

**EE545 Digital Signal Processing (3 credits)**  
**Fall 2005**  
**Klipsch School of Electrical and Computer Engineering**  
**College of Engineering**  
**New Mexico State University**

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**Instructor and Class Information**

Instructor: Dr. Phillip De Leon  
Goddard Annex 160G; (505) 646-DSP1 (3771); pdeleon@nmsu.edu  
Date and Time: M, W, F 1:30 – 2:20pm, (T&B204)  
Office Hours: Th, 3:00 – 4:00pm; F, 10:00 – 11:00am; and by *prior* appointment

**Course Description from the Graduate Course Catalog**

Graduate treatment of discrete-time signals and systems, sampling and reconstruction,  $z$ -transforms, transform analysis of linear time-invariant systems, structures for discrete-time systems, filter design techniques, discrete Fourier transform (DFT) and fast Fourier transform (FFT), spectral analysis, and advanced topics.

**Prerequisite**

EE311 Signals and Systems or equivalent undergraduate course. *Students will be automatically dropped without this prerequisite.* EE395 Introduction to DSP or equivalent undergraduate course is strongly recommended.

**Textbook and Other Required Materials**

Required: *Discrete-Time Signal Processing, 2/E* by Alan V. Oppenheim, Ronald W. Schaffer, and John R. Buck (ISBN 0-13-754920-2)

Required: *DSP Software Toolkit* by Phillip L. De Leon (available at Kinko's Copies, Univ. Ave.)

**Laboratory Resources**

The DSP teaching laboratory is located in T&B Rm. 204. Eighteen PCs with Windows XP and MATLAB are available for student use. PCs have sound card and speakers.

## Online Resources

EE545 Web Page

<http://www.ece.nmsu.edu/~pdeleon/Teaching/EE545/>

EE545 Email Distribution List

TO: [listproc@nmsu.edu](mailto:listproc@nmsu.edu)

BODY: subscribe ee545 YOURFIRSTNAME YOURLASTNAME

## Course Objectives

The objective of this course is to gain an understanding of digital signal processing:

- Discrete-time signals and systems
- Sampling of continuous-time signals
- $z$ -transform analysis of linear, shift-invariant systems
- Digital filter design techniques and filter structures
- Discrete Fourier Transform, Fast Fourier Transform, and spectral analysis

This objective is achieved through a graduate-level treatment of digital signal processing including both theoretical and experimental work.

## Contribution of EE545 to Meeting the Professional Component

EE545 Digital Signal Processing is a Klipsch School core course and a required course for specialization in Communications and Digital Signal Processing. Students in EE545 will apply techniques learned in class through problem solving, software development, and in-class discussions. Such a treatment will serve as a foundation for further study in Communications and DSP and other fields in engineering. This course may also be applied in other areas such as Astronomy, Biology, Computer Science, Economics, Linguistics, and Physics. Class provides 3 credits of engineering science credit.

## Relationship of the Course to Program Objectives

*Digital Signal Processing* provides a foundation for advanced level study in Communications, Digital Signal Processing, and Telemetry. This will allow students to further explore their graduate specialty and perform independent research.

## Prepared

Phillip De Leon, August 22, 2005.

## Grading

*Homework* – There will be regular assignments composed of textbook and software problems. The average of the homeworks is worth 20% of the final grade. It is expected textbook problems will be solved in cooperation with your peers and/or Prof. De Leon; software-based problems including the development of code are to be *individually* solved. Late homework is not accepted except in the case of an absence due to a medical or other very serious reason.

*Exams* – There will be two exams during the semester. Exam #1 is scheduled for Wednesday, Sep. 21 from 7:00pm – 9:00pm. Exam #2 is scheduled for Wednesday, Oct. 26 from 7:00pm – 9:00pm. Each exam is worth 25% of the final grade.

*Final Exam* - The final examination is scheduled for Monday, Dec. 5 from 1:00 – 3:00pm. Worth 30% of the final grade.

Note: No early exams will be given. No makeup exams will be given unless a *very serious* situation arose which prevented taking the exam as scheduled.

