COURSE: EECS 451. **TITLE:** Digital Signal Processing and Analysis. **PREREQUISITES:** EECS 306. **ELECTIVE.**

TEXTBOOK: J. Proakis and D. Manolakis, *Digital Signal Processing: Principles, Algorithms & Applications*, 2nd ed., Prentice-Hall.

CATALOG DESCRIPTION: Introduction to digital signal processing of continuous and discrete signals. The family of Fourier Transforms including the Discrete Fourier Transform (DFT). Development of the Fast Fourier Transform (FFT). Signal sampling and reconstruction. Design and analysis of digital filters. Correlation and spectral estimation. Laboratory experiences exercise and illustrate the concepts presented.

COURSE OBJECTIVES:

1. To teach students concepts of discrete-time signals: properties, frequency content, and aliasing;
2. To teach students concepts of linear time-invariant discrete-time systems, including representations, properties, convolutional relationship, and analysis techniques based on Fourier and Z transforms;
3. To introduce the concepts of, and methods for, FIR and IIR digital filter design using Matlab.

COURSE OUTCOMES [Program Outcomes Addressed]

1. Ability to convert representations of DT systems: difference eqns, poles+zeros, impulse response; [1]
2. Ability to compute Z transforms and inverse Z transforms of DT signals, including ROC; [1,13]
3. Ability to use DTFT and DTFS to analyze the frequency content of DT signals; [1,13]
4. Ability to design FIR filters using window, frequency sampling, or equi-ripple methods; [1,3,11,13]
5. Ability to design IIR filters by pole mapping or bilinear transformation of analog filters. [1,3,11,13]

TOPICS COVERED:

1. Discrete time signals and systems in time and frequency domains
2. Derive Nyquist sampling theorem
3. Z-transforms and difference eqns
4. DTFT & DTFS; computing them
5. Design and implementation of FIR and IIR digital filters
6. Discrete Fourier transform (DFT)
7. Fast Fourier Transform (FFT)

ASSESSMENT (Course outcomes)

1. Weekly problem sets [1,2,3,4,5]
2. 3 closed-book exams [1,2,3,4,5]

PROGRAM OUTCOMES ADDRESSED: 1,3,11
PROFESSIONAL COMPONENT ADDRESSED: 13
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CLASS/LABORATORY SCHEDULE:
LECTURES: 3 per week @ 50 minutes.
RECITATION: 1 per week @ 60 minutes

COURSE DESCRIPTION: University of Michigan, College of Engineering, ELECTRICAL ENGINEERING PROGRAM