Study Day (Tuesday Schedule)

Friday, December 3, 2021: Make up for Holiday, Last day to drop F21 one semester courses (Monday Schedule)

6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Assignment	5
Labs	20
Midterm Exam	25
Final Exam	50
Total	100

6.2 Assessment Details

Assignment (5%)

Due: Thu, Oct 14, 11:59 PM

Learning Outcome: 1, 2, 3

Will be released on September 30th.

Labs (20%)

Learning Outcome: 1, 2, 3, 4, 5, 6, 7

Five Labs will be held. See Lab Schedule for details.

Midterm Exam (25%)

Date: Thu, Oct 21, 01:00 PM, Virtual at class time

Learning Outcome: 1, 2, 3

Final Exam (50%)

Date: Thu, Dec 17, 7:00 PM, Virtual

Learning Outcome: 1, 2, 3, 4, 5, 6, 7

7 Course Statements

7.1 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Consideration of Religious Obligations: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

Missed midterm: If you miss a midterm due to grounds for granting academic consideration or religious accommodation, the weight of the missed midterms will be added to the final exam weight. There will be no make-up midterm test.

Lab Work: You must complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, the weight of the missed lab will be added to the final exam.

Late Lab Reports: Late submission of lab reports will not be accepted.

Assignment: Late submissions of assignment reports will not be accepted.

Passing Grade: As per University policy, the minimum passing grade is 50%

8 School of Engineering Statements

8.1 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.

8.2 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.

8.3 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.

9 University Statements

9.1 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.

9.2 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>

9.3 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>

9.4 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.

9.5 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>

9.6 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>

9.7 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.

9.8 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>

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

9.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
