Revised: December 15, 2018

EE 311 **Spring 2018/19**
Syllabus **Dr. Blandford**

Text: Blandford, D.K. and Parr, J.M., Introduction to DSP, Prentice-Hall, 2012

Software: MatLab (Student edition version R2017A (or later) or Professional edition available on CECS network).
GoldWave version 6.31. This is a shareware sound file manipulation program available from http://www.goldwave.com/release.php The free evaluation version is adequate for this class.

Hardware: ARM STM32F446 Nucleo board with an ARM M4 processor. These may be purchased online after classes start for about $15. (This is the same board used in EE 354).

There will be 3 hour exams, graded homework, and a 2 hour comprehensive final exam. The homework will count 20%, the final will count 20%, and the three hour exams will count 20% each.

All exams are open book and open notes. Homework will consist of digital filter design problems which will be done most conveniently with the aid of MATLAB®. Most of the homework problems will require implementation in real time on an ARM M4 processor.

Final Exam is Friday, May 3, 2019 at 8:00am

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Monday	Wednesday	Friday
Jan. 14 **Ch. 1** Introduction & overview of digital filters.	**Jan. 16** **Ch. 1- 2** Discrete systems review Convolution	**Jan. 18** **Ch. 2** Difference Equation, state Variables, and convolution
Jan. 21 **Martin Luther King Day**	**Jan. 23** **Ch. 3** Frequency concepts Fourier series	**Jan. 25** **Ch. 3** Transform Theory Fourier Series and transform
Jan. 28 **Ch. 3** Fourier Transform DFT Frequency Response function	**Jan. 30** **Ch. 3** The DTFT and the DFT	**Feb. 1** **Ch. 3** The Fast Fourier Transform (FFT) The z transform
Feb. 4 **Ch. 3** The z transform and LaPlace Transform	**Feb. 6** Review	**Feb. 8** **Hour Exam 1**
Feb. 11 **Ch. 4** The Sampling Theorem	**Feb. 13** **Ch. 4** Sampling process A/D and D/A conversion	**Feb. 15** **Ch. 5** Frequency analysis of digital Filters
Feb. 18 **Ch. 5** FIR Filters - Design using the Fourier Series	**Feb. 20** **Ch. 5** Linear phase conditions Intro to Windows	**Feb. 22** **Ch. 5** Window function - Rectangular, Bartlett,
Feb. 25 **Ch. 5** Window Functions Hamming, Blackman, and Von Hann	**Feb. 27** **Ch. 5** Kaiser Window Design. Design using MatLab	**Mar. 1** **Ch. 5** Frequency Sampling Filters
Mar. 4 **Ch. 5** Zero locations for linear phase.	**Mar. 6** **Ch. 5** Review	**Mar. 8** **Ch. 5** **Hour Exam 2**
Mar. 11 **Spring Break**	**Mar. 13** **Spring Break**	**Mar. 15** **Spring Break**
Mar. 18 **Ch. 6** IIR Filter Design Stability BLT	**Mar. 20** **Ch. 6** BLT frequency transformations	**Mar. 22** **Ch. 6** Analog filters – Butterworth, Chebyschev and Inverse
Mar. 25 **Ch. 6** Classic digital filters Butterworth, Chebyshev	**Mar. 27** **Ch. 6** Classic digital filters Inverse Chebyshev, elliptic	**Mar. 29** **Ch. 6** Direct Design of IIR filters Pole/zero placement
Apr. 1 **Ch. 6** Least squares - Pade's method Prony and Yule-Walker	**Apr. 3** **Ch. 6** IIR Applications -All pass, Moving avg, and comb filters **Last day to withdraw with a W**	**Apr. 5** **Ch. 6** IIR Applications
Apr. 8 **Ch. 6** Review	**Apr. 10** **Ch. 7** **Hour Exam 3**	**Apr. 12** **Ch. 7** Sample rate conversion **Last day to withdraw with a W**
Apr. 15 **Ch. 7** Sample rate conversion	**Apr. 17** Applications	**Apr. 19** **Easter Break**
Apr. 22 **Ch 8** Implementation issues	**Apr. 24** **Ch. 8** Coefficient quantization	**Apr. 26** **Ch. 8** Quantization Error fixed point arithmetic
Apr. 29 **Ch. 8** Realization structures Direct form and Lattice filters	**May 1** Course Review	

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EE 311 Syllabus Supplement

Catalog Description Provides an application of discrete system analysis and design techniques to digital signal processing (DSP). Reviews difference equations, the Z transform and the discrete Fourier transform. Topics include analysis and design of recursive and non-recursive filter structures, analog filter approximations, the realization problem, the Fast Fourier Transform, and two-dimensional filtering. Projects include MatLab simulations and implementations on real-time DSP systems using C. Prerequisite: Electrical Engineering 310. Spring.

Credit Hour Policy This course meets the federal requirements of 15 in-class hours plus an expected 30 hours of out-of-class work per credit hour over a semester. (At least 135 hours total; 9 per week)

Time & Place EE 311 meets Monday, Wednesday, and Friday at 10:00 AM in Koch Center 137

Learning Objectives

Course Objectives Statement

The objective of this course is to teach students to apply linear systems in the application of digital signal processing. Specifically, students learn to design and implement digital filters.

Course outcomes by program outcome

1a. Students will use math and science to solve problems in their major field of study. (ABET A)

Students will demonstrate an ability to use the following:

Fourier series, Fourier transforms, LaPlace transforms, z-transforms, discrete convolution, frequency domain analysis of discrete systems

Students will demonstrate an understanding of:

Frequency domain concepts, discrete signal analysis, real time implementation of digital signal processors.

Each student will correctly complete at least two significant problems in each of these areas.

1b. Students will be able to apply the concepts of their field of study to formulate problems and identify creative solutions.

Students will solve problems that require creativity and reflection. Each student will solve at least 3 open ended projects.

1c. Students will have mastered the skills and tools of their profession.Students will be competent users of MatLab. (ABET k)

Students will develop a working familiarity with at least one DSP system.

Homework Problems will be assigned daily. Most will require the use of MATLAB®. Assignments are posted on the website.

Attendance Policy You are expected to attend all class sessions. Absences may adversely affect your grade.

Office Hours Dr. Blandford's office is Koch Center 266, Campus phone is 2201. He will usually be in his office from 7:00 to 8:00 AM and 2:00-3:00 PM on MWF and from 7:00 to 10:00AM on TT.

Disability Policy It is the policy and practice of the University of Evansville to make reasonable accommodations for students with properly documented disabilities. Students should contact the Office of Counseling and Health Education at 488-2663 to seek services or accommodations for disabilities. Written notification to faculty from the Office of Counseling and Health Education is required for academic accommodations.

Honor code This course will be governed by the University of Evansville Honor Code, which is

I will neither give nor receive unauthorized aid, nor will I tolerate an environment that condones the use of unauthorized aid

This code has two fundamental expectations:

- Students will submit as their own work only those items that are indeed their own work
- Students will hold each other responsible for adhering to the Code