

Course Outline (W2024)

ELE632: Signals and Systems II

Instructor(s)	Dr. Dimitri Androutsos [Coordinator] Office: ENG 362 Phone: 555334 / 556104 Email: dimitri@torontomu.ca Office Hours: TBA
Calendar Description	The topics covered in the course includes a general discussion on discrete signals (periodic signals, unit step, impulse, complex exponential), a general discussion on discrete systems, Discrete-Time Fourier Series (DTFS), Discrete-Time Fourier Transform (DTFT); analysis and synthesis, Fourier Spectra; continuous nature, periodicity, existence, Properties of the DTFT; linearity, conjugation, time/frequency reversal, time/frequency shifting, etc. LTI discrete time system analysis using DTFT, DTFT and Continuous-Time FT comparison and relation, DFT and FFT discussion and their relation to DTFT and CTFT, Discrete-Time Sampling, Z-Transform; generalization of the DTFT.
Prerequisites	ELE 532
Antirequisites	None
Corerequisites	None
Compulsory Text(s):	1. B.P. Lathi, Linear Systems and Signals, 3rd edition, Oxford University Press, 2018.
Reference Text(s):	1. M. J. Roberts, Signals and Systems, 2nd edition, McGraw Hill, 2011.
Learning Objectives (Indicators)	At the end of this course, the successful student will be able to: <ul style="list-style-type: none"> 1. Learn mathematical foundations of frequency-domain analysis techniques (Discrete-Time Fourier series, Discrete-Time Fourier transform, z-transform) applicable to discrete-time signals and systems. Learn the mathematical relations and mapping between continuous-time and discrete-time techniques. (1b) 2. Learn properties of discrete-time, linear time-invariant (LTI) systems. Learn time-domain and frequency-domain analysis of discrete-time signals and systems. Learn the differences between continuous-time and discrete-time signals and systems. (1c) 3. Determine system output for a given input signal using time and frequency domain techniques. Learn to select the most appropriate and efficient solution technique based on the information and mathematical models provided. Identify system characteristics required to shape and modify signal characteristics such as in filtering and relate these characteristics to system parameters (pole-zero locations). (2b) 4. Applies engineering principles to analyze signals using time- and frequency-domain techniques, identifies signal parameters (bandwidth, signal-to- noise ratio) including potential distortion components at various points within a signal processing model. Uses analyzed and measured signal characteristics to formulate discrete-time systems to shape signal (e.g. filtering, elimination of distortion components) Develops software to implement

	<p>the required signal shaping Measures the effectiveness of the design by testing it with test signals. (4b)</p> <ol style="list-style-type: none"> Use Matlab/Simulink as a signal analysis, simulation and visualization tool. Generate system models using simulation tools to verify system properties and perform signal operations. (5a) Read and appropriately respond to technical and non-technical written instructions. Cites evidence to construct and support an argument. Produce five lab reports using appropriate format, grammar, and citation styles for technical and non-technical audiences. (7a) Illustrate concepts of discrete-time signals and systems through graphical presentation of their properties. (7c) Finding relationship between signals, building a signal based on other existing basis, digital signal processing and its practical issues that can be well explained with the theory. (12a) <p>NOTE: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p>														
<p>Course Organization</p>	<p>3.0 hours of lecture per week for 13 weeks 2.0 hours of lab per week for 12 weeks 0.0 hours of tutorial per week for 12 weeks</p>														
<p>Teaching Assistants</p>	<p>Khashayar BAYATI: khashaya.bayati@torontomu.ca Michael NIGRO: michael.nigro@torontomu.ca Randy TAN: randy.tan@torontomu.ca Seungho CHOE: seungho.choe@torontomu.ca Lianna MARRAFFINO: lianna.marraffino@torontomu.ca</p>														
<p>Course Evaluation</p>	<table border="1" data-bbox="427 951 1352 1360"> <thead> <tr> <th colspan="2" data-bbox="427 951 1352 1014">Theory</th> </tr> </thead> <tbody> <tr> <td data-bbox="427 1014 1166 1066">Midterm Exam</td> <td data-bbox="1166 1014 1352 1066">25 %</td> </tr> <tr> <td data-bbox="427 1066 1166 1119">Quizzes</td> <td data-bbox="1166 1066 1352 1119">15 %</td> </tr> <tr> <td data-bbox="427 1119 1166 1182">Final Exam</td> <td data-bbox="1166 1119 1352 1182">40 %</td> </tr> <tr> <th colspan="2" data-bbox="427 1182 1352 1245">Laboratory</th> </tr> <tr> <td data-bbox="427 1245 1166 1297">Lab Assignments</td> <td data-bbox="1166 1245 1352 1297">20 %</td> </tr> <tr> <td data-bbox="427 1297 1166 1360">TOTAL:</td> <td data-bbox="1166 1297 1352 1360">100 %</td> </tr> </tbody> </table> <p>Note: In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both "Theory and Laboratory" components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the "Course Evaluation" section above for details on the Theory and Laboratory components (if applicable).</p>	Theory		Midterm Exam	25 %	Quizzes	15 %	Final Exam	40 %	Laboratory		Lab Assignments	20 %	TOTAL:	100 %
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<p>Examinations</p>	<p>Midterm exam in Week 7 (right after reading week), two hours, (covers Weeks 1-6). Final exam, during exam period, three hours.</p>														
<p>Other Evaluation Information</p>	<p>Practice Problems/Assignments: Assignment problems and their solutions will be provided on D2L. These assignments will neither be collected nor graded; they are provided only as a study guide. You are strongly recommended to attempt to solve the problems on your own without looking at the solutions first. If you have any question about an assignment problem or its respective solution, please consult the course instructor or the teaching assistant during their consulting hours.</p> <p>Lab marks are based on completion of assignments and reports. Students will have the</p>														

