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Digital Signal Processing (ELC 423)

Department of Electrical and Computer Engineering

The College of New Jersey

## Course Curriculum

Fall 2016

Instructor: Dr. Ambrose Adegbege

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### Course Details:

Credits: 1.0

Course Venue: Room 137, Armstrong Hall.

Class Hours\*: 11:00-12:20 Mon. /Thur.

Prerequisite: Digital Circuits and Microprocessors (ENG312) and Signal and Systems (ELC 321).

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### Instructor Information:

Office Location: Room AR-153

Email Address: [adegbega@tcnj.edu](mailto:adegbega@tcnj.edu)

Office Hours: 9:30-10:50AM Mon/Thur. By appointment (Send email).

### Description

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This course provides the concepts and methodologies for digital signal processing. It covers discrete-time processing of continuous-time signals, filtering and digital filter design methods using fundamental concepts of Sampling, z-transform, Discrete-time Fourier Transform, and Fast Fourier Transform.

### Learning Outcomes

Upon a satisfactory completion of this course students must be able to:

- Apply knowledge of mathematics, science and engineering concepts such as sampling theory, analog-to-digital and digital-to-analog conversions, Fourier and z-transforms to solving engineering problems involving signal processing and filtering [a, c, e]<sup>†</sup>.
- Design engineering systems such as basic FIR and IIR analog and digital filters to meet specified design specifications [a, c, e, k]<sup>†</sup>.
- Be familiar with engineering tools such as Matlab/Simulink and LabVIEW for filter design [a, k]<sup>†</sup>.

## Topical Outline

- Linear Time-Invariant Systems
- Sampling
- Fourier Analysis
- Z-transforms and Transfer Functions
- FIR and IIR Filter Design Methods.

**Text:** Digital Signal Processing: A Computer Based Approach, Fourth Edition, by Sanjit K. Mitra., 2011.

## Student Assessment

Student proficiency in this course is assessed through two mid-semester exams, home-work, design project and a comprehensive final examination as follows:

Two Mid-semester Exams [A] †	30%
Homework [B] †	40%
Design Project [C] †	10%
Final Exam [A] †	20%

## College Level Policies:

Attendance Policy: <http://policies.tcnj.edu/policies/digest.php?docId=9134>

Academic Integrity Policy: <http://policies.tcnj.edu/policies/viewPolicy.php?docId=7642>

Americans with Disabilities Act Policy: <http://policies.tcnj.edu/policies/digest.php?docId=9206>

\* **Fourth Hour Statement:** This class offers an intensive analytical and design experiences that require each student to significantly increase out-of-class learning.

† **Lower case letters in bracket refer to educational objectives of the ECE department.**

‡ **Capital letters in brackets refer to the evaluation methods used to assess student performances.**

Tentative Class Schedules-ELC 423

<b>Date</b>	<b>Day</b>	<b>Topic/Activity</b>	<b>Reading</b>
Week 1		<b>Signals and Signal Processing</b>	Chapter 1
29-Aug	Mon		1.1-1.5
1-Sep	Thur	Signals and Signal Processing: Classifications and Applications	
Week 2		<b>Discrete-time Signals: Time Domain</b>	Chapter 2
5-Sep	Mon	Labor Day Break/Class Shifted to Tuesday	2.2-2.3
8-Sep	Thur	Time-Domain Signal Operations	
Week 3		<b>Discrete-time Signals: Time Domain</b>	Chapter 2
12-Sep	Mon	The Sampling Process	2.5-2.6
15-Sep	Thur	Correlation of Signals	
Week 4		<b>Discrete-time Signals: Frequency Domain</b>	Chapter 3
19-Sep	Mon	Discrete-time Fourier Transform (DTFT)-Properties	3.2-3.3
22-Sep	Thur	Discrete-time Fourier Transform-Theorems	
Week 5		<b>Discrete-time Signals: Frequency Domain</b>	Chapter 5
26-Sep	Mon	The Discrete Fourier Transform (DFT)	5.2-5.10
29-Sep	Thur	Linear and Circular Convolutions using DFT	
Week 6		<b>Z-Transform and Transfer Function</b>	Chapter 6
3-Oct	Mon	Rational z-Transform and Region of Convergence	6.1-6.4
6-Oct	Thur	Inverse z-Transform	
Week 7		<b>Z-Transform and Transfer Function</b>	Chapter 6
10-Oct	Mon	Mid-Semester Break	6.5-
13-Oct	Thur	z-Transform and Theorems	
Week 8		<b>Z-Transform and Transfer Function</b>	Chapter 6
17-Oct	Mon	MID-Semester Exam I	6.7-
20-Oct	Thur	The Transfer Function	
Week 9		<b>Digital Filter Structures</b>	Chapter 8
24-Oct	Mon	Block Diagrams and Equivalent Structures	8.1-8.3
27-Oct	Thur	Basic FIR Digital Filter Structures	
Week 10		<b>Digital Filter Structures</b>	Chapter 8
31-Oct	Mon	Basic IIR Digital Filter Structures	8.4-8.5
3-Nov	Thur	Filter Structure Realization using MATLAB	

Week 11		<b>Digital Filter Design</b>	Chapter 9
7-Nov	Mon	<b>MID-Semester Exam II</b>	9.1-
10-Nov	Thur	Digital Filter Design Specifications	
Week 12		<b>Digital Filter Design-IIR</b>	Chapter 9
14-Nov	Mon	Bilinear Transformation Method	9.2-9.6
17-Nov	Thur	Design Approaches to Digital IIR Filters	
Week 13		<b>Digital Filter Design-FIR</b>	Chapter 10
21-Nov	Mon	Digital FIR Filter Design Specifications	10.1-
24-Nov	Thur	<b>Thanksgiving Break</b>	
Week 14		<b>Digital Filter Design-FIR</b>	Chapter 10
28-Nov	Mon	Design Approaches to Digital FIR Filters	10.2-10.6
1-Dec	Thur	Design Approaches to Digital FIR Filters	
Week 15		<b>Revision and Feedback</b>	
5-Dec	Mon	Revision/Student Feedback	
8-Dec	Thur	Revision/Student Feedback	
Week 16		<b>Final Examination</b>	
12-Dec	Mon	Final Examination	
15-Dec	Thur	Final Examination	