ELEC ENG 3TP3
Signals and Systems

COURSE OUTLINE

Please refer to course website for updated information.

COURSE DESCRIPTION

This course introduces the theory and tools used in the analysis of systems. Topics covered include both discrete and continuous time-domain (differential and difference equations, convolution) and frequency-domain characterizations of systems (Fourier series and transforms, transfer function, frequency response, Z transforms, and Laplace transforms). The material in this course is fundamental background to most branches of electrical and computer engineering. The laboratory component of this course introduces and uses Matlab to characterize and analyze signals and linear time-invariant (LTI) systems.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in any Computer Engineering or Electrical Engineering Program, ELECENG 2CJ4 and 2CI5
Antirequisite(s): ELECENG 3TP4, MECHENG 4R03

SCHEDULE

Lecture: Monday, Wednesday, Thursday 1:30 pm – 2:20 pm in PGCLL B138.
Tutorial: Thursday 11:30 am – 12:20 pm in HSC 1A1.

INSTRUCTOR

Dr. Jun Chen
Email: junchen@mail.ece.mcmaster.ca
Office: ITB-A221
Phone: 905-525-9140 ext. 20163
Office Hours**:** by appointment

TEACHING ASSISTANTS

Contact information and office hours are provided on the course website.

- Xiaohong Liu

- Huan Liu
- Kangdi Shi
- Md. Ahsanul Hoque Rafi
- Jiaxiu Dong
- Sumedh Dhale
- Sami Nehme

COURSE WEBSITE/S

http://avenue.mcmaster.ca

COURSE OBJECTIVES

Introduction to Signals and Systems: Continuous-time and discrete-time signals and systems, Examples, Basic system properties.

Time Domain Models of Systems: Input/output representation of discrete-time systems, difference and differential equation models, continuous-time convolution, discrete-time convolution.

Fourier Series and Fourier Transforms: Representation of signals by frequency components, trigonometric and complex exponential series representations, Fourier transform and properties, Examples.

Fourier Analysis of Discrete-Time Signals: Discrete-time Fourier transform, Discrete Fourier transform, FFT, Applications.

The Z-Transform and Discrete-Time Systems: Z transform properties and the inverse Z transform, Application to discrete-time systems.

Analysis of Continuous-Time Systems Using the Transfer Function Representation: BIBO stability, System response to sinusoids and other inputs, Application examples.

Introduction to Matlab: Matlab will be used extensively in this course.

ASSUMED KNOWLEDGE

ELEC ENG 2CJ4 and 2CI5

COURSE MATERIALS

Required Texts:
Fundamentals of Signals and Systems (Third Edition), E. W. Kamen and B. S. Heck, Pearson Prentice Hall, 2007.

Calculator:
Only the McMaster Standard Calculator (Casio fx-991 MS or MS Plus) will be permitted in tests and examinations. This is available at the Campus Store.

Other:
PC or laptop with Matlab or Octave installed.

COURSE OVERVIEW

Week	Topic	Readings
1,2	Introduction to Signals and Systems	Text Ch. 1
3,4	Time Domain Models of Systems	Text Ch. 2
5,6,7	Fourier Series and Fourier Transforms	Text Ch. 3
8,9,10	Fourier Analysis of Discrete-Time Signals	Text Ch. 4
11,12	The Z-Transform and Discrete-Time Systems	Text Ch. 7

A more detailed time line is available on the course web site.
At certain points in the course it may make good sense to modify the schedule. The instructor may modify elements of the course and will notify students accordingly (in class, on the course website).

LABORATORY OVERVIEW

Week	Topic
3	Matlab Introduction and Refresher
6	Signal Convolution
9	Introduction to Aliasing in Signal Sampling
12	Signal Analysis Using the Discrete Fourier Transform

LABORATORY OPERATION

The labs use Matlab programming to illustrate various concepts. They can be done at home on PC or laptop installed with either Matlab or Octave.

ASSESSMENT

Component	Weight
Laboratories	30%

Midterm	0% or 30% (see below)
Final Exam	70% or 40% (see below)
Total	100 %

30% of the mark is taken as the best of the midterm and exam. There is no deferred midterm test.