	responsibility to achieve a working knowledge of the software package that will be used for the lab assignments. Students will work in INDIVIDUALLY.
Teaching Methods	All lectures will be recorded and posted as well as the instructor's notes
Other Information	<p>MAKE SURE that you familiarize yourself with the ECB Department's FAQ pages. Specifically, FAQs #1, #2, #3 and #4 regarding missing assessments.</p> <p>Religious Observances: If a student is requesting accommodation due to a religious, Aboriginal and/or spiritual observance, they must submit their request via the online Academic Consideration Request (ACR) system within the first two weeks of the class or, for a final examination, within two weeks of the posting of the examination schedule. If the required absence occurs within the first two weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these requests should be submitted with as much lead time as possible in advance of the required absence.</p>

Course Content

Week	Hours	Chapters / Section	Topic, description
1	3	Chp 3 Sect 1-3	Introduction to discrete-time systems and signals. Important signals and operations. Periodicity.
2	3	Chp 3 Sect 3-4	Time domain analysis of discrete time systems: linearity, time-invariance, causality, memory
3	3	Chp 3 Sect 4-6	Classification of discrete systems system equations system response to internal conditions.
4	3	Chp 3 Sect 7-8	Impulse Response and Convolution. Interconnected Systems.
5	3	Chp 3 Sect 8-9, Chapter 9, Sect 1	More convolution; Stability; Discrete-Time Fourier Series (DTFS) intro.
6	3	Chp 9 Sect 1-2	Discrete-Time Fourier Series (DTFS)

7	3	Chp 9 Sect 2	Discrete-Time Fourier Transform (DTFT)
8	3	Chp 5 Sect 2-54	DTFT properties, system analysis, filters.
9	3	Chp 8 Sect 4-6	Spectral Sampling, the DFT, DFT properties and applications, zero-padding, the FFT.
10	3	Chp 5 Sect 1,2,3	z-Transform intro; Inverse z-Transform; z-Transform properties, difference equations.
11	3	Chp 9 Sect 5,6,8	Frequency response; pole-zero analysis; stability;
12	3	Chp 9 Sect 4,6,8	Regions-of-Convergence; Bilateral z-Transform; z-Transform system realization

Laboratory(L)/Tutorials(T)/Activity(A) Schedule

No lab information set for course.

University Policies & Important Information

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on [the Senate website](#)

Refer to the [Departmental FAQ page](#) for further information on common questions.

Important Resources Available at Toronto Metropolitan University

- [The Library](#) provides research [workshops](#) and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or students can use the [Library's virtual research help service](#) to speak with a librarian.
- [Student Life and Learning Support](#) offers group-based and individual help with writing, math, study skills, and transition support, as well as [resources and checklists to support students as online learners](#).
- You can submit an [Academic Consideration Request](#) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the [Senate website](#) and select the blue radio button on the top right hand side entitled: **Academic Consideration Request (ACR)** to submit this request.

For Extenuating Circumstances, Policy 167: Academic Consideration allows for a once per semester ACR request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. Absences

more than 3 days in duration and those that involve a final exam/final assessment, require documentation. Students must notify their instructor once a request for academic consideration is submitted. See Senate [Policy 167: Academic Consideration](#).

- If a student is requesting accommodation due to a religious, Aboriginal and/or spiritual observance, they must submit their request via the online [Academic Consideration Request \(ACR\) system](#) **within the first two weeks of the class or, for a final examination, within two weeks of the posting of the examination schedule**. If the required absence occurs within the first two weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these requests should be submitted with as much lead time as possible in advance of the required absence.
- If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The [Remote Learning Guide](#) for students includes guides to completing quizzes or exams in D2L Brightspace, with or without [Respondus LockDown Browser and Monitor, using D2L Brightspace](#), joining online meetings or lectures, and collaborating with the Google Suite.
- Information on Copyright for [Faculty](#) and [students](#).

Accessibility

- Similar to an [accessibility statement](#), use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
- Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
- Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

- Learn more about [Academic Accommodation Support](#).
- Learn [how to register with AAS](#).

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about [Academic Accommodations versus Academic Consideration and how to access each](#).

Wellbeing Support

At Toronto Metropolitan University, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

- **Distress Line:** 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
- **Good2Talk:** 24/7-hour line for postsecondary students (phone: 1-866-925-5454)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via [My SSP app](#) or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- **Centre for Student Development and Counselling:** 416-979-5195 or email csdc@torontomu.ca
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email osvse@torontomu.ca
- **Medical Centre:** call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing](#) website.