Faculty of Engineering Technology	Course name Data Acquisition and Signal Processing
Mechatronics Engineering Department	Course number 315018561
Fall/Spring semester 2009	Pre-requisite(s) 315007364

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Short course description
Fundamentals of discrete-time processing of signals, Interpolation, Decimation, Upsampling, Downsampling, DTFT, DFT Algorithm, Convolution, Correlation, FIR/IIR Filter design, Z-Transform, FFT Algorithm, DCT Algorithm.

Course Objectives
Digital signal processing lies at the core of many new and emerging areas of technology, including telecommunication, biomedicine, digital television and media and digital audio instrumentation. This course will cover the major topics in digital signal processing design and analysis supported by mat-lab examples and other modeling techniques.

Course contents

Subject	Lectures/ Week
Introduction: Introducing the meaning and benefits of DSP, introducing the basic operations of DSP, and application areas of DSP.	1
Data acquisition: ADC process, sampling theorem, DAC process, discrete time systems, mat-lab function.	2
Discrete transforms: Fourier series and Fourier transform, properties of DFT, computational complexity of DFT, FFT, inverse FFT, discrete cosine transform, Walsh transform, Hadamard transform, discrete transforms with mat-lab.	3
First Exam	
The z-transform: Discrete time signals and systems, the z-transform, the inverse z-transform, properties of z-transform, transfer functions, some applications of the z-transform in signal processing, transfer functions with mat-lab.	3
Correlation and convolution: correlation description, convolution description and applications, relation between correlation and convolution.	2

Second Exam	
Digital filters: Introduction to digital filters, types of digital filters, realization of digital filters, digital filter forms with mat-lab.	1
Finite impulse response (FIR) filter: Introduction, FIR filter design, FIR filter specifications, FIR coefficient calculation methods, FIR filter approximation with mat-lab.	2
Infinite impulse response (IIR) filter: Introduction, continuous-time to discrete-time transformations, coefficient calculation methods, IIR filter approximation with mat-lab.	2

Learning Outcomes

- Have a complete understanding of the fundamentals, implementation and applications of DSP techniques from a practical point of view.
- Provide hands-on experience with mat-lab functions for signal processing.
- Enable students to design and develop actual DSP systems

Teaching methods (check the applicable methods and explain)

- Lectures

- Demonstrations
  All topics will be demonstrated via practical examples during the course.

- Tutorial
  Tutorial material will cover all topics of the course. These will be given to students in class and discussed with them.

- Laboratory
  Projects to be given to the students including:
  1. FFT
  2. DCT
  3. Z-Transform

- Assignments, reports, and projects
  10 % of the total mark is dedicated to assignments given in class

Grading policy

Exams

First exam	20%
Second exam	20%
Final exam	50%

Projects and assignments (Due dates: to be determined in class) 10%

Text Book

Digital Signal Processing, Ifeachor and Jervis, Prentice Hall, 2002.

References

Most signal processing books including:

- Digital Signal Processing: Concepts and Applications, B. Mulgrew & al, Palgrave Macmillan, second edition.
- Signal Processing First, McClellan, Schafer and Yoder, Prentice Hall, 2003.
- Paulo S. R. Diniz, Eduardo A. B da Silva, and Sergio L. Netto, **Digital Signal Processing: System Analysis and Design,** (2002). ISBN: 0 521 78175 2.
- Matlab Student Version and Matlab Signal Processing Toolbox.
- Schaum's series in Digital Signal Processing.