EE - 4253
Real Time Signal Processing

Curricular Designation: EE: elective  CpE: elective

EE 4253 – Real Time Signal Processing: Practical implementation issues around digital signal processing concepts as partially developed in EE4252 are discussed. The basic concepts, theory, algorithms, and implementation of digital signal processing using programmable DSP chips will be discussed. Emphasis would be on applications of DSP to Digital Communications, Data acquisition, Blind Source Separation (BSS), and filter design. Laboratory offers practical experience in the design and implementation of DSP solutions.

Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring Pre-requisites: EE 4252

Textbooks(s) and/or Other Required Materials:

2. Discrete-Time Signal Processing, 2nd Ed. by Oppenheim and Schafer, Prentice Hall, 1999;

Prerequisites by Topic:

Familiarity with DSP algorithms and non-real-time implementations.

Familiarity with the MATLAB (and MATLAB Simulink) programming language.

Course Objectives:

Mastery of the fundamentals of digital data issues, digital filter design, implementation, performance criteria, computational issues, and testing.

Familiarity with design, implementation, and testing of real-time DSP systems.

Topics Covered:

Computational Accuracy: Fixed vs. Floating Point;
Concepts of Stability, Casualty, Linearity, Region of Convergence;
Discrete Time Fourier Transform;
z-transform;
FIR, IIR Filters, Filter Implementation;
DSP Computational Building Blocks: Shifter, Multiply and Accumulator (MAC), Arithmetic Logic Unit (ALU), Bus Architecture, Addressing Mode;
Parallelism and Pipelining;
Quantization Theory: Quantization Noise, Quantization Input-Output Signal-to-Noise Ratio;
Sampling Theory;
Practical Frequency Selective Digital Filter Design: Linear Phase vs. Nonlinear phase filter design;
Concept of Digital Communications, Code Division Multiple Access (CDMA), Orthogonal Frequency Division Multiplexing (OFDM);

Concept of Blind Source Separation;

TMS320C6713 DSP Starter Kit

Written laboratory reports required

**Relationship of the Course Content to Program Outcomes:**

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<th>Outcome</th>
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<th>Minimally</th>
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<td>a an ability to apply knowledge of mathematics, science and engineering</td>
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<td>b an ability to design and conduct experiments, as well as to analyze and interpret data</td>
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<td>c an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, health and safety, manufacturability and sustainability</td>
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<td>d an ability to function on multi-disciplinary teams</td>
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<td>e an ability to identify, formulate and solve engineering problems</td>
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<td>f an understanding of professional and ethical responsibility</td>
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<td>g an ability to communicate effectively</td>
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<td>h the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context</td>
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<td>i a recognition of the need for, and an ability to engage in life-long learning</td>
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<td>j a knowledge of contemporary issues</td>
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<td>k the ability to use the techniques, skills, and modern engineering tools necessary for the practice of electrical engineering</td>
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**Contribution of Course to Meeting Degree Requirements:**

3 Credit Hours – Engineering Topics

**Class/Laboratory Schedule** (note: 1 hour = 50 minutes):

Lecture: 42 hours = 3 hours/week for 14 weeks
Lab: 26 hours = 2 hours/week for 13 weeks

**Prepared by:**
Seyed (Reza) Zekavat, Professor, Nov. 29, 2016