ENGG*3390 Signal Processing

01

Fall 2022
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 3.00 - September 02, 2022

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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:

Mondays and Wednesdays from 5:30 pm to 6:50 pm. The lectures will be in MACN, Room 113.

Laboratory:

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

1.3 Final Exam

Date: December 5 2022, Time: 11.30 am - 1.30 pm.

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

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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: Wednesdays from 4 pm to 5 pm. If this time does not work for you, 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): Samaneh Alidousti
Email: salidous@uoguelph.ca

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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

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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 trans- form, 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

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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

5.2 Lab

Thu, Sep 15 - Fri, Sep 16

Topics: Safety training, group formation and lab kit assignment

Thu, Sep 22 - Fri, Sep 23

Topics: Lab 1: Digital Signal Processing

Learning Outcome: 2

Thu, Sep 29 - Fri, Sep 30

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

Thu, Oct 6 - Fri, Oct 7

Topics: Lab 2: Convolution

Learning Outcome: 1, 7

Thu, Oct 13 - Fri, Oct 14

Topics: Lab 2: Follow-up Hour(s)

Thu, Oct 20 - Fri, Oct 21

Topics: Lab 3: Filtering and Frequency Response

Learning Outcome: 2, 3, 4, 5

Thu, Oct 27 - Fri, Oct 28

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

Thu, Nov 3 - Fri, Nov 4

Topics: Lab 4: FIR and IIR Filter Design

Learning Outcome: 6, 7

Thu, Nov 10 - Fri, Nov 11

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

Thu, Nov 17 - Fri, Nov 18

Topics: Lab 5: Frequency Domain Filtering

Learning Outcome: 5, 6, 7

Thu, Nov 24 - Fri, Nov 25

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

5.3 Lecture Schedule

*Lecture schedule is subject to change.

5.4 Other Important Dates

Monday, October 10, 2022: Holiday -- **No Classes Scheduled** -- Classes rescheduled to Friday, December 2

Tuesday, October 11 2022: Fall Study Break Day -- **No Classes Scheduled** -- classes rescheduled to Thursday, December 1

Thursday, December 1, 2022: Make up for Study Day (Tuesday Schedule)

Friday, December 2, 2022: Make up for Holiday (Monday Schedule), Last day to drop F22 one semester courses

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Labs (each lab: 5%)	25
Midterm Exam	25
Final Exam	50
Total	100

6.2 Assessment Details

Labs (25%)
Learning Outcome: 1, 2, 3, 4, 5, 6, 7
Five Labs will be held. See Lab Schedule for details.

Midterm Exam (25%)
Date: Wed, Oct 19, 05:30 PM, Virtual
Learning Outcome: 1, 2, 3
The midterm will be held virtually during the class time. The exam will be invigilated using the Zoom tool. The students are expected to keep theirs cameras on during the exam time.

Final Exam (50%)
Date: Mon, Dec 5, 11:30 AM, Virtual
Learning Outcome: 1, 2, 3, 4, 5, 6, 7
The final exam will be held virtually. The exam will be invigilated using the Zoom tool. The students are expected to keep theirs cameras on during the exam time.

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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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

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

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