

## **ECE 43600 - Digital Signal Processing**

### **Type of Course**

Required for EE Program, Elective for CmpE Program

### **Catalog Description**

Introduction to discrete systems and digital signal processing. Topics include sampling and reconstruction of continuous signals, digital filter design, and frequency analysis including the Fourier transform, the Z transform, the discrete Fourier transform, and the fast Fourier transform.

### **Credits**

3

### **Contact Hours**

3

### **Prerequisite Courses**

ECE 30100

### **Prerequisites by Topics**

Understanding of basic signals such as the impulse, unit step, and exponential, as well as basic operations such as time shifting and scaling. Understanding the linear systems concepts of impulse response and convolution. Knowledge of the Fourier transform and its utility in continuous-time signals and systems.

### **Textbook**

Discrete-Time Signal Processing by Oppenheim & Schafer, Pearson, 3rd Ed., 2010.

### **Course Objectives**

This course will introduce the fundamentals of digital signal processing. Students should be able to understand and appreciate Fourier analysis of discrete signals and apply this knowledge in filter design.

The design projects form an integral part of the course to provide practical experiences in implementation of digital signal processing.

### **Course Outcomes**

#### **Students who successfully complete this course will have demonstrated**

1. Knowledge of what DSP is and possible applications for its use. (7)
2. An understanding of the Nyquist sampling theorem and its implication in the design of digital filters and in displaying of the DFT and DTFT. (2)

3. Knowledge of properties of discrete time linear time-invariant (LTI) systems and the application of LTI systems in the implementation of digital filters via convolution. (2)
4. An understanding of Discrete Fourier Series, Discrete Time Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, and z-transform, and the ability to apply such information in display of frequency content of discrete signals and systems. (2)
5. An understanding of the distinction between IIR and FIR filters, the ability to design both, and the ability to discern the appropriate use of each. (6)
6. An ability to use appropriate software to design and implement a digital filter. (2)
7. An ability to interpret results of the filter design and to discern whether it meets design specifications.(6)

### **Lecture Topics**

1. Sampling Discrete Signals
2. LTI Systems, Difference Equations
3. Convolution, Impulse Response
4. Frequency Response
5. Digital Filters
6. Pole-zero analysis
7. Z-transforms
8. Inverse Z-transforms, ROCs
9. Discrete Fourier series
10. Discrete Fourier transform
11. Analog Filter Design
12. Digital Design of Nonrecursive Filters
13. Recursive Filters
14. Fast Fourier Transform
15. Design Project Presentations

### **Computer Usage**

Medium

### **Laboratory Experience**

None

### **Design Experience**

Medium

### **Coordinator**

Elizabeth A. Thompson, Ph.D.

### **Date**

9/28/2018