Fall 2018 Syllabus

Fairfield University School of Engineering

Course Number: CR331-BEN331	Course Name: BioEngineering DSP
Course Time: **Mon/Thur 12:30 - 1:45 PM**	Course Location: **Bannow 333**
Schedule: **9/05/18-12/11/18**	Final Exam: **Project**
Instructor: **Jeffrey Denenberg**	Office: **BNW 301C**
Office Phone: **203-254-4000x3330**	Hours: **M/R 11:00 AM-Noon, W/R 5:00 - 6:00 PM or by appt.**
Email1: **jeffrey.denenberg@ieee.org**	Goggle Voice: **203-513-9427**
Email2: **jdenenberg@fairfield.edu**	**WWW: http://doctord.webhop.net**

Course Description:

This course presents an overview of different methods used in biomedical signal processing. Signals with bioelectric origin are given special attention and their properties and clinical significance are reviewed. In many cases, the methods used for processing and analyzing biomedical signals are derived from a modeling perspective based on statistical signal descriptions. The purpose of the signal processing methods ranges from reduction of noise and artifacts to extraction of clinically significant features. The course gives each participant the opportunity to study the performance of a method on real, biomedical signals.

Prerequisites: CS131 or CS141 or SW408, and MA126 or MA122, or permission of the instructor

Textbook:

Smith, Steven W., The Scientist and Engineer's Guide to Digital Signal Processing, California Technical Publishing, 1997, ISBN: 0-9660176-3-3 - Homework Problems

References:

Java for programmers, by D. Lyon, Java Digital Signal Processing by Lyon and Rao
Earlier Course at DocJava.com
Digital Signal Processing, John G. Proakis, Dimitris K Manolakis, 4th Edition, Pearson, 2006, ISBN: 978-0131873742
Schaum's Outline of Digital Signal Processing, Monson H. Hayes, McGraw-Hill 2012, ISBN: 976-0-07-163509-7
DSP Video Lectures, Rich Radke, Rensselaer Polytehnic Institute

Required Software:

1. MatLab / Simulink (download directly from mathworks following instructions posted on Blackboard).
2. Java JDE and an IDE (e.g. Eclipse)
3. Recommended general computer requirements – PC running Windows 10 or later, Adobe reader, high-speed internet access, Internet Explorer or Firefox browser. You may encounter difficulties with the lectures, simulation software, or internet testing software if you use Mac OS or Linux. Please check all software compatibilities for your system promptly.

MatLab Tutorials: Mathworks **Tutorial,** Prof. Aliane **Tutorial**

Signals and Systems References:

U. of Washington Interactive Notes (Phillips and Parr), **EE235** (analog) and **EE341** (Discrete).

Recorded Lectures

Objectives and Outcomes:

No.	Objective	Outcomes
1	The students will learn the principles of biomedical signal modeling. The student will become proficient with the tools needed for simulating the models.	Students will understand the fundamental concepts and principles of Digital Signal Processing. (1, Comprehension)
2		Students will use the Matlab and/or Java to analyze and synthesize biomedical signals. (2, Application)
3	The Students will learn how to analyze the biomedical signals	Students analyze biomedical signals. (2, Analysis)
4		Students synthesize biomedical signals (2, Synthesis)
5	Students will learn about various biomedical devices and how they work.	Students will research and report (Oral and written) on a class of biomedical instruments. (3, b, c, Analysis, Synthesis)
6		Students will demonstrate the use and application of MatLab software in the above application. (2, Application)

*Objectives, **ABET Criteria** outcomes (a, b, c, k), and Bloom **Cognitive Level** in parenthesis

Grade allocation:

Mid terms	40%
Project	40%
Homework	20%
Total	100%

Grade Histogram

Exam:

The purpose of the exams is to convey your understanding of the material; therefore, it is important that you show your work. Even if you feel that the solution to a problem is obvious; you must still explain why it is obvious. Furthermore; if you are asked to solve a problem using a given technique; then please use that technique; otherwise, I have no way to judge your understanding of the technique being tested.

Homework policy:

Homework will be assigned from the book as your primary preparation for the exams. We will review select homework problems in class and you will be asked to work them on the board for a participation grade. Homework must be completed on time or it will not help with the exams. We will also incorporate design problems as appropriate to the material. These problems are designed to challenge you to think beyond what the book has told you, and do real engineering. There may be more than one correct answer.

