University of Massachusetts - Amherst
Department of Electrical and Computer Engineering
ECE 313 - Signals and Systems
Fall 2016 Syllabus

DESCRIPTION

"IT WOULD BE DIFFICULT TO OVERSTATE THE IMPORTANCE OF THE FOURIER TRANSFORM. IT IS USED IN ALMOST EVERY AREA OF SCIENCE AND ENGINEERING, AND IT EVEN POPS UP IN PURE MATHEMATICS WHEN YOU LEAST EXPECT IT, E.G. DERIVING THE FIRST BILLION DIGITS OF PI. THE COMPUTER YOU ARE USING TO BROWSE THIS WEBSITE PROBABLY HAS 4 DIFFERENT IMPLEMENTATIONS OF THE FOURIER TRANSFORM, IN VARIOUS APPLICATIONS, PLUS A COUPLE MORE IN HARDWARE AND/OR MICROCODE."

Karl Dahlke, mathreference.com

This course focuses on the study of signals and linear systems. It constitutes the basic theory behind a further study of communication theory and systems, control theory and systems, signal processing, microwave and radar systems, networking and almost all disciplines of electrical and computer systems engineering.

INSTRUCTION TEAM

Lectures: Prof. Patrick Kelly, Marcus Hall 215B, kelly@ecs.umass.edu, Phone: 545-3637
Office Hours: Monday 3:00pm-5:00pm (or by e-mail appointment)
Roles: Lectures, Exams

Discussions: Prof. Marco Duarte, Marcus Hall 215I, mduarte@ecs.umass.edu, Phone: 545-8583
Office Hours: Tuesday 10:00am-11:00am, Thursday 10:00am-11:00am (or by e-mail appointment)
Roles: Discussions, Homeworks, OpenStax Problems, Discussion Quizzes

Teaching Assistants: (Office Hours @ 106-108 Marcus)
Shermin Hamzehei, shamzehei@engin.umass.edu, Office Hours Tuesday 5-7 PM
Harikrishnan Sreedharan Pillai, hsreedharanp@umass.edu, Office Hours Monday 5-7 PM

Supplemental Instruction (SI) Leader:
Istvan Kreis, ikreisz@umass.edu, Session Times TBD

You are always welcome to come to office hours with any questions about the course. Since this is a large class, coming to office hours will also make it easier for us to get to know you.

COURSE FORMAT

Lecture: 10:10am–11:00am on Monday, Wednesday, and Friday @ 134 Hasbrouck.
Discussion: One 50-minute session on Friday. Sections: 12:20pm @ 211 Marston; 1:25pm and 2:30pm @ 220 Marston.

PREREQUISITES

Students must have obtained a grade of C or better in ECE 212, Circuit Analysis II.

TEXTBOOK

No textbook is required. Most of the content is covered in a collection (online course notes) in OpenStax CNX (cnx.org). You can browse through course modules (lecture notes) on the website or download them as

PDF files to print. However, online notes will be updated through the semester to correct mistakes and typos, so let the instruction team know if you find any. The collection URL is http://cnx.org/content/col11557/. Several options exist for students who want to follow a textbook during the course:

- M. L. Roberts, "Fundamentals of Signals & Systems," McGraw Hill, 2007.
- B. P. Lathi, "Linear Systems and Signals," Second Edition, Oxford, 2004.
- A. V. Oppenheim, A. S. Willsky, S. H. Nawab, "Signals and Systems," Prentice Hall, 1997. (Available at the Integrated Science Library)
- H. Hsu, "Signals and Systems," Schaum's Outline Series, McGraw Hill, 2010. (This book provides a large number of problems and worked-out examples.)

OTHER COURSE MATERIALS

- Summaries of the most important topics covered in the lectures will be posted on Moodle.
- Additional (ungraded) practice problems and their solutions will be made available through the OpenStax Tutor Learning System. OpenStax Tutor (OST) is a learning tool designed to increase long-term retention and transfer of learning. You will need to create an account and register to use the system.
    1. To create an account: Go to http://www.openstaxtutor.org and click Join Now. To activate your account, click the link in confirmation email.
    2. To register: From the main page, go to Current Classes, select ECE 313, and click Register.
    3. To access practice problems: From the main page, go to Dashboard, select ECE 313, then scroll to the Assignments section. You will also receive an email notification when new practice problem sets become available.

