THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

# Introduction to Discrete Time Signals & Systems

## ECE 2050

**Credit Hours:**
3.00

**Course Levels:**
Undergraduate (1000-5000 level)

**Course Components:**
Lecture
Lab

**Course Description:**
Introduction to sampled time signals and linear time invariant sampled time systems.

**Prerequisites and Co-requisites:**
Prereq: 2060, 2000, or 2061 and 2067; and CSE 1222. Prereq or concur: Math 2174 or 2568.

**Course Goals / Objectives:**
- Be competent with the fundamentals of discrete time linear time invariant (LTI) systems
- Be competent in using laboratory instruments, methodology and reporting standards
- Be competent in working in teams for laboratory experiments
- Be competent is performing z-transforms and inverse z-transforms
- Be competent in analyzing, designing and sythesizing discrete time LTI systems, including finite impulse response (FIR) and infinite impulse response (IIR) filters
- Be familiar with sampling, analog to digital and digital to analog conversions
- Be familiar with how to implement designs in hardware using modern techniques such as FPGAs and microcontrollers
- Be exposed to troubleshooting and debugging practices

**Course Topics:**

- Introduction to continuous & discrete signals, sampling & aliasing, quantization
- Review of complex numbers
- Discrete time signals and special functions
- Discrete time systems descriptions & properties: LTI systems, impulse response, FIR/IIR conditions, convolution, difference equations, zero-state and zero-input, flow diagrams
- Z-transform techniques: two-sided vs one-sided z-transform, region of convergence (ROC), rational z-transforms, LTI systems in z-domain, power series and partial fraction expansion, transient and steady-state, stability
- Steady-state frequency response of discrete time LTI systems: spectrum, Fourier series, discrete time Fourier transform & relationship to z-transform, frequency response from poles & zeros in transfer function
- Frequency response of LTI systems and LTI frequency selective filters
- Instrumentation and CAD tool review: oscilloscope, Matlab, and microcontroller programming.
- Microcontroller-based implementation of discrete time filters (FIR, IIR)

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**Designation:**
Required