EEE 307 (formerly EEE394) Signal Processing for Digital Culture - Internet Course Spring 2017

Format: Lectures on Internet Course, and one meeting per week for problem solving and Q&A
Pre-Requisite: MAT 210 Brief calculus or equivalent (see proficiencies below / talk to Dr. Spanias)
Catalog Description: Introduction to signal processing for non-majors. Digital Filters, Fourier and z Transform, DFT and FFT, Digital Signal Processing Computing, Interdisciplinary DSP Applications.
Credits: 3; **Credit Content:** Engineering and Science , Computer Tools, Interdisciplinary applications
Course Instructor: A. Spanias (spanias@asu.edu). **Course TA and Grader:** TBD
Office Hours; TBD**,** Others by Appointment at GWC 411F
Book: DSP First (2nd Ed) by J. McClellan, R. Schafer, M. Yoder, ISBN-13: 978-0136019251
Optional Book: DSP; An Interactive Approach; A. Spanias, 2nd Edition, ISBN 978-1-4675-9892-7
Software Tools: Java-DSP will be used to run simulations and some exercises will be designed around this program. Some MATLAB will be used as needed.

The course in terms of proficiencies is described as follows:
I**NCOMING PROFICIENCIES:** Requirements, Introductory Algebra and Computational Tools
OUTGOING PROFICIENCIES: Basic Signal Processing Tools and Applications
COURSE DESCRIPTION Content: linear systems, filters, transforms, spectra, filter design, DSP principles

Topics:
Introduction to DSP, History and Applications
Sinusoids and Tones, Frequencies and Spectral Representations, Adding Tones and Superposition, Beats,
Time shift and phase, Magnitude and phase representations of signals
Periodic Signals, Harmonics - Relation to Music and Other Signals, Time-Varying Sinusoids and their Applications
Fourier Series Representations and Applications, Sampling & Aliasing, Oversampling, D-to-A Conversion. Applications to Music and Other Signals, Sampling Rate Standards and Conversions / Sampling and Aliasing demos
Simple Analog Filters and Frequency Responses, Digital Filters, FIR and IIR
Frequency Response of FIR and IIR filters, Special Filters for Music and other Applications
Audio Effects, Echo, Reverberation, Vocoding, distortion, Filters for Noise Reduction and Enhancement
Filters programmed as Oscillators for Tone Synthesis, Examples of Filters for Images
Oscillators and Dual Tone Synthesis, Superposition, Linearity and Convolution Z transform and transfer functions, IIR Filters and Feedback, Poles and zeros, Frequency Response, Stability
Introduction to Quantization, Applications of Filters in Signal Compression and Cell Phones
Applications of Filters in Audio Compression in the iPod, Filterbanks and applications to MP3 and AAC
Elements of Psychoacoustics and MP3 and AAC, Analog and Digital Filters. Continuous and Discrete-time Fourier Transforms, The FFT and the Spectrum. Compression of Audio using the FFT, Applications of FFT in Communications
Applications of FFT in Music Synthesis and Transformations, Modulation with the Fourier Transform and the FFT / Applications in WiFi, Other Applications (Medical, Financial, Computing, Military, Arts)

This Digital Signal Processing (DSP) class across the curriculum is for non ECEE majors. The course involves qualitative and quantitative descriptions of DSP algorithms, software and applications. Applications in arts, music, computing, engineering, financials, biomedical. MATLAB and Java simulations. Code given to students for several algorithms and applications.

Outcomes:

- **will enable students to understand simple filtering and signal analysis algorithms and their applications**
- **skill building in terms of enabling students to express simple algorithms in MATLAB and Java-DSP.**

Note that the class is for non ECEE majors (can not be used in ECEE POS). It can be used as elective for non majors including AME Digital Culture students (all students should check with their advisor whether they can apply the course in their POS).

Multidisciplinary Applications of Digital Signal Processing (DSP)

DSP and Music	From Fourier transform to MP3	How does the iPhone/iPod work	Market Forecasting & DSP