1. Course Number and Name

CMPE323 Signals and Systems

2. Credits and Contact Hours

4 units, 3 hours lecture, 1 discussion period, 1 MATLAB laboratory period
(see discussion of schedule in 5d, below)

3. Instructor or Course Coordinator Name

E. F. Charles LaBerge (Fall 2016) chuck.laberge@umbc.edu
Office: ITE358
Office Hours: As posted on Blackboard

Open Door Policy:

- If my laptop is on my desk, I'm somewhere in the department, probably in ITE325, and should be back soon.
- If my door is open, come on in.
- If my door is ajar, I'm meeting with another student, please knock softly so I know you're there. You may have to wait a few minutes.
- If my door is closed, I'm occupied. Please come back at another time.

Telephone:
410-455-5684 (UMBC campus)
410-241-8940 (mobile, voice + text) If you text me, please identify yourself in the text.
410-821-8934 (home)

Teaching Assistant: Qunfang Long qunfang1@umbc.edu

Before you call me or text me, check the course Blackboard site.

4. Textbook and Material

Nahvi, M. *Signal and Systems Theory,* McGraw-Hill, ISBN:978-1308807997

This text is a UMBC-specific subset of *Signal and Systems Theory* by M. Nahvi. The content is taken exactly from the original text, which has ISBN 978-0073380704. I highly recommend purchasing (not renting) a *hard copy* (not an e-book) version, but any/either version is acceptable.

5. Specific Course information

a,b: Brief Description and Prerequisites

This course covers basic linear signal and system theory from both continuous-time and discrete-time perspectives, covering linear systems, impulse response, Fourier Series and Transforms including DFT and FFT, transfer functions, and filters. It will touch on Laplace and Z transforms as time permits. It is a core requirement for students taking the Communications Track and is an elective for all other students. The course includes a laboratory section that focuses on the use of MATLAB to solve and visualize problems that apply the theory discussed in lecture.

c. Required/Elective/Selected Elective

Elective. This is a Track Elective for the Communications Track and a List A elective for the Electronic Systems track.

d. Class Schedule (IMPORTANT)

For Fall 2016, CMPE323 is scheduled to meet for four time blocks each week. These are nominally indicated as

Lecture: MW 2:30-3:45

Discussion: W 11-11:50

Lab: F 9-9:50

This course will be taught using an active-learning model consisting of intense student involvement in the material. **None** of the meetings is optional. While attendance will not be taken, students will be responsible for material presented and/or practiced during all class sections. Failure to attend will almost certainly have a detrimental effect on your grade. This is especially true of the Friday morning labs!!

6. Specific Goals for Course

1. Students learn the basic characteristics of linear time-invariant systems and their input/output relationships. (ABET a,e,k)
2. Students learn the concept of frequency domain with Fourier Series and Transforms. (ABET a,e,k, IEEE 3,4)
3. Students become familiar with the simulation and computation of various signal processing functions through the use of MATLAB or equivalent software. (ABET a,c,e,k)
4. Students become familiar with various analog modulation (ABET a,c,e, k)
5. Students become familiar with the concept of poles and zeros of transfer functions in the complex plane and their implication for the frequency response. (ABET a,c,e,k)
6. Students acquire skills in the analysis of systems using digital domain techniques to include sampling and the FFT. (ABET a,c,e,k)
7. Students obtain sufficient skills to permit meaningful review and learning from other textbooks and technical articles. (ABET i)

7. Brief List of topics to be covered

Introduction to CMPE323
Use of MATLAB for Signals and Systems
Basic Continuous Time Signals
Continuous-time Convolution
Linear, Time Invariant Systems
LTI systems, Convolution & Differential Equations
Eigenfunctions of Continuous time LTI systems
The Laplace Transform & Regions of Convergence
The Fourier Series
The Continuous Time Fourier Transform
Properties & Applications of FT
Frequency Response of LTI Systems

System Functions
Standard Continuous Time Filter Forms
Discrete Time Systems
The Z transform

8. Tentative Class Schedule & Topics

A detailed, but tentative, schedule for the semester is shown below. Pay attention! There's lots of information in this table! Dr. LaBerge reserves the right to make minor modifications to the schedule as appropriate to achieve the desired learning outcomes.

9. Policies and Procedures

Attendance: You, or your parents, or someone, is paying me to teach. We can't teach you if you aren't here. Please attend class. I do not, however, take attendance.

Homework Part 1: Homework is nominally due within one week of assignment. If you don't stay up to date, you *will* (I assure you), do poorly in the exams. We'll review the homework in the discussion section each week, so you need to do it..

Homework Part 2: Homework may be solved in groups. In fact, I encourage this practice. You are responsible for transcribing your own solution by hand (no copy or scanning). The approach for a MATLAB lab assignment may be discussed jointly, but you need to write your own MATLAB code!

Homework Part 3: Homework will generally be scored in terms of perceived effort: 2, 1, 0 for "student attempted everything", "student skipped parts of the assignment", and "student didn't do anything or didn't turn anything in". Homework will *not* be "graded" for correctness. Solutions will be posted for all homework problems. Students should study those solutions, finding and correcting their own errors. This is essential for success in the course.

