ECET 461 Digital Signal Processing
Spring 2009 - 3 Credit Hrs.

Instructor: Dr. James Z. Zhang

Contact Info: Office Hours: Please see the office hours posted on my door.
Please call or e-mail if these times will not work with you. I can be contacted at the following:
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Office Location: 336 Belk Building

Meeting Periods: Lectures – Mondays and Wednesdays: 2:30pm-4:10pm, in Belk 370.

Course Description: The course is presented in four main units. Foundations: the review of continuous-time and discrete-time signals, and spectral analysis; design of finite impulse response and infinite impulse response digital filters. Image processing: two dimensional signals, systems, and spectral analysis; image enhancement; image coding; and image reconstruction. Speech processing: vocal tract models and characteristics of the speech waveform; short-time spectral analysis and synthesis, linear predictive coding. Array processing: basic radar principles; representation of propagating waves; delay-and-sum beamformer, array pattern.

Course Goals:

A. General Course Goals/Objectives:

The objective of this course is to introduce the students' knowledge of digital signal processing theories and techniques. Mathematical concepts are essential for success in this course, and Matlab will be used intensively in this course.

B. Specific goals and objectives (Knowledge, Skills, and Abilities):

(A) KNOWLEDGE

The students will:

1. An understanding of linear time invariant systems.
2. The ability to manipulate discrete parameter signals.
3. Knowledge of how to use linear transforms.
4. The ability to apply linear system analysis to engineering problems.

Evaluation Strategies: Class discussion, homework assignments and unit tests.

(B) SKILLS

The students will:

1. Understand basic designs of Digital Filters and fluency in using Matlab
2. Prepare a formal report of an experiment and present the findings orally

Evaluation Strategies: Mini-design projects assigned in homework problems, ability of writing Matlab scripts and functions.

Prerequisites: ECET 341 Advanced Circuit Analysis, MATH 255 Calculus II

Required Text: Ingle, V. K. and J. G. Proakis, *Digital Signal Processing Using MATLAB*, Thomson-Engineering, 1999.

References: McClellan, J. H., R. W. Schafer, and M. A. Yoder, *DSP First: A Multimedia Approach*, Prentice Hall, 1997.

Proakis, J. G. and D. Manolakis, *Digital Signal Processing: Principles, Algorithms and Applications*, 3rd Edition, Prentice Hall, 1995.

Instructional Approach: Two lecture/discussion periods per week. Some lecture periods maybe dedicated to Matlab simulation sessions. Open class discussion is an important element of this class. Students are responsible for the content of all reading assignments whether or not the material is covered in class. Additionally all students will be required to utilize the assigned software for project administration.

Rules for Preparing your Homework Solutions:

The instructor will have to handle a lot of paperwork for the course, and wade through many pages of handwritten solutions. It will be to your benefit in terms of maximizing your grade, and will be greatly appreciated if you adhere to the following 4 rules when preparing your assignments:

1) Do not use paper torn out of a spiral bound notebook.
2) Write on only one side of each page.
3) Put the problems in the proper order.
4) Staple the pages together before turning in the assignment.

Evaluation: Final grades will be based on the following percentages:

Assignments	20%
Hour Exams	45% (15% each)
Lab Reports	10%
Final Exam	25%

Grading Scale:

> 97	A^+	73-75	C
93-96	A	69-72	C-
89-92	A-	66-68	D+
86-88	B+	63-65	D
83-85	B	60-62	D-
79-82	B-	0-59	F
76-78	C+		

Assignments: Instructor's Special Grading Policy Comments:

Homework is due on the date indicated on each homework handout.
All labs must be observed, signed and dated by the instructor
Late labs and homework will receive a zero
Lab reports are due in class on Friday following the last lab period
No make-up exams without prior approval from the instructor
Any assignment missed due to an excused absence will be due during the next class period

Honor Code: Students are expected to comply with the spirit and intent of the University Academic Honesty Policy as stated in the Undergraduate Catalogue**. Visit WCU's Undergraduate Student Handbook for all related policies and procedures. http://www.wcu.edu/studentd/StudentHandbook**

Accommodations for Students with Disabilities: Western Carolina University is committed to providing equal educational opportunities for students with documented disabilities. Students who require disability services or reasonable accommodations must identify themselves as having a disability and provide current diagnostic documentation to Disability Services. All information is confidential. Please contact Disability Services for more information at (828) 227-2716 or 144 Killian Annex.

Course Activities – Lectures (Tentative)

Week	Text Chapter	Subject
1	1	Introduction & Mathematical Preamble
2	2	Sampling of continuous signals, Discrete-time signals and systems
3	2, 3	Linear-Time-Invariant systems, Discrete Fourier Transform (DFT)
4	3	DFT properties, Discrete-time processing of continuous-time signals
5	n/a	Review and Examination 1
6	4	The Z-transform and the Inverse Z-transform
7	4	Transform analysis of LTI systems, Frequency response of rational systems
8	3	Magnitude and Phase, Minimum phase systems
9	n/a	Spring Break, No classes
10	6	Structures for discrete-time systems
11	7	FIR Filters –Equi-ripple Designs & Examination 2
12	7	Filter Design by windowing
13	8	IIR Filters from common analog filters
14	8	Bilinear transformation and frequency transformation
15	5	The discrete-Fourier series and DFT continued & Examination 3
16	5	Divide-and-Conquer Approach, Radix-2 FFT
17	10	Sampling rate conversion
18		Final Examination