EEL 4511: REAL-TIME DSP APPLICATIONS

INSTRUCTOR

Dr. Karl Gugel   **gugel@ufl.edu**   Off. Hours: MWF 11:30 – 12:30 pm, online via Zoom

LECTURES

Online, however we may have a regular quiz day or prior announcement for when a quiz will occur.

LAB SECTIONS (Online)

Mon 25205 Per E2-E3	Tue 25209 Per 5-6	Wed 25206 Per 11-E1	Fri 25208 Per 8-9

CATALOG DESCRIPTION

Real world digital signal processing (DSP) tasks are presented and solved in a lab environment that utilizes a 150 MHz Floating Point DSP & a sophisticated code development tools/hardware emulation.

COURSE OBJECTIVES (ABET Design Content 50%)

To understand the differences between floating point and fixed point DSP implementations. To be able to design and implement low, high and band pass filters in the digital domain. To study and accurately employ appropriate digital sampling and windowing of data techniques. To understand and use the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) algorithms in Spectrum analysis related problems.

TEXTBOOK

Not required, instead we will rely on various Texas Instruments data pages (technical documents) identified in the lab link on the below website:

HOMEPAGE

http://www.add.ece.ufl.edu/4511

HARDWARE PURCHASES

- TI TMS32028379 Development board & lab parts kit will be handed out or sent out later.
- Optional Wire-wrap tool and Soldering Iron, highly recommended for work at home.

REQUIRED SOFTWARE

Download TI's free software development tool, Code Composer Studio. Near the end of the class you will also need to use Matlab for filter design and FFT experimentation.

REFERENCE MATERIALS (Optional)

- Numerical Recipes in C by Press, Teukolsky, Vetteriling and Flannery, 2nd Ed. (ISBN#: 0521431085)
- Discrete-Time Signal Processing by Oppenheim and Schafer, 1st Ed. (ISBN#: 013216292X)

COURSE GRADE DETERMINATION

Homework	5%	
Quizzes	25%	
Laboratory	70%	; L1= 1%, L2 = 5%, L3 – L8 = 8% each, Final Project= 16%

WORKING TOGETHER

You are encouraged to work together on homework assignments and share ideas on lab assignments. However, you are not allowed to copy or duplicate any lab material (code, drawings, etc.) from another student. This work will be considered cheating and will be dealt with in a severe manner.

LABORATORY RULES (Labs will administered via Zoom)

1. Students must work ***individually*** on their Lab projects.   Every student should have their own unique design/approach and software.

2. Students must attend lab Zoom meetings during their assigned time.

3. Students must be prepared for the Lab Zoom meeting. ***No student will be admitted to the Zoom Lab Meeting without the required pre-lab work in hand***, i.e., circuits, flow charts and software designs submitted to your TA prior to the meeting.

4. You must log in at your standard lab meeting starting time for check-in. If you are late, you may miss a lab quiz and thus get a zero for this portion of the lab.

EEL 4511 Real-Time DSP Applications Schedule

Week	HW Due	Lab Start	Topics & Lecture Viewing
1 – Jan 4	**None**	**L1:** Aug 31	***Review:*** Computer Buses & Memory Interfacing, Computer Architectures, Assembler Directives, DSP Programming Model With Ex0.asm, Lectures 1 – 6
2 – Jan 11	**H1:** Jan 15	**L1:** Jan 11	Assembly Language, Ex0.lst, Direct Addressing, Conditional Branches, Flags, Ex1.asm, GPIO & WD Timer, Lectures 7 - 9
3 – Jan 18	**H2:** Jan 22	**L2:** Jan 19	I^2 C Bus, Serial LCDs, Bit Banging GPIO, Stack, Ex2.asm, Floating Pt. Instructions, FPU_Ex1.asm, Lectures 10 - 12
4 – Jan 25	**H3:** Jan 29	**L3:** Jan 27	Programming in C, C LCD Drivers, Fixed Pt. vs. Floating Pt., IEEE Flt. Pt. Format, SPI, SSRAM, Lectures 13A – 14
5 – Feb 1	**None**	**L4:** Feb 1	A/Ds & D/As, Internal DSP A/D, Codec IC, McBSP Peripheral Lectures 15 - 17
6 – Feb 8	**H4:** Feb 12	**L5:** Feb 9	Sampling Theory, Aliasing, Fixed Pt. Filter Implementations, Digital Gain & Mixing, Lectures 18 - 20
7 – Feb 15	**None**	**Mon Only**	Interpolation & Decimation, A/Ds & D/A Noise/Dynamic Range, Reverb & Echo, Circular Buffers, Lectures 21A – 22
8 – Feb 22	**H5:** Feb 26	**L6:** Feb 22	Discrete Sine Generation, Magnitude & Phase, FIR Filters, Matlab Filter Coefficient Generation, Lectures 23 – 25
9 – Mar 1	**H6:** Mar 5	**L7:** Mar 1	IIR Filter, Lectures 26 – 28
10 – Mar 8	**None**	**None**	***Spring Break!***
11 – Mar 15	**H7:** Mar 19	**L8:** Mar 17	DFT, FFT, Block Processing, Ping Pong Buffers, Lectures 29 – 31
12 – Mar 22	**H8:** Mar 26	**Fri Only**	Windowing Techniques, Special Effects, TI Library Filter Functions, Lectures 32 - 34
13 – Mar 29	**None**	**L9:** Mar 29	Special Effects, Dual CPU, Speech Recognition, Lectures 35 – 37
14 – Apr 5	**H9:** Apr 9	**Final Proj**	General Debug & Analysis, Speech Recognition, Lectures 38/39
15 – Apr 12	**None**	**Final Proj**	Debug Techniques, Final Project Question & Answers
16 – Apr 19	**None**	**None**	Reading Day Week, Final Project reviews.

Weeks with Partial Labs (7, 12):
Students who did not have the previous week will complete lab this week. Students who completed their lab the previous week may attend a TAs "Workshop" lab. A "Workshop" refers to an open lab intended to help students: (1) correct deficiencies from previous laboratory assignments; and/or (2) get an early start on the next laboratory assignment.   Please exercise patience when your TA is servicing multiple students.