Required Course:	ECE 30100 Signals and Systems
Credit and contact hours:	(3 cr.) Class 3
2014-16 IUPUI Campus Bulletin description:	ECE 30100 Signals and Systems (3 cr.) P: ECE 20200 and MATH 26600. Class 3. Signal and system representation. Fourier series and transforms, sampling and discrete Fourier transforms. Discrete-time systems, difference equation, Z-transforms. State equations, stability, characteristic values and vectors. Continuous-time systems, time and frequency domain analysis. Continuous systems with sampled inputs.
Prerequisite or corequisite:	P: ECE 202 and Math 266 C: None
Prerequisites by topic:	1. Linear circuits, circuits in time-domain, s-domain, systems 2.The first and second Kirchhoff laws 3.Laplace transform, convolution, transfer function 4.Differential and difference equations 5.Linear Algebra and matrices 6.Programming, and MATLAB
Textbook:	*Linear Systems and Signals*, 2nd ed. by B. P. Lathi, Oxford University Press, 2005. **References:** • A.V.Oppenheim, A. S. Willsky and S. H. Nawab, *Signals and Systems,* Prentice Hall, NJ, 1996, ISBN 0-13-814757-4 • E. W. Kamen and B. S. Heck, *Fundamentals of Signals and Systems Using Matlab,* Prentice Hall, NJ, 1997, ISBN 0-02-361942-2 • H. P. Hsu, *Signals and Systems,* McGraw Hill, 1995, ISBN 0-07-030641-9.
Coordinator:	Lingxi Li, Associate Professor of Electrical and Computer Engineering
Goals:	To provide a general background in continuous-time and discrete-time signals and systems using cornerstone methods. The goal of this course is to assist students in learning of basic fundamental concepts upon which the signal framework and linear system theory are based and must be studied. To develop student ability to deal with the increased level of system sophistication, a solid working skills in advance software will be developed, and state-space methods will be emphasized by studying continuous-time and discrete-time signals and systems. In particular, the MATLAB environment (conventional and advanced toolboxes) is emphasized and used.
Outcomes:	Upon completion of the course, students should be able to: 1. Determine the Laplace, z-, and Fourier transforms of continuous and discrete signals and systems (student should be capable of obtaining the signal's and systems Laplace transforms, Fourier Series, and Fourier Transforms). Determine the state transition matrices for linear dynamic systems to study the dynamic responses. [a, k] 2. Determine the conditions and study the stability of systems and convergence of signals (continuous- and discrete-time). [a, e, k] 3. Determine and apply the appropriate methods and techniques to study transient responses and stability after determining the nature of the signals and systems. [a, k] 4. Determine the systems (filters) attenuation capabilities using the analysis in the frequency domain (Bode plots). [a, e, k]

	5. Determine the output of the continuous and discrete-time filters for the input signals of different magnitude and frequency. [a, e] 6. Determine the state-space models for continuous and discrete systems. [a] 7. Determining the system responses using the linear differential equations with initial conditions using the Laplace and z-transforms. [a, e] 8. Determine the applicability of different methods (e.g., Laplace transform, continuous and discrete-time state-space, et cetera) for linear dynamic systems with applications to stability analysis and dynamic responses. [a, e, k]
Topics:	**Topics:** 1. Introduction to Course, Signals (1 class) 2. Signals and Sequences, MATLAB (2 classes) 3. Continuous-Time Systems (2 classes) review convolution. Covered in 202. 4. Laplace Transform (2 classes) review 5. Frequency Response (2 classes) review 6. Fourier Series and Transforms (2 classes) 7. Continuous State-Space Systems (3 classes) 8. Discrete-Time Systems (3 classes) 9. Z-Transform (3 classes) 10. Discrete Frequency Response (1 class) 11. Discrete Fourier Transform (3 classes) 12. Discrete State-Space Systems (3 classes) 13. Exams (2-3 classes)
Computer usage:	The students are required to use the advanced software. The MATLAB environment is used in this course. To demonstrate solution and results of various topics in the course (and Fourier transforms, transfer functions, and state-space concept), the MATLAB environment is used by the instructor. Some of the activities in solving problems and modeling are intended to encourage students to think beyond simply finding the right answer by applying the corresponding methods and MATLAB m-files. These activities emphasize the connection between a variety of mathematical results in signals and systems, and the corresponding simulation and modeling. Collaborative learning is encouraged throughout the course.
Laboratory projects:	
Evaluation methods:	**Grading:** Homework average Quizzes(2-3) Final
ABET category:	Engineering Science (100%)
Prepared by:	Dr. Eliza Du, Lauren Christopher
Date:	August 24, 2009, April 13, 2010