

### COURSE OUTLINE

**TITLE:** APPLICATIONS IN DIGITAL SIGNAL PROCESSING

**TEXTS:** "Digital Signal Processing - A Computer-Based Approach", third edition, ISBN 0-07-286546-6, S. K. Mitra, McGraw-Hill, 2006. **(Required)**

"Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers", for version 7, Rudra Pratap, Oxford University Press, 2002, ISBN 0-19-517937-4. **(Recommended)**

**PREREQUISITES:**

ENGR 541 (Probability and Stochastic Processes) or equivalent, and EE 510 (Introduction to Digital Signal Processing) or equivalent.

**INSTRUCTOR:** Ananth Iyer - Engr. & Arch. Bldg. Room 401, (215) 204 6984  
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web page: <http://astro.temple.edu/~aniyer>

Office Hours – Monday – 4:00-5:00pm, Thursday – 5:00-6:00pm

**Course Webpage** – <http://blackboard.temple.edu>

**COURSE OBJECTIVES:** To provide you with an understanding about the relationship between time and frequency as related to discrete-time signals. You will become familiar with FIR and IIR digital filter design. You will also become familiar with finite word length effects, filter banks and multirate signal processing as well as the various types of spectral analysis, such as classical, modern, parametric and nonparametric techniques. You will also be introduced to adaptive filtering (Wiener filter theory) and speech production, analysis, and processing tools and speech coding.

**COURSE EXPECTATIONS AND EXPERIENCE:** There are some things which I think will be very beneficial to you with respect to this course. First of all, it is essential that you be involved with the educational process. This means that you will be expected to contribute to the class discussion and ask lots of questions. Also, I do emphasize the importance of thinking in a qualitative way, that is, to put pencil to paper to express ideas rather than "*crank out solutions*". Therefore, to maximize your learning you must be involved in the process, that is, be an active participant in the classroom experience. I am available to help you learn. This course is a learning experience for me, and we can do it together!

**GRADE BREAKDOWN/SCALE**

Course Component	Percentage	Points	Grade*
Study Questions	10	90-100	A
Computer Assignments	90	80-89	B
		70-79	C
		60-69	D
		0-59	F

\* The grades include plus and minus. Therefore, 90 is not an A but rather an A- and 88 would be a B+.

## COMPUTER ASSIGNMENTS

There will be 7 computer assignments. Each assignment submitted will have a "short" introduction/background/methods and a "short" results/discussion/conclusion. The length for both sections will be 1-3 pages typewritten double-spaced or 2 - 6 pages handwritten double-spaced. Observations and comments are very important! See Computer Assignments Information on course's web page under Computer Assignments link.

**Note:** All graphs must be labeled and must have an explanation both in the figure legend/caption and in the narrative.

## LATE SUBMISSIONS

You will be allowed one late (maximum - one week) submission of a Matlab assignment. However, for any other late submissions of Matlab assignments, the grade for that assignment will be reduced by 10 points for each 24 hour period it is late, i.e., 95 goes to 85 for first 24 hours late. You will be allowed two late (maximum - one week) submissions for the reading focus guide questions. However, for any other late submissions of reading focus guide questions, the grade for that assignment will be reduced by 50% for each week it is late, i.e., 100 goes to 50 for first week late. If an assignment is submitted late I will not be responsible if the assignment is lost or misplaced. Late submissions must be made both electronically as well as with a hard copy.

## INCOMPLETE

There will be no incomplete granted except for a serious medical problem. No incomplete will be given on the basis of missed exams.

## ACADEMIC INTEGRITY

Sharing of thoughts and ideas is encouraged; sharing of work, computer code, etc. is not! You are strongly encouraged to discuss assignments and course material with your classmates! Note that discussion does not mean copying. For any incident of copying the person or persons who copied as well as the person or persons who were copied from will receive zero for that assignment. A second incident of copying will result in an automatic F for the course for all parties involved!

## CELL PHONES

During class your cell phone must be turned off – unless you are emergency personnel in which case you must let me know at the beginning of the semester. Under no circumstances whatsoever are you allowed to leave the classroom to answer your cell phone unless you are emergency personnel which would mean that you will be leaving the class for that day.

## WITHDRAWAL & REPEAT COURSE POLICIES

Beginning in Fall 2003, you may withdraw from a course within the first two weeks and no record of that course will appear on your transcript. However from week three through nine week you may withdraw and will receive a "W" on your transcript. It should be noted that you are not allowed to withdraw from a course after week nine. You may not withdraw from the same course more than once. Also you may withdraw from no more than five courses during the duration of your undergraduate career. Students thinking about withdrawing from a course should consult with their instructor and must receive approval from their academic adviser. (Policy #02.10.14)

The Repeat Course Policy - now, instead of only the highest grade occurrence of a class counting, only the lowest will be removed. Which means if you take a course three times, the two highest grades will be averaged together. (Policy #02.10.12)

**STUDENT INPUT**

Your input is considered very important not only to this semester's class but to those who will take this course in the future. If you have any comments concerning the book, the quizzes or tests, or the material presentation, please let me know, either by stopping by my office to talk, sharing your thoughts or ideas with your class representative or dropping off an anonymous note.

**LECTURE OUTLINE**

Class	Chapter	Topic
1	*	Review Z Transforms, Frequency Analysis of Signals - Discrete Fourier Transform (DFT), Discrete-Time Systems Frequency Characteristics and Pole Zero Placement, Finite and Infinite Impulse Response (FIR and IIR) Filter Realizations
2	9-10	IIR Digital Filter Design, Bilinear Transform, Spectral Transformations, Computer-Aided (Matlab) IIR Digital Filter Design and FIR Digital Filter Design
3	10	Windows and Computer-Aided (Matlab) FIR Digital Filter Design
4	11	DFT and FFT Algorithm Implementation and Tunable Digital Filters
5	12	Analysis of Finite Word-Length Effects, Quantization Effects, A/D Conversion Noise Analysis and Round-off Errors
6	12	Dynamic Range Scaling, Low Sensitivity Digital Filters, Limit Cycles, and Round-Off Errors in FFT Algorithms
7	13	Multirate Digital Signal Processing, Decimation and Interpolation, and Polyphase Decomposition
8	14	Multirate Digital Filter Banks - Two-Channel Quadrature Mirror, Multilevel Filter Banks and Discrete Wavelet Transform
9	*	Spectral Analysis - Classical and Nonparametric
10	*	Spectral Analysis - Modern and Parametric and Linear Prediction
11	*	Spectral Analysis - Modern and Parametric
12	*	Stationary Discrete-time Stochastic Processes and Eigenvalues
13	*	Wiener Filter Theory and the Normal Equations
14	*	Speech Production, Speech Analysis and Speech Processing Tools

\* Handouts will be provided in class.