EE3353: DISCRETE-TIME SIGNALS AND SYSTEMS
SYLLABUS FOR SPRING 2014 (Ver. 1, 1/22/14)

INSTRUCTOR: Sergio D. Cabrera, Associate Professor
Dept. of Electrical and Computer Eng.
Engineering Annex Bldg. **Room 309**, UTEP campus
Tel. Direct (915)747-6968; ECE Dept. (915)747-5470; Fax (915)747-7871
E-mail: **sergioc@utep.edu** (best way to communicate)

OFFICE HRS.:

Monday & Wednesday	4:30 – 5:00 PM (after my other class)
Tuesday & Thursday	11:20-12:20 PM
Friday (unless other meetings)	11-12 noon (send e-mail or call before)

CLASS TIME/PLACE: 12:00 pm - 1:20 pm MW Chemistry Computer Sci. Bldg. **1.0202**

TEXTBOOK: SIGNALS, SYSTEMS AND TRANSFORMS, ***FOURTH EDITION*** by C. L. Phillips, J M. Parr, and E. A. Riskin, Prentice-Hall, 2008. Book URL: ***http://www.ee.washington.edu/class/SST_textbook/textbook.html***
***** ***ONLY PAPER COPIES OF THE BOOK MAY BE USED DURING OPEN-BOOK EXAMS*** ******

PREREQUISITE: EE2353 Analog Signals and Systems, including: (1) Definition, manipulation and properties of continuous-time signals and systems; (2) Linear Time-Invariant (LTI) systems and the convolution integral; (3) Fourier Series, Fourier Transform, and Laplace Transform. Familiarity with the Matlab software package is very helpful but it will not be assumed (it will be developed quickly in this course by running and modifying existing scripts/code and by studying the code from class demos).

COURSE OVERVIEW: Introduction to the concepts and tools of the discrete-time (D-T) theory of signals and systems to parallel and expand on previous concepts from the continuous-time case. Initially, the emphasis will be on time-domain analysis of linear, time-invariant (LTI) systems, the role of D-T convolution and difference equations. Transform-domain LTI system analysis and design will be approached using the z-transform and D-T Fourier transforms. The use of digital filters will be illustrated as a general approach to process signals in modern applications. Similarly, DFT-based spectrum analysis will be introduced as a major tool for the analysis of the frequency contents of signals. In general, this course will continue to prepare students for Senior (and graduate) level courses in Controls, Communications and Signal and Image Processing. Matlab assignments and projects will give students more hands-on experience with discrete-time signals and systems concepts and applications.

COURSE GRADING (**)

- In-class Semester Exams (2 in-class exams, open paper copy books or self-prepared notes) **40% (*or 25%)**
  Tentative date for Exam 1: **Monday February 24, 2014**
  Tentative dates for Exam 2: **Monday April 7 or14, 2014**
  Course drop deadline is **Friday April 4, 2014**
- Homeworks, Matlab projects **10% (*or 10%)**
- Quizzes **20% (*or 20%)**
- Comprehensive Final Exam, during Final Exams week **30% (*or 45%)**

  TOTAL **100%**

*** Alternative weighting used only if it gives you a higher grade (this sometimes helps 1-2 students improve one grade level with a heroic effort)**
>>>> STUDENTS THAT ARE CLEARLY NOT DOING THE HOMEWORKS, FAILING THE QUIZZES, AND FAIL EXAM 1 WILL BE DROPPED FROM THE COURSE WELL BEFORE DROP DAY.

USE OF E-MAIL: Each student is required to read their officially registered UTEP e-mail account often enough to monitor ongoing information related to this course.

COMPUTER USAGE: The MATLAB software package (with many Toolboxes) is made available via a DVD to all Engineering Students from the Engineering Technology Center (ETC)
Engineering building E351D (3rd floor between CRBL and Eng. Bldg.) **http://etc.utep.edu/**
Mon. – Thu: 8AM – 7PM; Friday 8AM – 5 PM, Tel. (915)747-5223, E-mail: **etchelpdesk@utep.edu**

TOPICS TO BE COVERED (the exact order, pages and/or sections and subsections will be listed in homework handouts and/or will be sent via e-mail).

I- Preliminaries, Introduction and Software
- I- Samplers and discrete-time physical systems (Sect. 1.3, please read on your own)
- II- Intro. to Matlab and Simulink (Sect. 1.4, please read on your own)

II- Discrete-Time (D-T) Signals and Systems (Chapter 9).
- a) Axis and amplitude transformations and basic signal properties
- b) Basic, important D-T signals including D-T sinusoids
- c) Definition and properties of discrete-time systems

III- Discrete-Time Linear, Time-Invariant (LTI) Systems (Chapter 10)
- a) Impulse response and D-T convolution for LTI systems
- b) Properties of D-T LTI systems
- c) Iterative solution of Difference Equations (DEs) and LTI Difference Equations
- d) Difference Equation (DE) models, block diagrams

IV- The z-Transform (Chapter 11 and supplements)
- a) Definition and evaluation of z-transforms of basic signals
- b) z-transform properties and inverse z-transform
- c) LTI systems analysis and D-T convolution using the z-transform.
- d) Solution of LTI DEs using z-transforms
- e) Intro. to bilateral z-transform and region of convergence.

V- Discrete-Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT) (Sects. 5.4, 6.4 Chap. 12 & supplements)
- a) Review Sampling theory relating to Continuous-Time Fourier Transform
- b) DTFT Definition and basic transform pairs
- c) Properties of the DTFT and relationship to bilateral z-transform
- d) Discrete-time processing of continuous-time signals (handout)
- e) The Discrete Fourier Transform (DFT) and its computation using Fast Fourier Transform (FFT) algorithms
- f) Application of the DFT to perform convolution
- g) Windowing and spectrum analysis using the DTFT and the DFT.
- h) Time-varying spectrum analysis of non-stationary, real-world signals.

VI- Digital Filtering based on LTI Systems (in parallel with Chapters 10-12 and using Matlab projects)
- a) Response of LTIs systems to sinusoidal inputs.
- b) Frequency response of Finite Impulse Response (FIR) LTI systems
- c) Frequency response of DE based, Infinite Impulse Response (IIR) LTI systems.
- d) Applications of LTI digital filtering: signal separation, noise removal, etc.