Smith College
Picker Engineering Program
EGR 320: Signals & Systems
Spring 2011
Course Information and Syllabus

Professor:	Dr. Susan E. Voss, Associate Professor of Engineering, Smith College
Email:	svoss@smith.edu
Office:	Ford Hall Office 013
Office Hours:	Monday 8:30-9:30 am; Thursday 8:30-9:30 am; After class when available.
Class Times:	Lectures Monday, Wednesday, Friday 11:00-12:10
	Lab sections: Either Monday 1:10-3 pm or Tuesday 1-2:50 pm
Master Tutor:	Chin Yen Tee
Tutor Hours:	Wed., Thurs., and Sunday evenings 7-9pm.
Prerequisites	EGR 220 and PHY 210
Textbooks:	Required: Signals and Systems, Oppenheim and Willsky; Prentice Hall, ©1997, second edition
	Required: Computer Explorations in Signals and Systems, Buck, Daniel, Singer; Prentice Hall, ©1997
Course Website:	Lectures, labs, and homework will be posted at: EGR 320 link at http://www.science.smith.edu/∼svoss/

Course Description: The concepts of linear system theory (e.g., "Signals and Systems") are fundamental to all areas of engineering, including the transmission of radio signals, signal processing techniques (e.g., medical imaging, speech recognition, etc.), and the design of feedback systems (e.g., in automobiles, power plants, etc). This course will introduce the basic concepts of linear system theory, including convolution, continuous and discrete time Fourier analysis, Laplace and Z transforms, sampling, stability, feedback, control, and modulation. Examples will be utilized from biomedical, chemical, electrical, environmental, and mechanical engineering.

Objectives: During this course, you should learn

1. To explain conceptually [ABET Program Outcome 1] and analyze or show mathematically [ABET Program Outcome 2] the following fundamental engineering concepts from Signals & Systems:

   a the description of both continuous- and discrete-time signals,

   b what is meant by a linear time-invariant (LTI) system,

   c how a LTI system can be characterized by its impulse response so that the system's output is known for all inputs,

   d how to represent a signal and a system in terms of both the time domain and the frequency domain,

   e how to both derive and apply the fundamentals of the sampling theorem, and

   f the effects of a variety of systems on a variety of signals (e.g., modulation, control systems).

2. To apply the theory of Signals & Systems to the design, analysis, and construction of specific devices (e.g., AM radio, ECG recording system) or processes (e.g., echo cancellation, touch-tone phone sound generation, sampling of signals) and the testing of the device or process to ensure it meets specified criteria [ABET Program Outcomes 3A, 3B, 9A].

Learning Methods:

- Three lectures each week to discuss new material and solve problems.
- Homework assignments to provide practice in solving problems and describing concepts through writing about them.
- Laboratory sessions and projects that solve practical problems related to concepts presented in lecture.
- Three in-class exams and one final exam to solidify concepts and assess progress.

Homework

The purpose of the homework is to provide additional experience and practice for you to think about the course material. Homework will be due on Fridays at 11am. Homework will sometimes be discussed in class, and it is expected that students will come to class prepared with the homework complete. The in-class exams will be based heavily on the homework.

Students are encouraged to work together to understand the concepts in the homework assignments. However, an important part of the learning process involves struggling with and thinking deeply about problems; if all work was done collaboratively many of you would lose the opportunity to think the problems through fully. Thus, the following rule holds and will be strictly enforced: **Prior to working in a group, each student must first attempt all problems on her own.** You may only collaborate with others after each individual working in a group has worked individually and both thought about and worked out in writing all of the problems on her own. It is your responsibility to document and assure that this rule is upheld. To be specific, when you work on a homework assignment with others, you must (1) note on your homework names of all students you collaborated with and (2) certify with your signature on your homework that you worked on all of the problems individually before you collaborated with someone. Incorrect information regarding homework collaboration will be considered infringement of the Smith honor code.

Homework should be completed as follows:

1. Problem sets will be due on Friday at the beginning of class.
2. Solutions will be posted immediately after class on the EGR 320 web site.
3. You will be responsible for making corrections to the homework over the weekend.
4. Problem sets with corrections (in different color ink) are due the following Monday. Using a standard form, you will suggest a grade (based on the rubric below) and certify that the original work and corrections are accurately delineated. The instructor will verify your work and assign a final grade (0-3) for each problem set. If the final grade is lower than your suggested one, the instructor will provide a brief written explanation for the change.

Grading Rubric
0 = Little or no work completed.
1 = Some problems attempted, some solved correctly, mostly completed w/ soln.
2 = Most problems attempted, many solved correctly, and fully completed w/ soln
3 = Almost all problems solved correctly and fully completed w/ soln.