GRADING

- Midterm Exam 1: 25% (Wednesday Oct. 12, 7:00pm-9:00pm, Morrill 2 Room 131)
- Midterm Exam 2: 25% (Thursday Nov. 17, 7:00pm-9:00pm, Morrill 1 Room N375)
- Final Exam: 30% (Thursday Dec. 22, 8:00am-10:00am, Goessmann Room 20)
- Homework assignments: 15%
- Discussion Quizzes: 5%

HOMEWORK ASSIGNMENTS

There will be approximately nine homework assignments (one every week, except for exam weeks) that will be posted on the Moodle course website at https://moodle.umass.edu. Each assignment will be posted on a Wednesday and due the following Wednesday. Assignments must be turned in at the beginning of the class period on the due date. Late submissions will **not** be accepted. Discussion of the problem sets with other students is encouraged, but each student must turn in a unique personal write-up or code implementation. *Homework assignments are preparation for exams*, so do not rely too heavily on other students for help. Homework solutions will be posted online in Moodle after the due deadline.

EXAMS

All exams will be closed-book and closed-notes; calculators will **not** be allowed. Exam packets will include some formula sheets (for example, Fourier transform pairs) and will be disclosed in advance by the instructors. Additionally, a **single-sided handwritten** formula sheet will be allowed for exams 1 and 2, which are non-cumulative. The final exam will be cumulative and a **double-sided handwritten** formula sheet will be allowed.

DISCUSSION QUIZZES

A quiz will be given during the discussion session before each exam. The quizzes are meant to provide additional (and realistic) preparation for exams. Solutions will be posted on Moodle.

PIAZZA

This term we will be using Piazza for class discussion. The system is highly catered to getting you help quickly and efficiently from classmates and the instruction team. Rather than emailing questions to an instructor or TA, we encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com. Find our class page at: piazza.com/umass/fall2016/ece313

HONORS COLLOQUIUM

The Honors Colloquium will involve team-based projects and will begin meeting in early October. More details will be sent soon to students who have registered for the colloquium.

ACADEMIC HONESTY POLICY

It is expected that all students will abide by the Academic Honesty Policy, available at the Academic Honesty Office (Ombud's Office), or online at http://www.umass.edu/dean_students/codeofconduct/acadhonesty/. Acts of academic dishonesty (such as taking or giving answers in an exam, use of extra crib sheets, submitting another person's work as your own, etc.) will result in a grade of F in the course, and possibly additional sanctions including being placed on probation or suspension for a period of time or being dismissed from the University. All students have the right of appeal through the Academic Honesty Board.

ACCOMMODATION POLICY

The University of Massachusetts-Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological or learning disability on file with Disability Services (DS), Learning Disability Support Services (LDSS) or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify the instructors within the first two weeks of the semester so that we may make appropriate arrangements.

INCLUSIVITY AND DIVERSITY

The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued for any reason, please speak with one of the instructors privately. If you wish to communicate anonymously, you may do so in writing or speak with Dr. Paula Rees, Director of Engineering Diversity Programs (rees@umass.edu, 413.545.6324, Marston 128). We are all members of an academic community where it is our shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect.

TENTATIVE LECTURE SCHEDULE

Week 1: Why Learn All This Math? Complex numbers. Graphical operations.

Part 1: Continuous-Time Signals and Systems
Week 2: Continuous-Time Signals. Basic Operations. Classifications and Properties.
Week 3: Continuous-Time Systems. Classification and Properties. System Analysis: Convolution.
Week 4: The Continuous-Time Fourier Transform. Advantages for Analysis (No convolution).
Week 5: Properties of the Continuous-Time Fourier Transform.
Week 6: More Properties of the Continuous-Time Fourier Transform. (Yes, it's that useful)

Part 2: Discrete-Time Signals and Systems
Week 7: Discrete-Time Signals. Basic Operations. Classifications and Properties.
Week 8: Discrete-Time Systems. Classification and Properties. System Analysis: (Easier) Convolution.
Week 9: The Discrete-Time Fourier Transform. Properties and Advantages (Again, no convolution).
Week 10: Properties of the Discrete-Time Fourier Transform: Déjà-Vu All Over Again.

Part 3: From Continuous to Discrete: Sampling Theory
Week 11: Connecting Continuous and Discrete-Time Signals and Systems: Sampling. Aliasing.
Week 12: Discrete-Time Processing of Continuous-Time Signals: All About Bandwidth.
Week 13: Applications in Sensing and Communication. Connections with Other Topics.