EE324: Signals and Systems II

http://www.ece.iastate.edu/~rkumar/EE324

	Course-Instructor	Lab-Instructor	Course-TA
Name:	Ratnesh Kumar	See Class Web	See Class Web
Email:	rkumar		
Office Hr:	See Class Web		

Texts:

1. Signals and Systems, by S. Haykin and B. Van Veen, John Wiley and & Sons, 2005.
2. (Reference:) Structure and Interpretation of Signals & Systems, by E. Lee and P. Varaiya, Addison-Wesley, 2002
3. (Reference:) Mastering Matlab, by D. Hanselman and B. Little Field, Prentice Hall, 2001 (http://www.eece.maine.edu/mm/).
4. Other Web Resources:
   Mathworks (MATLAB): http://www.mathworks.com
   Washington Course Webpage: http://www-rcs.ee.washington.edu/SST textbook/textbook.html
   Berkeley Course Webpage: http://ptolemy.eecs.berkeley.edu/eecs20/index.html
   Johns Hopkins Demo Webpage: http://www.jhu.edu/~ signals

Course Content:

1. Laplace Transform (Chapter 6)
2. Z-Transform (Chapter 7)
3. Application to Filters/Equalizers (Chapter 8)
4. Application to Linear Feedback Systems (Chapter 9)

Grading Scheme:

- There will be two in class midterm exams; in roughly the 6th and 11th week, respectively. There will be one nal exam (in 16th week) that will be comprehensive.
- Home works (which will include matlab exercises) will be assigned on a weekly basis. Those will be due a week later.
- There will be a certain number of quizzes given in the class.
- The course involves weekly labs. Prelab reports are due the day of the lab, and lab-reports are due the day of the next lab.
- Make-up or late submission will be allowed only with a prior arrangement with the instructor, or for emergency (eg, medical); adequate documentation should be provided for the same.
- TAs/Graders will supervise the labs and do the grading, so please contact your TAs/Graders for questions regarding your grading first.

The overall distribution of grades is obtained as:

Homeworks:	12%
Labs:	12%
Quizzes	6%
Midterms:	40%
Final Exam:	30%
Total:	100%

Final letter grade will be assigned based on class score distribution with average being the cutoff for B+ or better, and below 45% in exams is automatic F.

Syllabus Statements: See Canvas.

Learning Objectives:

- Learn Laplace transform (also, referred here as s-transform) as a generalization of Fourier Transform to decompose signals as exponentially decaying/growing sinusoids with xed decay/growth rate, and understand the Region of Convergence (RoC) consisting of decay/growth rates required to be able to succeed in obtaining the decomposition.
- Learn s-transform for common signals (impulse, step, polynomial, exponential, sinusoids) and Laplace Transform properties (linearity, shift, modulation, scaling, convolution, differentiation, integration, t-multiplication, initial/final values)
- Learn how to compute inverse s-transform and the role of partial fractions, RoC, and causality/stability properties in performing inverses properties of the Fourier series and Fourier transform.
- Learn how to use s-transform to solve differential equations with initial conditions, and also initial analyze circuits, to obtain forced versus natural responses.
- Learn the notions of impulse response versus transfer function, stability, causality, inverse systems and minimum-phase systems.
- Learn the above five items for the case of z-transform, by first learning that z-transform is essentially Laplace transform for sampled continuous-time signals to obtain the discrete-time signals, and it generalizes the Discrete-time Fourier transform;
- Learn RoC (values of z for which z-transform based signal decomposition is possible); common z-transform pairs and z-transform properties (linearity, shift, inversion, modulation, linear-multiplication, etc.)
- Learn how to invert z-transform to obtain time-domain signal using partial fractions, and applying RoC or stability/causality requirements
- Learn how to use z-transform to solve difference equations with initial condition
- Learn impulse response versus transfer function, stability, causality, inverse system, minimum-phase system.
- Learn how to approximate continuous-time models as discrete-time models using trapezoidal approximation (also referred as bilinear-mapping)
- Learn application of s-transform and z-transform in designing filters: analog filters by going frequency response to stable and causal transfer function
- Learn how to design FIR lter by computing impulse response for given frequency response, and introducing delay as well as windowing to truncate the impulse response
- Learn how to design IIR filter by first designing an analog filter, and next applying the bilinear-mapping to move to discrete-time domain, but first applying "pre-warping" to nullify the effect of "warping" introduced by bilinear-mapping.
- Learn how to apply transform function for design of feedback systems, by first learning the need for feedback in tracking reference signals under uncertainty
- Learn how to compute closed-loop transfer function from open-loop transfer function; Learn the effect of sensor noise and actuator disturbance on closed-loop behavior
- Learn how to analyze stability of closed-loop transfer function using Routh-Hurwitz, root-locus, Bode and Nyquist plots
- Learn output feedback design using root-locus, and determine stability margins (gain and phase mar-gins) from Bode as well as Nyquist plots