Milwaukee School of Engineering Electrical Engineering and Computer Science Department

Professor:	Cory J. Pru L-341 414.277.733 prust[at]ms	ust, Ph.D. 34 soe.edu	Lecture: Laboratory Office Hours:	TRF 1:00pm (S-206) W 12:00pm (S-365) Mon 10am, 11am Tues 9am, 12pm Wed 10am Thur 12pm Fri 9am or by appointment
Prerequisites: Course Materials:		EE3032, EE1910 or EE2905 or EE3910B or CE2812 Signals and Systems: Theory and Applications Fawwaz T. Ulaby and Andrew E. Yagle, Michigan Publishing, 2018 ISBN 978-1-60785-486-9 (hardcover), ISBN 978-1-60785-487-6 (electronic) Free PDF download and resources: http://ss2.eecs.umich.edu/		
Website:		https://facult	ty-web.msoe.edu	1/prust/EE3221/

# EE3221 Digital Signal Processing Section 031, Spring 2020

## **Course Description**

This course is an introduction to the digital processing of signals. It begins with the examination of sampling and reconstruction of continuous-time signals, which then motivates the study of fundamental DSP topics. Discrete time signal and system interaction is examined in both the time and frequency domains. The course then examines DSP topics and techniques including the discrete Fourier transform, fast Fourier transform, FIR and IIR filtering, and design of digital filters using various techniques. Lecture topics are supported and extended by laboratory experiments that integrate DSP theory, MATLAB simulation, and implementation on actual real-time DSP hardware.

## **Course Learning Outcomes**

- Relate the spectrum of a continuous-time signal to the spectrum of the sampled signal computed using the DFT
- Compute the z-transform of a discrete-time signal using the z-transform summation and a table of common pairs and properties
- Determine the transfer function, frequency response, and stability of a discrete time system
- Determine the signal-to-noise ratio that results from digitizing an analog signal
- Design an IIR digital filter by using pole-zero placement methods
- Implement a prototype analog filter in a discrete-time system using the Bilinear Transform
- Compute the output of a discrete-time LTI system using time-domain and frequency-domain technique
- Use computer-aided methods to design FIR and IIR digital filters
- Implement digital filters in real-time using actual DSP hardware

## Grading

Grades for the course will be computed according to the following percentages:

Homework and Quizzes	10%
Laboratory	25%
Midterm Exam	25%
Final Exam	35%
Class Participation and Professionalism	5%

### Homework and Quizzes

Solving homework problems is critical to your learning of the course material and should be a regular part of your study routine. It is important that you can solve problems yourself. Students who rely on a study group or published solutions usually find the exams exceedingly difficult.

Homework sets will be assigned regularly throughout the term. Homework will be collected and checked for completion. Students who make a reasonable attempt to solve a problem will receive full credit. Homework must be neatly hand-written and submitted on engineering graph paper, single sided. No photocopies or other reproductions will be accepted.

Quizzes may be administered during the class period in which homework is due. Quiz questions will be based on the course material, including assigned reading, pertaining to that homework set. Students will be allowed to use their hand-written homework solutions as notes for the quiz.

No late homework will be accepted. No make up quizzes will be administered. Exceptions may be made due to extenuating circumstances. Each student's lowest homework/quiz score will be dropped.

#### Exams

All exams are closed book and closed notes. Selected materials to be used during an exam may be provided. **Attendance at exam periods is required.** Arrangements for a make-up exam will be made only in the case of extenuating circumstances and only if the reason for the absence is verifiable. Written arrangements must be made in advance of the exam period.

#### Laboratory

The laboratory activities are designed to explore, reinforce, and extend the lecture material. Details regarding format and procedures for laboratory submittals will be provided by your instructor. Attendance at lab sessions is required. A student with three (3) unexcused absences from laboratory sessions may be administratively dropped from the course.

Late laboratory submittals will be penalized. The deduction is 15% for the first school day late and an additional 10% deduction for each school day thereafter (e.g., a lab assignment submitted two days late will incur a 25% deduction). Exceptions may be made due to extenuating circumstances.

No lab work will be accepted after 5PM on Friday of Week 10.

#### Attendance and Drop Policy

Students are strongly encouraged to attend lecture sessions. **Please be on time.** Please note that you will not be administratively dropped from the course for poor lecture attendance, so if you wish to drop the course, be sure and take care of this yourself.

# **Class Participation and Professionalism**

Class participation means that you are fully present and engaged in class. Students are expected to act with professionalism in all matters pertaining to this course.

**Electronic Device Policy:** Use of electronic devices is strictly limited to class-related work. Engaging in activities such as texting and gaming during class is unprofessional and disrespectful to me and the rest of the class. **Please silence cell phones and place out of sight.** Failure to adhere to this policy will result in deductions from your course grade.

Please inform me in advance if you may need to excuse yourself to take an important call.

# Academic Integrity

Students will be held to strict adherence to MSOE's Policy on Student Integrity, as stated in the Undergraduate Catalog (http://catalog.msoe.edu/). Discussing ideas, approaches, and solutions to problems is part of the engineering discipline and I encourage you to have such discussions with your classmates. However, representing any other person's work as your own is a serious offence and will be handled accordingly. If you have questions regarding acceptable forms of cooperation, please talk with me.

## Regrades

Please know that every effort is made to to grade student work both accurately and fairly. Students who feel that an error has been made in grading of their work can request a regrade. All regrade requests must be submitted in writing. You must thoroughly and precisely describe the nature of the error. Regrades must be submitted to me in person within 72 hours after the graded work was returned. A regrade means that the item in question will be evaluated in its entirety – your grade my go either up or down as a result of the regrade request.

# **Office Hours**

I provide regular office hours as a resource to students. If you have questions, please see me. I will make every effort to help you learn the material and be successful in the course. Furthermore, I am always open and willing to discuss any matters that are impacting your academic and professional success. Anytime my office door is open, even outside of officially posted office hours, I am available to talk with you.

I may limit office hours on the day of an exam. Please see me well in advance of the exam.

# Student Accessibility Services (SAS)

For students with documented disabilities, chronic medication conditions and mental health concerns; MSOE provides services to make reasonable accommodations available. If you are a student who requires or anticipates the need for accommodations, please contact Student Accessibility Services Office at 414-277-7281, by email at moureau@msoe.edu, or in person at K250 to discuss appropriate accommodations and eligibility requirements.