*Final Grades* – Final grades will be assigned as follows (we reserve the right to lower the grade ranges for particular letter grades but will never raise the grade ranges)

A+		C+	79 – 76
A	100 – 95	C	75 – 73
A–	94 – 90	C–	72 – 70
B+	89 – 86	D+	69 – 66
B	85 – 83	D	65 – 63
B–	82 – 80	D–	62 – 60

## Policies

All required software codes must developed on an individual basis. While we encourage discussion of lectures, algorithms, and programming techniques, codes must be sole the work of the individual. We will thoroughly examine student codes—*any plagiarism of codes will result in an automatic F in the course.*

## Topics Covered / Class Schedule

The topics covered and class schedule are described in the Course Outline section of this syllabus.

## EE545 Fall 2005 Course Schedule

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**Week 1 August 21, 2005**

Chapter 1: Introduction  
Chapter 2: DT Signals and Systems

**Week 2 August 28, 2005**

Chapter 2: DT Signals and Systems cont.

**Week 3 September 4, 2005**

*Sep. 6 Labor Day (no class)*  
Chapter 3:  $z$ -Transform

**Week 4 September 11, 2005**

Chapter 3:  $z$ -Transform  
Chapter 4: Sampling of CT Signals

**Week 5 September 18, 2005**

*Sep. 21, 7:00 – 9:00pm Exam #1 (Ch 1 – 4)*  
Chapter 5: Transform Analysis of LTI Systems

**Week 6 September 25, 2005**

*Sep. 29/30 no office hours or class*  
Chapter 5: Transform Analysis of LTI Systems

**Week 7 October 2, 2005**

Chapter 6: Structures for DT Systems  
Appendix B: Analog Filter Design Techniques

**Week 8 October 9, 2005**

*Oct. 12 Last day to drop with "W"*  
Chapter 7: Filter Design Techniques

**Week 9 October 16, 2005**

*Oct. 20/21 no office hours or class*  
Chapter 7: Filter Design Techniques

**Week 10 October 23, 2005**

*Oct. 26, 7:00 – 9:00pm Exam #2 (Ch 5 – 7)*  
Chapter 8: Discrete-Fourier Transform

**Week 11 October 30, 2005**

Chapter 9: Computation of the DFT  
Chapter 10: Fourier Analysis of Signals Using the DFT

**Week 12 November 6, 2005**

Chapter 10: Fourier Analysis of Signals Using the DFT

**Week 13 November 13, 2005**

Appendix A: Random Signals

**Week 14 November 20, 2005**

*Nov. 21 – 25 Thanksgiving Holiday (no class)*

**Week 15 November 27, 2005**

Real-time DSP implementations (C code)

**Week 16 December 4, 2005**

*Dec. 5, 1:00 – 3:00pm Final Exam (Comprehensive)*

## STUDENTS WITH DISABILITIES

If you have (or believe you have) a disability and would benefit from classroom accommodation(s), please contact the Services for Students with Disabilities (SSD) Office located at Garcia Annex [Phone: 646-6840; TTY: 646-1918].

If you have a condition that may affect your ability to exit safely from the premises in an emergency or that may cause an emergency during class, you are encouraged to discuss any concerns with the Instructor.

### Student Responsibilities:

1. Register with SSD and obtain accommodation documents early in the semester;
2. Deliver the completed accommodation and testing form(s) to the instructor(s) within the first two weeks of beginning of classes (or within one week of the date services are to commence);
3. Retrieve the signed form(s) from faculty and return to SSD within five (5) days of receipt from faculty and at least one week before any scheduled exam; and,
4. Contact the SSD Office if the services/accommodations requested are not being provided, not meeting your needs, or if additional accommodations are needed. Do not wait until you receive a failing grade. Retroactive accommodations cannot be considered.

### Faculty Responsibilities:

1. Sign the *ACCOMMODATION REQUEST FORM* and *TESTING ACCOMMODATION FORM* (when presented), retain a copy, and return the original to the student within five (5) working days of receipt;
2. Contact SSD immediately if there are any questions or disputes regarding accommodation(s), disruptive behavior, etc.; and,
3. Refer the student to SSD for any additional accommodations.

**Accommodations: SSD Office, 646-6840 (Garcia Annex, Rm 102) Michael Armendariz**  
**Discrimination: EEO/ADA & Employee Relations, 646-3333 (Hadley Hall, 15) Elva Telles**

*All medical information will be treated confidentially.*