

ECE455 Digital Signal Processing Required

2003-2005 Catalog Data:	Digital Signal Processing (3-0) Credit Hours: 3 Prerequisites: ECE 380 Introduction to discrete time systems. Z-transforms. Discrete Fourier transforms and fast Fourier transforms. Design and implementation of digital filters. Statistical methods, optimal filters and error analysis.
Textbook:	Sanjit K. Mitra, 2001. <u>Digital Signal Processing, a Computer-Based Approach</u> . Second Edition, McGraw-Hill.
Reference Texts:	<u>DSP: Principles, Algorithms, and Applications</u> , Proakis & Manolakis, 3 rd Ed., Prentice Hall, 1996. <u>Discrete-time Signal Processing</u> , A. V. Oppenheim and R. W. Schaffer, Prentice-Hall, 1999. <u>DSP FIRST, A Multimedia Approach</u> , McClellan, Schaffer, Yoder, PH, 1998.
Coordinator:	Ikhlas Abdel-Qader, Assistant Professor, ECE
Instructor	Ikhlas Abdel-Qader, Assistant Professor, ECE

Prerequisites by topic:

1. Fourier series and Fourier Transforms
2. Linear system analysis
3. Random signals and processes
4. Introduction to analog filters

Objectives (with corresponding ABET Criteria/outcomes):

To provide knowledge in discrete system analysis, digital filtering, and digital filter design. To achieve an understanding of design methods and techniques. To have the skill of simulating filter design using MATLAB. Generate an understanding of DSP in real time. This course lecture and laboratory supports ABET criteria and outcomes of a, b, c, e, f, g, i, j, and k.

Learning Objectives:

1. Develop an understanding of the fundamental concepts of DSP theory such as sampling theory, discrete frequency, and Z –transform.
2. Develop an understanding of DFT, DTFT, and FFT.
3. Understand the concept of filtering, time-frequency methods and relations between them.
4. Learn FIR and IIR filters, their frequency response and characteristics
5. Design and implement FIR and IIR filters using different methods. Test and analyze and refine design.
6. Complete and demonstrate a successful design and implementation of a DSP filter design project.
7. Work with, and understand how to use signal processing concepts, a DSP design and simulation environment (MATLAB), and a real-time signal processor (TMS320C6701EVM and its accompanying development environment).
8. Work in a team environment to complete project assignments.
9. Search for technical information resources on software and hardware, such as the library, research and technical literature, the World Wide Web, and consultation with local experts.

Topics:

1. Course Introduction and Overview
2. Signals and Systems (CT & DT), Sampling Process, Correlation and Random Signals
3. Frequency Domain Representation of DT Signals, the Z-transform, its properties and inverse.
4. Fourier Transforms (DTFT & DFT), Discrete Transfer Function, Frequency Response,
5. Introduction to Digital Filters
6. Analog Filter Design
7. Digital Filter Structures, FIR and IIR.
8. Design of IIR Digital Filter, Design of FIR Digital Filters and design tradeoffs.
9. Fast Fourier Transform Algorithm, Additional Topics, Applications of DSP

Course/Laboratory Schedule:

Three 50-minutes lectures per week. Two 1-hours exams, a two hour final exam, frequent homework assignments, team-work assignments that include several MATLAB assignments and laboratory work on DSP processors.

Computer usage:

Students will use MATLAB to work on several homework assignments. Also, students will use QEDesign software package for filter design problems. Students will work in teams on two assignments (short projects) that involve the use of DSP processors for real time implementation of algorithms.

Evaluation:

Homework assignments	10%
Laboratory assignments (MATLAB and DSP processors)	15%
Quizzes	10%
Midterm Exams	30%
Final Exam	35%

Contribution to Professional Component:

ABET professional component content as estimated by faculty member who prepared this course description: **Engineering Science 75%** **Engineering design 25%**

Prepared by: Ikhlas Abdel-Qader Date: March 23, 2004
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