Homework Passes: There are no homework passes. You are expected to turn in the homework when it is due. If you don't keep up with the homework, the exams will be *extremely* challenging.

Projects: I plan to have at least one project for CMPE323, but haven't made a final decision (as of late August 2016). Depending on how things shake out, I reserve the right to have a project or not in substitution for other course assessment material. The project will include both MATLAB and analytical material

Labs: There are 10 weekly laboratory exercises to be accomplished using MATLAB. In addition, MATLAB exercises will be part of both mid-term exams. There are no lab reports to be written, but I may require that sample MATLAB solutions be submitted online. More details about what lab artifacts are due and when will be given in class and in the lab instructions.

See the section on MATLAB, below. Material about MATLAB will be included on the course Blackboard site.

CMPE323 Fall 2016, Detailed Syllabus
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Wk	Day	Date	UMBC	Lecturer	W 11-11:50 Discussion	MW2:30-3:45 Lecture	F9-9:50 Lab	HW Assignment	Pre-Class Assignment	Due
1	Wed	8/31	**First Day**	LaBerge	L1: Organization, syllabus, intro	L2: Linear Systems, what, why, where we're going		Complete the Academic Integrity disclaimer available on Blackboard	Skim 1.1-1.12	Academic Integrity
	Fri	9/2		LaBerge			Lab 0: MATLAB fundamentals		Lab 0 Writeup. Have MATLAB downloaded and installed on your laptop, see link on Blackboard	
	Mon	**9/5**	**Labor Day, No Class**							
2	Wed	9/7		LaBerge	L3: Math Refresher: Complex numbers, calculus, diff eq., linear algebra	L4: Mathematical description of signals part 1		HW#1 MATH & Mathematical Desc of signals	Nahvi, 1:13 to end of Chapter 1	
	Fri	9/9		LaBerge			Lab 1: Sampling for modelling and simulation		Lab 1 writeup	
	Mon	9/12		LaBerge		L5: Mathematical description of signals part 2			Nahvi, 1:13 to end of Chapter 1, review Chapter 2 on sinusoids (CMPE306)	
	Wed	**9/14**	**ADD/DROP DATE LAST DATE TO ADD OR TO DROP WITHOUT INCURRING A "W"**							
3	Wed	9/14		LaBerge	Examples & exercises of elementary functions & time adjustment	L6: Continuous linear systems		HW#2 Continuous Linear Systems	Chapter 3	HW#1
	Fri	9/16		LaBerge			Lab 2: Sinusoids, times delays, time scaling			
	Mon	9/19		LaBerge		LTI systems, causality, right/left side, etc			Chapter 3	
4	Wed	9/21		LaBerge	Examples & exercises of LTI systems	Superposition & Convolution		HW#3 LTI Systems & Convolution	Chapter 4	HW#2
	Fri	9/23		LaBerge			Lab 3: Modelling continuous time convolution in MATLAB			
	Mon	9/26		LaBerge		Convolution Properties			Chapter 4	
5	Wed	9/28		LaBerge	Examples & exercises convolution!!	Convolultion & Correlation		HW#4 More convolution	Chapter 4	HW#3
	Fri	9/30		LaBerge			Lab 4: Advanced Convolution			
	Mon	10/3		LaBerge		Differential Equations and LTI			Chapter 5	
6	Wed	10/5	SC222	LaBerge	Examples & exercises convolution	Review for Exam #1		HW#5 Diff Eq / LTI / Block Diagrams		HW#4
	Fri	10/7		LaBerge			Exam #1 Part 1			
	Mon	10/10		LaBerge		LTI System Block Diagrams			Chapter 5 + notes	
7	Wed	10/12		LaBerge	Diff eq & LTI Examples	Eigenfunctions for LTI systems				
	Fri	10/14		LaBerge			Exam #1 Part 2			
	Mon	10/17		LaBerge		The Fourier Series			Chapter 7	

