

SAMPLE SYLLABUS

This syllabus is to be used as a guideline only. The information provided is a summary of topics to be covered in the class. Information contained in this document such as assignments, grading scales, due dates, office hours, required books and materials may be from a previous semester and are subject to change. Please refer to your instructor for the most recent version of the syllabus.

ABET Course Syllabus EEE407

1. **Course: EEE 407 Digital Signal Processing**
2. **Credits and Contact Hours:** 4 Credit Hours (lecture, lab), Topics: Engineering
3. **Course Coordinator:** Dr. A. Spanias, Professor
4. **Textbook:** Oppenheim and Schaffer, *Discrete-Time Signal Processing 3rd^d Ed*, ISBN-13: 978-0131988422, Prentice Hall, 2009.
Supplemental materials:
Lab Text Book: A. Spanias, DSP; An Interactive Approach, 2nd Ed., May 2014.
J-DSP On-line lab software, Tablet Android and iOS DSP software, MATLAB tools.
Software and Computer Lab descriptions in Lab text book and <http://jdsp.asu.edu>
5. **Specific course information**
 - a. **Catalog description:** Time and frequency domain analysis, difference equations, z-transform, FIR and IIR digital filter design, discrete Fourier transform, FFT, and random sequences.
 - b. **Prerequisites or co-requisites:** EEE 203; MAT342.
 - c. **Required/elective/selected elective:** Elective
6. **Specific goals for the course**

Students will be able to apply time and frequency domain analysis and solution techniques to signal processing problems.

 - a. **Outcomes of instruction:**
 1. Students understand the issues and methods associated with the sampling of continuous time signals.
 2. Students are proficient in Z transform analysis.
 3. Students can design linear phase, FIR, and IIR digital filters
 4. Students can use the FFT
 5. Students understand elements of discrete-time random signal processing.
 6. Students develop software to simulate a DSP task associated with a modern application
 - b. **Outcomes of Criterion 3 addressed by the course:**
 - (1) Students are exposed to the fundamental theory and applications of digital signal processing (DSP). Students receive exposure by analyzing in-depth of certain basic problems and applications, conduct computer laboratories and interpret data, develop DSP simulations (multi-rate sampling, filtering, FFT-based spectral analysis, random signal processing). Students obtain models for simple DSP algorithms and their properties.
Open-ended problems are discussed from signal processing, telecommunications, rich-media productions, PC/internet, audio entertainment technologies, defense applications, sensor signal processing.
 - (2) DSP is an enabling technology for information exchange, telecommunications, wireless networks, digital audio (MP 3), multimedia and cinema surround sound applications. As such, it involves considerable component design and integration.
 - (1,2,6): Students get exposed to Java-DSP, Tablet and MATLAB software for signal analysis and DSP algorithm simulation.
7. **Brief list of topics to be covered**

1. Difference equations
2. Digital Filters and BIBO Stability
3. Z-transforms and Frequency Response
4. FIR and IIR Digital Filter Design
5. Impulse invariant methods and the Bi-linear transformation
6. Frequency-domain analysis, DTFT, DFT, FFT, STFT basics
7. Multi-rate signal processing, Σ - Δ A/D, simple sub-band QMF design
8. Deterministic vs random sequences
9. Stationary and ergodic sequences
10. The mean and the autocorrelation
11. Signal processing application algorithm design and implementation

Computer Usage:

- Students use the computer to perform several on-line NSF-sponsored J-DSP laboratories on key DSP topics including design of FIR, IIR, and QMF filters. Laboratories are outlined below
- Students execute a computer project involving C or MATLAB programming

Laboratory Experiments:

EEE 407 has both on-campus and distance learning students. Students execute a series of computer laboratories using the NSF-funded on-line software Java-DSP. The software enables students to perform comprehensive on-line simulations of DSP algorithms. A TA coordinates the laboratory, grades electronic lab reports, holds office hours for students. Laboratories include:

- Lab 1: Continuous and discrete-time convolution
- Lab 2: The z-transform and frequency responses
- Lab 3: Pole-Zero Plots and Frequency Responses
- Lab 4: Linear Phase, FIR Filter Design by Windowing / IIR Filters design
- Lab 5: The Fast Fourier Transform (FFT)
- Lab 6: Multirate Signal Processing and QMF banks

Course Contribution to Engineering Science and Design:

Students are required to solve open-ended problems both as part of the homework and as part of the laboratory exercises. Course involves filter design using several methods and participants are asked to analyze these filter design methods and perform comparisons. Students are asked to design algorithmic steps and develop software to execute a specific signal processing task in terms of a MATLAB- or C-based programming project.

Person preparing this description and date of preparation: A. Spanias, K. Tsakalis, June, 2021.