ACCREDITATION LEARNING OUTCOMES

Note: The *Learning Outcomes* defined in this section are measured throughout the course and form part of the Department's continuous improvement process. They are a key component of the accreditation process for the program and will not be taken into consideration in determining a student's actual grade in the course. For more information on accreditation, please ask your instructor or visit: http://www.engineerscanada.ca .

Outcomes	Indicators	Measurement Method(s)
Understanding of continuous-time and discrete-time signals and systems including their properties, e.g., linearity, time-invariance, causality, etc. Knowledge of time-domain models and input/output behaviour of continuous and discrete time systems, e.g., difference and differential equation models, continuous and discrete time convolution.	1.3	Final exam
Understanding of 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. Understanding of the frequency domain descriptions/analysis of discrete-time signals and systems, e.g., working knowledge of the discrete-time Fourier transform, discrete Fourier transform, FFT. Know how to solve for the input/output response of discrete-time systems, e.g., the Z-transform and its properties.	7.3	Final exam
Introduction to Matlab and its use in discrete-time signal and system analysis	5.2	Final exam

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 www.mcmaster.ca/academicintegrity .
The following illustrates only three forms of academic dishonesty:
• Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
• Improper collaboration in group work.
• Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATIONS

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca . For further information, consult McMaster University’s Academic Accommodation of Students with Disabilities policy.

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to the Engineering Student Services 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.

STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

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”.

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.

ONLINE ACCESS OR WORK

In this course we will be using Avenue to Learn for laboratory report submission. 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.

www.eng.mcmaster.ca/ece

Electrical and Computer Engineering Lab Safety

Information for Laboratory Safety and Important Contacts

This document is for users of ECE instructional laboratories in the Information Technology Building.

This document provides important information for the healthy and safe operation of ECE instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in ECE. It is expected that revisions and updates to this document will be done continually. A McMaster University lab manual is also available to read in every laboratory.

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following:

1. Food and beverages are not permitted in the instructional laboratories.
2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
3. Laboratory equipment should only be used for its designed purpose.

4. Proper and safe use of lab equipment should be known before using it.
5. The course TA leading the lab should be informed of any unsafe condition.
6. The location and correct use of all available safety equipment should be known.
7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
8. Proper waste disposal procedures should be followed.

Location of Safety Equipment

Fire Extinguisher
On walls in halls outside of labs

First Aid Kit
ITB A111, or dial "88" after 4:30 p.m.

Telephone
On the wall of every lab near the door

Fire Alarm Pulls
Near all building exit doors on all floors

Who to Contact

Emergency Medical / Security: On McMaster University campus, call Security at extension **88** or **905-522-4135** from a cell phone.
Non-Emergency Accident or Incident: Immediately inform the TA on duty or Course Instructor.
University Security (Enquiries / Non-Emergency): Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.
See TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs
Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.
ECE Specific Instructional Laboratory Concerns: For non-emergency questions specific to the ECE laboratories, please contact 24103.

In Case of a Fire (Dial 88)

When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout "*Fire!*" and pull the nearest fire alarm.
5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire. Most labs are equipped with Class A, B, and C

extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire

Do not use a fire extinguisher on people

1. Douse with water from safety shower immediately or
2. Roll on floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

Equipment Failure or Hazard

Failure of equipment may be indicative of a safety hazard - You must report all incidents.

Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:
1. Immediately discontinue use of the equipment.
2. In Power Lab, press wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

Protocol for Safe Laboratory Practice

Leave equipment in a safe state for the next person - if you're not sure, ask!

In general, leave equipment in a safe state when you finish with it. When in doubt, consult the course TA.

Defined Roles

TA	The first point of contact for lab supervision	
ECE Lab Supervisor	Steve Spencer- ITB 147	steve@mail.ece.mcmaster.ca
ECE Course Instructor	Please contact your specific course instructor directly	
ECE Administrator	Kerri Hastings- ITB A111	hastings@mcmaster.ca
ECE Chair	Tim Davidson- ITB A111	davidson@mcmaster.ca