Laboratory Assignments
There will be six laboratory sessions, five are matlab based on the computer and one is building an AM radio. Except for the first lab session (Matlab tutorial), students will write a short report and answer some questions about the particular lab assignment. Students are encouraged to work together to understand the concepts in the lab assignments. However, each student must write her own responses; it is unacceptable to share any computer code. If you have any questions, you should

ask the instructor. Labs are due at 11 am on Mondays and should be submitted at the beginning of class as a hard copy, neatly stapled.

Late Assignments
In fairness to students who pass in assignments on time, there will be stiff penalties for late work. Late homework assignments will not be accepted. Grades on late laboratory assignments will be multiplied by a lateness factor L, with $L = 0.3e^{-t/4} + 0.7e^{-t/72}$, where t is the number of hours late.

Class attendance
Students are required to attend class and to participate in discussions.

Reading and Quizzes
The reading outlined in this syllabus should be done before the class during which it will be discussed. Please come prepared to participate in class!

Grade
The letter grade for the subject will be determined from a weighted sum of grades for the assignments. The weighting factors are

Labs	In-class Exams	Final Exam	Homework	Participation
20%	30%	20%	20%	10%

Note, the highest two of three grades on the in-class exams will count. The lowest grade will be dropped. Overall averages of 90% or higher will earn at least an A-, 80% or higher will earn at least a B-, etc. It is possible that a curve will be applied to allow lower-than-specified percentages to earn higher letter grades, but a curve in the opposite direction will not be used.

Honor Code
I take the Smith College Honor Code very seriously, and I expect that you do too. If my expectations on a certain assignment are not clear to you, it is your responsibility to clarify them by asking questions. I expect all work that you pass in to be your own, original work, and I expect that you will follow the rules outlined above regarding collaboration on assignments. Please remember that it is a violation of the honor code to either (1) use another student's work or (2) provide another student with your work.

Week	Date	Lecture	Reading	HW	Lab Session	Other due
1	1/24	1. Introduction to course	Forward, 1.0-1.2		Matlab Tutorial	
	1/26	2. Signals & properties of systems	1.3-1.7, p. 71			
	1/28	3. Convolution Sum (DT)	2.0-2.1	HW #1		
2	1/31	4. Convolution Integral (CT)	2.2	HW #1 corrected		Response #1
	2/2	Snow Day				
	2/4	5. Convolution examples				
3	2/7	6. Properties of LTI systems	2.3	HW #2	Echo Cancellation	
	2/9	7. Differential equations	2.4	HW #2 corrected		
	2/11	8. Difference equations	2.4			
4	2/14	9. Fourier Series (CT)	3.0-3.5	HW #3		Echo Cancellation
	2/16	10. Fourier Series (DT)	3.6-3.8	HW #3 corrected		
	2/18	11. Frequency Response, Filtering	3.9-3.11			
5	2/21	12. Review		HW #4		
	2/23	Rally Day - No class		HW #4 corrected		
	2/25	13. **In Class Exam #1**				
6	2/28	14. Fourier Transform (CT)	Chapter 4			
	3/2	No Class				
	3/4	15. Fourier Transform (CT)	Chapter 4	HW #5		
7	3/7	16. Fourier Transform (DT)	Chapter 5	HW #5 corrected	Touch tone phone	
	3/9	17. Fourier Transform (DT)	Chapter 5			
	3/11	No Class		HW #6		
		Spring Break				
8	3/21	18. Sampling I	7.0-7.4	HW #6 corrected	Sampling	Touch tone phone
	3/23	19. Sampling II				
	3/25	20. Sampling Examples/Discussion		HW #7		
9	3/28	21. Review		HW #7 corrected		Sampling
	3/30	22. **In Class Exam #2**				
	4/1	23. Communications: Modulation	8.0-8.2			
10	4/4	24. Amplitude Modulation			AM Radio	
	4/6	25. Finish AM radios				
	4/8	26. Laplace Transform	Chapter 9	HW #8		
11	4/11	27. Laplace Transform	Chapter 9	HW #8 corrected		AM radio
	4/13	28. LaPlace Transform				
	4/15	29. Intro to EKG	tbd	HW #9		
12	4/18	30. Feedback	11.0-11.2	HW #9 corrected	Build an EKG	
	4/20	31. Feedback	11.3, 11.5			
	4/22	32. Transfer Functions		HW #10		
13	4/25	33. Review		HW #10 corrected		EKG
	4/27	34. **In Class Exam #3**				
	4/29	35. Course evaluations				Response #2