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8	Wed	10/19		LaBerge	Fourier Series Examples & Practie	The Fourier Series		HW#6	Chapter 7	HW#5
	Fri	10/21		LaBerge			Lab 4: Fourier Series by brute force in MATLAB			
	Mon	10/24		LaBerge		The Fourier Transform			Chapter 8	
9	Wed	10/26		LaBerge	Fourier transform examples & practice	Properties of the Fourier Transform		HW#7 Fourier Transforms	Chapter 8	HW#6
	Fri	10/28		LaBerge			Lab 5: Fourier Transform by brute force in MATLAB			
	Mon	10/31		LaBerge		Using the Properties of FT		HW#8 Fourier Transforms & Properties	Chapter 8	HW#7
10	Wed	11/2		LaBerge	FT examples & practice	The DTFT and FFT			Notes	
	Fri	11/4		LaBerge			Lab 6: The FFT in MATLAB			
	Mon	11/7		LaBerge		More DTFT and FFT		HW#9 DTFT & FFT	Notes	HW#8
11	Wed	11/9		LaBerge	FT/FFt Examples & practice	Review for exam #2		**Exam #2 Take home**		
	Fri	11/11		LaBerge			No lab (take home exam)	**Exam #2 Take home**		
	Mon	11/14		LaBerge		The Laplace Transform		**Exam #2 Take home**	Chapter 6	
	Tue	**11/15**	**Last day to withdraw from CMPE323 with a "W"**							
12	Wed	11/16		LaBerge	Laplace Transform examples	Poles, Zeros, & RoC		**Exam #2 Take home due by start of class**	Chapter 6	
	Fri	11/18		LaBerge		**FFT Project Assigned**	FFT project			
	Mon	11/21		LaBerge		Properties of Laplace Transform			Chapter 6	
13	Wed	11/23		LaBerge	Laplace Transform examples	FFT Project Work			Chapter 6	HW#9
		11/24			**THANKSGIVING**					
		11/26			**THANKSGIVING**					
	Mon	11/28		LaBerge		Transfer Functions			Chapter 6	
14	Wed	11/30		LaBerge	Transfer function examples	Analog Filter Designs		HW#10 Analog Filters	Chapter 6	HW#10
	Fri	12/2		LaBerge		**FFT Project due at start of Class**	Analog filter design with MATLAB			
	Mon	12/5		LaBerge		Discrete time systems			Notes	HW#12
15	Wed	12/7		LaBerge	Discrete time examples	Discrete time systems #2		HW#11 Discrete Time (Short)	Notes	
	Mon	12/12		LaBerge		Review HW, questions, surveys				HW#11
	Wed	**12/14**	**Campus wide study day**		**Review for final exam!!!**			Take Home Final Exam Assigned??		
	Final Exam	<tbd>								

Exams: There will be two exams and a final. I reserve the right to give either in-class or take-home exams. Our particular classroom for Fall 2016 is the ACTIVE classroom, ENGR231, which will prevent us from spreading out during exams. Therefore I reserve the right to issue multiple versions of all exams. MATLAB sections of the exams are likely to be take-home. Don't even try to copy, because the person next to you is doing a similar problem with different parameters.

Calculators, including graphic calculators, are permitted in all exams. Laptops are permitted (required) for the MATLAB exam. If your calculator is capable of matrix manipulations, please learn how to use them. Such use is permissible in exams.

Mobile Phones: If your phone rings during class, be prepared to stand and sing "My UMBC", the alma mater. I'm not kidding! This includes text messages. Best solution is to put your phone on vibrate and in your backpack. A "study guide" for "My UMBC" is posted on Blackboard. **Mobile Phones must remain in your backpack during any exam!** If you feel like you must text or IM or Tweet or Facebook or web surf during class, do me a favor and don't come (see attendance, above). You won't be learning anything while you're distracted, but you will be a distraction to others, most importantly, me. You're still responsible for the content even if you aren't there.

10. Grading

Homework 10% Graded on attempt as described above

MATLAB lab exercises 10%

Project: 15%

As in CMPE306, exams are cumulative in extent, that is, content from Exam #1 is also included in Exam #2. Thus, later exams are worth more credit.

Exam #1 15%,
Exam #2 20%,
Final 30%

Despite my love for and experience with this material, this is only the second time I've taught CMPE323. Therefore, I reserve the right to adjust the weighting given above as we gain experience with the class. In the event of a change in weighting, students will be graded based on the original weighting and the changed weighting, with the higher grade awarded.

Grading definitions and thresholds:
An "A" means you have mastered the content and can apply it independently. Generally > 90%
A "B" means you have mastered the content, but need help applying it. Generally > 80%
A "C" means you need some help with the content Generally > 70%
A "D" means you need a lot of help with the content. Generally > 60%
An "F" means you don't get it at all.
My goal is for you to get "A" or "B". Your goal should be to achieve that standard. I am, however, perfectly willing to award "D" or "F" grades. You get what you earn.

I also reserve the right to make minor downward adjustments to these thresholds (e.g., an "A" might be an 89.5%) in the interest of fairness. Such adjustment is *completely at my discretion!* You ***should not*** assume that any such adjustments will take place! The thresholds will *never* be adjusted ***upward***: achieve this performance and earn the indicated grade!

11. Academic Honesty

By enrolling in CMPE323, each student assumes the responsibilities of an active participant in UMBC's scholarly community, in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal.

The full Student Academic Conduct Policy, is available in the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory.

Students will be required to sign a confirmation of compliance with these policies.
Violations of the Academic Conduct Policy will be considered for a range of sanctions from a zero for the assignment to failure of the course.

Cheating or overt cooperation on take-home exams or projects is a very serious matter. Students who are caught can expect to lose assignment credit for all cooperative content AND to suffer a course credit penalty of 150% of the assignment weight. I'll explain how this works in the first class. Students who are caught will be reported to the Academic Integrity database.

If a student is confused about whether a behavior is or is not in violation of the stated policy, the appropriate action is to ask Dr. LaBerge prior to submitting the relevant assignment.

EFC LaBerge
July 16, 2016
Revised August 28, 2016