Signals and Systems Analysis- EGR 361
Block 2, 2018-19

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Textbook: *Linear Systems and Signals, 3rd Edition,* B.P. Lathi; Roger Green, Oxford University Press, ISBNs: 9780190200176, 0190699582, 9780190699581

Prerequisite: EGR 311 - Engineering Circuits

Daily Schedule: We start the day at 9 am by discussing the homework assignments that you already worked on then the homework is collected. From 10 to 11 am, we work on the new materials. In the afternoon, we solve examples and deepen our understanding of the subject of the day. The class location is West Hall, 5.

Course Description: This is a four semester credit, selected elective class. A signal is a collection of data or information. A system is a device that processes a signal to produce a new signal. The twin concepts of signals and systems are simultaneously quite abstract, and yet are fundamental to many engineering concepts. You have already encountered signal and systems in many of your engineering and physics courses. For example, in EGR 311, you have studied how electronic circuits respond to various input signals. Electronic circuits represent electrical systems and we have already learned some useful techniques in EGR 311, such as Laplace transforms, that we'll further exploit in this course. You have also learned how mechanical systems respond to mechanical signals. For example, in PHY 161, you have learned how the position of an object (the output signal) responds to a time-varying force (an input signal). In this course, we will learn how to treat both mechanical and electrical systems using the same formalism, which will permit us to analyze electro-mechanical systems that combine elements of both systems. The course will make extensive use of the MatLab/Octave program to analyze signals and systems. You are encouraged to have your laptop in the class and practice working on Octave with me.

Course Objectives: The purpose of this course is to understand the concepts of signals and systems and be able to apply these principles to analyze both specific and fairly broad classes of engineering problems. This level of understanding is essential to a future career in engineering at a graduate level. This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, and communication. Upon completion of this course, students will have a good understanding of the following concepts:

1- Size of a signal, signal operations, classification of signals, step, impulse and exponential functions, evene and odd functions, classification of systems: linear/nonlinear, time-invariant/time-varying, causal/noncausal, analog/digital, invertible/noninvertible, stable/unstable, system model.
2- Time-domain analysis of continuous-time systems, zero-input response, unit impulse response, zero-state response, convolution integral, interconnected systems, total response, system stability: external (BIBO) stability, internal (asymptotic) stability, systems behavior based on characteristic modes, system time constant, resonance phenomenon.

3- continuous-time system analysis using Laplace transformation, properties of Laplace transformation, solution of differential and intergrow-differential equations, analysis of electrical networks, block diagrams, system realization, application to feedback and controls, frequency response of an LTIC system, Bode plots, filter design by placement of poles and zeros of transfer function.
4- Continuous-time signal analysis using Fourier series, periodic signal representation by trigonometric Fourier series, existence and convergence of the Fourier series, exponential Fourier series, LTIC system response to periodic inputs, generalized Fourier series.
5- Continuous-time signal analysis using Fourier transform, aperiodic signal representation by Fourier integral, Dirichlet conditions, properties of Fourier transform, signal transmission through LTIC systems, signal distortion during transmission, bandpass systems and group delay, ideal and practical filters, signal energy, amplitude modulation, double-sideband, suppressed-carrier (DSB-SC) modulation, amplitude modulation (AM), single-sideband modulation (SSB), data truncation.
6- Sampling theorem, practical sampling, signal reconstruction, analog-to-digital conversion, discrete Fourier transform, fast Fourier transform.

This course supports the students outcomes in Criterion 3 of ABET for baccalaureate level programs including: 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics, 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Assignments:

Homework:

There are homework assignments for every day. You are expected to work on them and reach an understanding of the problem and have a good idea on how they are being solved, and the best is when you solve a problem to the end. We discuss the problems the day after (you need to come to class ready and bring your questions regarding the problems, I don't solve and explain the problems from scratch). There will be a lot of in-class work on the homework, so class attendance is essential.

List of homework problems	
Chapter 1	1-6: a, d, f, 2-5 use Octave, 2-6 use Octave, 3-5, 3-7, 4-6: a, d, g, 5-5, 5-6, 6-1, 7-1,7-12, 8-2, 8-5, 10-2, 11-1 Octave, 11-2 Octave
Chapter 2	2-1: a, c, e, 2-4, 2-11, 3-2, 3-4, 3-7, 4-13, 4-16, 4-18, 4-30, 4-34, 4-39, 5-1: a, c, 5-2: b, d, 5-6, 5-9, 6-2, 6-3, 6-6, 6-8, 6-10: use Octave
Chapter 4	1-1: b, e, h, 2-1: b, I, 2-7: c, d, 2-12, 2-14, 3-3, 3-11, 3-17: b, d, 4-2, 4-6, 4-7, 4-12, 5-4, 6-1, 6-9, 8-3, 8-5, 8-7, 9-5: use Octave, 10-2, 10-3: use Octave, 10-6, 10-15
Chapter 6	1-1: a, e, 1-5, 1-8, 3-1: a, b, d, f, plots in Octave, 3-3, 3-4, 3-7, 3-11, 4-1, 4-2, 4-4, 4-5, 5-4, 5-7,
Chapter 7	1-3, 1-6, 1-7, 2-1, 2-3, 3-2, 3-3, 3-7, 3-9: use Octave, 3-11: a, b, c, 4-2, 4-5, 5-1, 5-3, 6-1, 6-4, 6-9, 7-1, 7-2, 7-5
Chapter 8	1-2, 1-4,

Grades:

Homework	100	First exam (second Monday)	100
Bonus points	20	Second exam (third Tuesday)	100
Total grade out of 450.		Final exam (Cumulative)	150

Bonus points: for brief written reports, up to two, on events/talks/discussions on campus or off campus which contribute to your liberal arts education.

A	93-100		C	74-76
A-	90-92		C-	70-73
B+	87-89		D+	67-69
B	84-86		D	64-66
B-	80-83		D-	60-63
C+	77-79		F	<60

Absence from class and late assignments: You may be absent from class due to a few reasons. Your absence is excused if either 1) you obtain permission from your instructor in advance of the absence or 2) the absence is of an emergency or medical nature. If your absence is excused, you will need to make up the material that you missed, but there will be no other penalty. If your absence is not excused, then you will not be allowed to make up the work. If you turn in an assignment late, then you will not receive full credit.

Students with disabilities: Cornell College makes reasonable accommodations for persons with disabilities. Students should notify the Coordinator of Academic Support and Advising and their course instructor of any disability related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format. For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see http://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml.

Academic Honesty: Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Compass, our student handbook, under the heading "Academic Policies – Honesty in Academic Work."