New Jersey Institute of Technology
Department of Electrical and Computer Engineering

ECE 640 Digital Signal Processing

Description: The fundamentals of signal theory and transforms are introduced in this course. The representation of signals in the time and complex domains are covered. Z-transform is presented and Laplace transform to Z-transform mapping techniques are studied. Fourier analysis tools for analog and discrete-time signals are developed and tied with popular engineering applications. Design techniques are introduced and digital filter design techniques are covered in this course. ***MATLAB*** use is a ***requirement*** for course assignments.

Prerequisites: ECE 601

Instructor: Prof. Ali N. Akansu, ECE Dept. [Akansu@NJIT.EDU, X5650] http://web.njit.edu/~akansu/

Time: Tuesday, 6:00-9:05PM, KUPF 208

Office Hour: Wednesday, 4:30-5:30PM, ECE Center Room# 317

Course Book:
Lecture Notes Distributed and
Sanjit K. Mitra, Digital *Signal Processing, A Computer-Based Approach.*4th Edition, McGraw Hill, 2010.

Supplementary Course Material:

MATLAB Student Edition

Sanjit K. Mitra, *Digital Signal Processing Laboratory Using MATLAB*, McGraw Hill.

R.V. Churchill and J.W. Brown, *Introduction to Complex Variables and Applications.* 5th Edition, McHraw Hill, 1990.

Topics:

Mathematical preliminaries: Time domain and complex domain representation of signals and systems (1 week)
Sampling of Continuous-Time Signals and Nyquist Theorem (1 week)
Discrete-Time Signals and Systems (1 week)
The Z-Transform (1 week)
Discrete Fourier Series (DFS), Discrete-Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Circular Convolution (3 weeks)
Infinite Impulse Response (IIR) Digital Filter Design (3 weeks)
Finite Impulse Response (FIR) Digital Filter Design (1 week)
DSP Algorithm Implementation and Applications (1 week)
Introduction to Multi-rate DSP (2 week)

Assignments:
Homework Problems including MATLAB based one(s) (every week)
Term Project involving design and computational implementation (one per semester)

Grading Policy: Mid-term 40%; Final 50%; Term Project 10%.

Homework Assignments (From Mitra Book, 3rd Ed.)

HW1: 2.1, 2.3, 2.8, 2.9, 2.15, M2.1, M2.2, M2.3, M2.4, M2.5, M2.6, M2.7
HW2: 2.30, 2.32, 2.34, 2.49
HW3: 2.66, 2.83, 2.86, 2.92, M2.8, M2.9, M2.10
HW4: 3.11, 3.18, 3.22, 3.26, M3.1, M3.2
HW5: 3.73, 3.75, 3.83, 3.84, M3.5, M3.7, M3.8
HW6: 4.9, 4.10, 4.12, 4.31, M4.1, M4.2
HW7: 5.4, 5.13, 5.20, 5.28, 5.49
HW8: 9.9, 9.11, 9.12, 9.23, 9.24
HW9: 9.25, 9.26, 9.27, M9.1, M9.2
HW10: 9.3, 9.4, 9.5, 9.6, 9.8

Homework Assignments (From Mitra Book, 4th Ed.)

HW1: 2.1, 2.26, 2.21, 2.27, 2.28, M2.2, M2.3, M2.3, M2.4, M2.7, M2.8, M2.9
HW2: 2.30, 2.32, 2.34, 2.49
HW3: 2.66, 2.83, 2.86, 2.92, M2.8, M2.9, M2.10
HW4: 3.11, 3.18, 3.22, 3.26, M3.1, M3.2
HW5: 3.73, 3.75, 3.83, 3.84, M3.5, M3.7, M3.8
HW6: 4.9, 4.10, 4.12, 4.31, M4.1, M4.2
HW7: 5.4, 5.13, 5.20, 5.28, 5.49
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HW9: 9.25, 9.26, 9.27, M9.1, M9.2
HW10: 9.3, 9.4, 9.5, 9.6, 9.8