

## EEL 4511: REAL-TIME DSP APPLICATIONS

### INSTRUCTOR

Dr. Karl Gugel [gugel@ufl.edu](mailto:gugel@ufl.edu) Off. Hours: MWF 9:30 – 11 am, 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)

Tue 20892 Per 5-6	Tue 20891 Per 11-E1	Wed 20889 Per E2-E3
Thur 20895 Per 3-4	Thur 20890 Per 9-10	Fri 20888 Per 7-8

### 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, Vetterling and Flannery, 2nd Ed. (ISBN#: 0521431085)
- Discrete-Time Signal Processing by Oppenheim and Schaffer, 1st Ed. (ISBN#: 013216292X)

## COURSE GRADE DETERMINATION

Homework	5%
Quizzes	23%
Laboratory	72% ;Lab weighting: L1= 2%, L2 = 6%, L3 – L10 = 8%

## 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

<u>Week</u>	<u>HW Due</u>	<u>Lab Start</u>	<u>Topics &amp; Lecture Viewing</u>
1 – August 31	None	L1: Aug 31	<b>Review:</b> Computer Buses & Memory Interfacing, Computer Architectures, Assembler Directives, DSP Programming Model With Ex0.asm, Lectures 1 – 6
2 – Sept 7	H1: Sept 11	None	Assembly Language, Ex0.lst, Direct Addressing, Conditional Branches, Flags, Ex1.asm, GPIO & WD Timer, Lectures 7 - 8
3 – Sept 14	H2: Sept 18	L2: Sept 14	I <sup>2</sup> C Bus, Serial LCDs, Bit Banging GPIO, Stack, Ex2.asm, Floating Pt. Instructions, FPU_Ex1.asm, Lectures 9 -11
4 – Sept 21	H3: Sept 25	L3: Sept 22	Programming in C, C LCD Drivers, Fixed Pt. vs. Floating Pt., IEEE Ft. Pt. Format, SPI, SSRAM, Lectures 12 – 14
5 – Sept 28	None	L4: Sept 30	I <sup>2</sup> C Driver, CODECs, A/Ds & D/As, 379 Internal A/D Lectures 15 – 17
6 – Oct 5	H4: Oct 9	L5: Oct 8	Sampling Theory, Interpolation, Decimation, Echo & Reverb, Lectures 18 – 20
7 – Oct 12	None	None	General Filtering, FIR Filters & Matlab, Lectures 21 – 22
8 – Oct 19	H5: Oct 23	L6: Oct 19	IIR Filters, Noise & Dynamic Range, Lectures 23 – 25
9 – Oct 26	H6: Oct 30	L7: Oct 27	DFT, FFT, Lectures 26 – 28
10 – Nov 2	None	L8: Nov 4	FFT, Block Processing, Ping Pong Buffers, Lectures 29 – 31
11 – Nov 9	H7: Nov 13	None	Windowing Techniques, Special Effects, TI Library Filter Functions, Lectures 32 – 33
12 – Nov 16	H8: Nov 20	L9: Nov 16	Special Effects, Dual CPU, Speech Recognition, Lectures 34 – 36
13 – Nov 23	None	None	No Lectures, this time is reserved for students to finish all previous labs & get caught up with all previous material. This is also the Thanks Giving Holiday week.
14 – Nov 30	H9: Dec 4	L10: Nov 30	General Debug & Analysis /Speech Recognition
15 – Dec 7	None	None	Reading Day Week, Most likely a short quiz on Monday and then we are finished for the semester.

### Weeks with No Labs (Weeks 2,7,11, 13):

On the weeks where there are no labs and no holiday, the TAs will hold an online “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.