If you understand how to do the homework problems you will have an easier time with the exams.

Academic Integrity:

Working with classmates to study, resolve problems, and learn the material is expected and encouraged during normal course work. However, during individual evaluations (e.g. quizzes, exams, individual projects, etc.) you are expected to comply with all standards of academic honesty. You will be graded fairly, and so your work should fairly represent your knowledge, abilities, and effort, not that of others. Any breach of integrity (including but not limited to: copying solutions, internet solutions, copying from peers, claiming work or designs without proper citation, etc.), will not only impact your ability to learn the material and my ability to help you through proper feedback, it will result in academic penalty. Any individual found in breach of this code will fail the afflicted assignment and will be asked to meet privately; any other offenses will be referred to the Dean for further action, and could result in penalties as severe as expulsion from the University.

Disability:

If you have a documented disability and wish to discuss academic accommodations, please contact: Academic and Disability Support Services (203) 254-4000, x2615 and notify the course instructor within the first two weeks of the semester.

Class Expectations:

TEACHER:

Distribute syllabus.
Review the material described in the syllabus.
Explain material.
Identify additional materials, Internet sites or books that clarify the material.
Relate material to "real world" situations when possible.
Answer questions.
Be available to discuss problems.
Be receptive to new ideas.
Announce business/class conflicts in advance.
Make up missed classes.
Prepare and administer exams and projects.
Grade fairly.
Assign appropriate homework problems.

STUDENT:

Be familiar with the prerequisite material
Ask questions.
Stay current.
Study the material described in the syllabus, preferably before it is covered in class.
Complete the assigned homework (all chapter problems with answers).
Obtain class notes and homework if a class is missed.
Use the library and the Internet to obtain supplemental material.
Prepare for exams.
Ask for help (tutors are available for assistance)
Follow standards of academic integrity.

Class Topics and Order of Material

Wk	Date	Topic	Text Materials	Homework	Lecture Notes	Outcome
1	9/06	Course Introduction: Why Digital? Projects!	Ch1	Review programming, Get ahead in reading	Why Digital?-Mitra Ibrahimy Biomedical Signal Processing	
2	9/10 9/13	Matlab			Matlab Tutorial by Dr Aliane	
3	9/17 9/20	Fourier Series/Transform, Impulse Response, Convolution	Ch13, Ch33 Ch5,	Ch13: 1 - 3, 5, 6 Ch5: 1 – 4;	DoctorD-Linear Systems FourierSeries, FourierTransform	
4	9/24 9/27	Sampling: The analog world in a computer Discrete Fourier Transform and FFT	Ch3, Ch8, Ch9, Ch10, Ch11, Ch12	Ch3: 1, 3, 4, 7, 8; Ch8: 1-3,6; Ch9: 2,5; Ch10: 1, 4, 5, 6; Ch11: 1, 3, 4; Ch12: 1-4	Sampling, DFT1.ppt, DFT2.ppt Discrete-Fourier-Transform	
5	10/01 10/04	Laplace Transform, z-Transform Review for Exam 1	Ch32, Ch33		Laplace-1, Laplace-2, Laplace-3, z-transform	
6	**10/08** **10/11**	**Columbus Day – No Classes** **Exam 1 – DSP Basics (Thru 9/27)**				
7	10/15 10/18	Exam 1 Reprise, Introduce Project Topics Discrete Number systems	Ch4	Ch4: 1, 3, 5, 7, 8	Project Topics, Fixed-Point, Floating Point	
8	10/22 10/25	Discrete Convolution, Correlation Random Signals and Noise	Ch6, Ch7 Ch2	Ch6: 1 - 3, 5, 6; Ch7: 1 - 3, 5, 6	FIR.ppt, Discrete-Convolution Noise Intro	
9	10/29 11/01	Electrocardiograms Noise Reduction techniques				
10	11/05 11/08	Ultrasound imaging Tomography			UltraSound-1, Ultrasound-2 ComputedTomography	
11	11/12 11/15	Project discussion				
12	11/19 **11/22**	Review for Exam 2 **Thanksgiving – No Classes**				
13	**11/26** **11/29**	**Exam 2 (10/1-11/08)** Exam 2 Reprise				
14	12/03 12/06	Project Presentations				
15	12/10 TBD	Project Presentations	Exam Week (12/13 – 12/19)	Last day to submit materials		